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The role of confidence in rehabilitation and the recovery of motor performance

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The Role of Confidence in Rehabilitation and the Recovery of Motor Performance

By

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SUMMARY

This thesis examined the role of confidence in injury and rehabilitation. It is written as a series of four research papers, each of which examines a specific facet of this topic. The four research studies are preceded by a General Introduction, which comprises a comprehensive review of the literature. Previous research has highlighted and acknowledged confidence as an important factor in the recovery process, however, very little was known regarding the precise role of confidence. A review of the literature put forward in Chapter 1 indicated that it was not sufficient to focus exclusively on self- or sport-confidence, rather researchers should investigate more diverse aspects of confidence. The study in Chapter 2 employed qualitative methods to investigate the importance of confidence with respect to different facets of the entire injury experience. Content analysis identified six first-order categories directly related to confidence and four first-order categories indirectly related. In Chapter 3 the results from the qualitative study were employed to develop the Self-Evaluation Inventory, a population specific measure of confidence during the entire injury experience. The Self-Evaluation Inventory was employed in Chapter 4 to examine whether certain facets of confidence early in the rehabilitation period could predict physical recovery from anterior cruciate ligament construction later on. Results indicated that certain facets of confidence might be beneficial in the recovery process. A major strength of this study was the inclusion of both psychological and physical outcome variables. The final study in Chapter 4 examined the efficacy of an imagery intervention to augment the confidence of patients rehabilitating from hip/knee replacement surgery. The results demonstrated that the imagery intervention enhanced certain aspects of patients' confidence and recovery. The thesis concludes with a review of the theoretical and applied implications of all four studies, together with suggestions for future research.

Chapter 1

General Introduction

Major injury is one of the most traumatic events that can happen to a serious sports performer, possibly more disturbing even than losing a World Championships or failing to medal at an Olympics. Despite the obvious disappointment that accompanies failure, athletes usually manage to convince themselves that they could get another chance to achieve at some stage in the future. However, major injury and the period of rehabilitation that follows it are often characterised by long periods of depression (e.g., Brewer, Petitpas, Van Raalte, Sklar, & Ditmar, 1995; Leddy, Lambert, & Ogles, 1994; McDonald & Hardy, 1990; Smith & Milliner, 1994; Smith, Stuart, Wiese-Bjornstal, Milliner, O'Fallon, & Crowson, 1993) and self-doubt about the possibility of ever fully recovering previous levels of performance (e.g., Bandura, 1990; Heil, 1993; Taylor & Taylor, 1997; Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998). Quite what effect this pattern of emotional trauma and self-doubt has upon the speed and degree of recovery ultimately achieved has not been researched. This is an important question because it seems likely that such patterns could have a negative effect on at least the rate of recovery.

Furthermore, the pattern of trauma does not appear to be unique to high level sports performers. It appears to be similar to the patterns of responses that are observed in patients who are rehabilitating from other major medical conditions, such as heart attacks (e.g., Frasure-Smith, Lespe´rance, & Talajic, 1995a, b; Havik & Mæland, 1990; Lane, Carroll, Ring, Beevers, & Lip, 2002; Schleifer *et al.*, 1989; Thompson & Meddis, 1990) road accidents (e.g., Blanchard & Veazey, 2001; Ursano et al., 1999), and rheumatoid arthritis (e.g., Creed & Ash, 1992; Katz & Yelin, 1993; Rodin, Craven, & Littlefield, 1992; Wells, Stewart, & Hays, 1989). Consequently,

research into this area might make use of athletic populations to draw conclusions that had external validity in a larger number of rehabilitation populations.

Within the sports psychology literature, the majority of researchers have focused on identifying the antecedents of injury (e.g., Andersen & Williams, 1988; Kerrr & Minden, 1988; Hanson, McCullagh, & Tonymon, 1992) and studying the psychological affect that accompanies serious injury (for reviews see Evans & Hardy, 1995; Pargman, 1999). Much less attention has been focused on the precise role that psychological factors play in injury and rehabilitation (Gould, Udry, Bridges, & Beck, 1997b). However, an interesting subtlety that can be gleaned from this research is that psychological recovery of full performance appears to take considerably longer than physical recovery from injury. Qualitative studies by Evans, Hardy and Flemming (2000) and Johnston and Carroll (1998) have suggested that high-level performers often have low confidence in their previously injured body part for some time after they have been declared medically and physically fit. The athletes in Evans et al's., (2000) study reported that subsequent to being passed as physically fit, it took at least six weeks of competing in their sport before they were able to focus fully on their performance, have confidence in their previously injured body part, and not be distracted by injury related cognitions. Johnston and Carroll (1998) also found that injured athletes with higher self-confidence returned to training and competition faster than injured athletes with lower self-confidence. What is not clear from this finding is whether the greater confidence and faster resumption of training and competition were well-founded or falsely founded. That is to say, do injured athletes who show high levels of confidence genuinely recover previous performance levels quicker, or do they delude themselves into trying to return to their previous levels of performance too quickly and consequently re-injure themselves?

Conceptual constructs related to the study of self-confidence within the sports psychology literature include, self-efficacy Bandura, (1986, 1997), sport-confidence (Vealey, 1986; Vealey, Hayashi, Garner-Holman, & Giocobbi, 1998), perceived competence (Harter, 1982; Nicholls, 1984), and movement confidence (Griffin & Keogh, 1982). Within the context of athletic injury rehabilitation, the majority of research has focused on self-efficacy and sport-confidence. Bandura's (1977, 1986) theory of self-efficacy was originally developed within the framework of the social cognitive theory, which argues that behaviour, cognitive and physiological factors and environmental influences operate as interacting determinants of each other (Bandura, 1986). Self-efficacy beliefs are not concerned with an individual's skills objectively speaking. Rather, they are the individual's perception of their capabilities to organise and execute the courses of action required in a given task at a given time (Bandura, 1997). Although originally developed for the treatment of anxiety in clinical psychology, the self-efficacy theory has been expanded to explain behaviour in several disciplines of psychology including health and exercise behaviours (e.g., McAuley, 1992; McAuley & Mihalko, 1998; O'Leary, 1985) and sport psychology (e.g., Feltz, 1988; Feltz & Lirgg, 2001)

Vealey's (1986) model of sport-confidence was developed to provide an operationalisation of self-confidence to predict behaviour across a range of sport situations. Vealey (1986) defined sport-confidence as the degree of certainty an individual possesses regarding their ability to be successful in sport and is conceptualised into trait and state components. Vealey (2001) argues that sport-confidence is similar to self-efficacy, however, the sport-confidence model was developed specifically to operationalise confidence in relation to the unique context of competitive sport. Self-efficacy can be viewed as a micro-level of situation specific

confidence, whereas, sport-confidence represents a more global macro-level of confidence (Hardy, Jones, & Gould, 1996).

Within the context of rehabilitation, health and sport psychology researchers have begun to examine the role of self-efficacy in rehabilitation. Specifically, rehabilitation research has shown self-efficacy to be negatively correlated with pain and biological progression of disease (Holman & Lorig, 1993), positively correlated with functioning in patients with lower back pain (Altmaier, Russell, Kao, Lehmann, & Weinstein, 1993), rehabilitation self-efficacy to be positively correlated with rate of recovery (Shaffer, 1992), and to predict variance in rehabilitation from orthopaedic surgery (e.g., Waldrop, Lightsey, Ethington, Woemmel, & Coke, 2001).

Other researchers have investigated sport-confidence in athletic injury rehabilitation. This research has demonstrated the influence of situational factors on the sport-confidence of injured athletes. LaMott (1994) showed that, relative to their pre-surgery levels of sport self-confidence, athletes had higher sport-confidence after reconstructive knee surgery. Quinn and Fallon (1999) also found temporal differences in sport self-confidence over the sport injury rehabilitation period, with athletes commencing rehabilitation high in confidence, this was followed by a decline in confidence during rehabilitation and an increase in confidence again upon recovery. However, there were some limitations to this study such as, no pre injury profiles of the variables tested were obtained. Also, there was extensive variation in the injuries and recovery times of the participants. In a study examining sport-confidence restoration following athletic injury, Magyar and Duda (2000) found that sport-confidence restoration was related to goal orientation. However, confidence restoration early in the rehabilitation process was by far the strongest predictor of later sport-confidence restoration.

Although the studies discussed above provide an insight into both self-efficacy and sport-confidence in rehabilitation, neither one of these conceptualisations of confidence appears to be entirely suitable as a conceptual construct to explain or investigate global levels of confidence during injury rehabilitation. Specifically, studies employing self-efficacy may illustrate how confidence in specific situations, for example rehabilitation self-efficacy, is associated with rehabilitation. However, rehabilitation self-efficacy is only one facet of an athlete's global confidence. For example, the confidence an athlete has in their rehabilitation team is important during rehabilitation, but would not be covered by self-efficacy. Indeed, Bandura (1997) argues that a high self-efficacy in one activity domain is not necessarily accompanied by a high self-efficacy in other areas (Di Clemente, 1986; Hofstetter, Sallis, & Hovell, 1990). Similarly, studies focusing on sport-confidence during athletic injury rehabilitation may provide a good description of how sport-confidence is affected by injury, however, during rehabilitation when the athlete is not competing in sport, it could be that other facets of confidence, become more important than confidence regarding an upcoming sporting event. The confidence an athlete has in their injured body part is a prime example of a facet of confidence specific to the rehabilitation context.

Vealey's model of sport-confidence and its associated measure the State Sports Confidence Inventory (SSCI; Vealey, 1986) were not developed for specific application to injury, rather to measure confidence for current sporting performance. This limitation highlights a key methodological weakness in the literature focusing on the psychological aspects of sport injury rehabilitation. Although major advances have been made in both the quantity and quality of research over the past three decades (Brewer, 2001), there still remains a dearth of psychological measures

specific to the sport injury rehabilitation context. Evans and Hardy (1999) advocated the development of measures specific to the rehabilitation context in order to develop a cohesive foundation of knowledge in this area. However, whilst conducting a review of the literature for this thesis it became clear that no empirically validated measure of confidence in injury rehabilitation existed. Researchers have either utilised non-validated measures developed specifically for their study, or employed non-population specific measures such as Vealey's SSCI.

Intuitively, it seems likely that a number of facets of confidence may be important to athletes rehabilitating from serious injury. In order to begin to understand the precise role of confidence in injury rehabilitation, researchers might consider focusing on a number of situations in which an individual's beliefs regarding the likelihood of events occurring might have an impact on their behaviour and feelings, rather than focus exclusively on self-confidence. Previous research has hinted at a number of different facets of confidence that might be important during injury rehabilitation that would not be accounted for by instruments developed for healthy athletes. For example, confidence in the injured body part (Evans et al., 2000; Johsnon & Carroll, 1998), confidence in situations where the injury occurred (Evans et al., 2000); confidence in the medical team and treatment (Duda, Smart, & Tappe, 1989; Shaffer & Wiese-Bjornstal, 1999; Taylor & May, 1996); rehabilitation confidence (Dolce, Crocker, Molatteire, & Doleys, 1986; Duda et al., 1989; Meichenbaum & Turk, 1987; Waldrop et al., 2001); confidence beliefs regarding return to full participation (e.g., Bandura, 1990; Heil, 1993; Magyar & Duda, 2000; Taylor & Taylor, 1997; Weise-Bjornstal, Smith, Shaffer, & Morrey, 1998); and fear of re-injury (e.g., Bianco, Malo, & Orlick, 1999; Evans et al., 2001; Gould et al.,

1997a; Ievleva & Orlick, 1991; Johnston & Carroll, 1998; Udry, Gould, Bridges, & Beck, 1997b).

Researchers (e.g., Petitpas & Danish, 1995) in the sport psychology field have argued for the inclusion of psychological consequences of injury as well as physical treatment. However, the majority of psychology of injury research has operated independent of any physiological considerations, despite arguments that the body is not composed of two autonomous systems (Flint, 1995; Heil, 1993). Green, Green and Walters (1979) adhere to what they call the psychophysiological principle, which suggests that:

> Every change in physiological state is accompanied by an appropriate change in the mental-emotional state, conscious or unconscious; and conversely, every change in the mental-emotional state conscious or unconscious, is accompanied by an appropriate change in the physiological state (Green, Green, & Walters, 1979, p. 3)

Physiological healing occurs in an orderly biological repair process (Leadbetter, 1994), and this dynamic healing process usually follows a pattern dictating pain, range of motion, hormones and chemicals released, strength gains and so forth (Flint, 1998). Thus, examining psychological reactions to injury or the influence of psychological factors during rehabilitation without considering the physical healing process, may not provide a true reflection of the actual recovery process. Further, research (e.g., Johnson & Carroll, 1998) has indicated that athletes higher in confidence may return to training and competition faster than athletes lower in confidence. However, can psychological factors such as confidence actually speed up the orderly process of healing? Or might they influence compliance to medical advice and adherence to rehabilitation programs and thereby enhance recovery rates (Flint,

1998)? In order to begin to address such questions, there is a need to include a combination of psychological and physiological outcome variables in injury rehabilitation research (Durso-Cupal, 1996; Petitpas & Danish, 1995). Indeed, Flint (1998) argues that although it is often complicated and difficult to achieve, psychological and physiological reactions to sport injury and outcome variables must be considered concurrently.

Although the majority of psychology of injury research has been conducted independent of any physiological considerations, a small number of studies have begun to examine the relationship between psychological variables and physical outcome. Ievleva and Orlick (1991) were among the first to explore this relationship with athletes recovering from knee and ankle injuries. In a retrospective survey study, they found positive correlations with recovery rates for goal setting, positive self-talk, and healing imagery. In a follow-up study, Loundagin and Fisher (1993) similarly indicated that goal setting, healing imagery and focus of attention were most highly related to faster healing rates. Some caution needs to be taken with these findings, since the results are based on retrospective self-report methods, rather than actual measures of psychological skill usage during rehabilitation. However, these studies have provided a foundation of information for rehabilitation intervention studies to build upon.

Despite the hypothesised support for the role of psychological factors in injury rehabilitation outcomes, there have been few controlled and empirically validated intervention studies in the context of athletic injury rehabilitation (Cupal, 1998). In a review of the literature Cupal (1998) argued that the majority of the 17 studies reviewed had several methodological limitations. The first being a lack of control groups, only 1 out of the 17 studies included a control group. The lack of a control

group can result in Hawthorne and placebo effects as opposed to the psychological intervention, being responsible for any positive findings. Other problems included unstandardised treatment or assessment measures, and lack of statistical significance testing. Nonetheless, bearing these quite serious limitations in mind, some of the studies have suggested support for biofeedback in enhancing physical rehabilitation outcomes for sport-related knee injuries (Draper, 1990; Draper & Ballard, 1991; Krebs, 1981; Levitt, Deisinger, Wall, Ford, & Cassisi, 1995). Some support has been indicated for goal setting (Theordorakis, Beneca, Malliou, & Goudas, 1997; Theordorakis, Malliou, Papaioannou, Beneca, & Filactakidou, 1996); imagery and relaxation (Cupal & Brewer, 2001; Durso-Cupal, 1996) and self-talk (Theodorakis, Beneca, Malliou, Antoniou, et al., 1997) in enhancing the rate or quality of athletic injury rehabilitation. As yet, to the best of the authors knowledge there have been no interventions conducted that have focused specifically on developing appropriate levels of confidence in athletes rehabilitating from serious injury. A possible reason for this could be the lack of knowledge to date regarding the precise role of confidence in injury rehabilitation. Once more is understood regarding the functions of confidence in injury recovery, researchers will be able to determine how specific interventions might be employed with certain populations to develop appropriate levels of confidence, restore confidence and expedite return to previous levels of functioning (Williams & Roepke, 1993).

The majority of studies that have highlighted confidence as a potentially important factor in athletic injury rehabilitation were not designed to empirically investigate the role of confidence in injury, rather confidence has emerged from the data as an important factor during the recovery process (e.g., Evans et al., 2000; Johnston, 1996; Johnson & Carroll, 1998; Weise-Bjornstal, Smith, Shaffer, & Morrey,

1998). Other researchers have examined specific aspects of self-efficacy (e.g., Altmaier, Russell, Kao, Lehmann & Weinstein, 1993; Holman & Lorig, 1993; Shaffer, 1992; Waldrop, Lightsey, Ethington, Woemmel, & Coke, 2001), and sport-confidence (e.g., LaMott, 1994; Magyar & Duda, 2000; Quinn & Fallon, 1999). However, there appears to be a lack of theory-based, systematic research examining the role of the multiple facets of confidence in injury rehabilitation, crucial to furthering our understanding of the area. There is a lack of descriptive data specifically identifying how athletes perceive different facets of their confidence to be affected by injury rehabilitation, which facets of confidence become important during the recovery process, and the nature of the relationship between different facets of confidence and psychological and physical recovery outcomes. In order to begin to build and test theories regarding these relationships, it is first necessary to establish a descriptive foundation of knowledge concerning the role of confidence in athletic injury rehabilitation. From this, instruments to measure the effects of injury on confidence during the recovery period can be developed and interventions designed to enable athletes to develop appropriate levels of confidence during the entire rehabilitation process.

The above line of reasoning leads to four research questions that are the subject of this thesis:

1) Exactly how important is confidence with respect to different facets of the injury experience and to what extent are different facets of confidence affected by, or themselves affect, different encounters during the injury experience?
2) Exactly how serious a problem is confidence when athletes are returning to sport, and can an inventory be developed to measure (all the) different facets of confidence that are important during this period?

3) To what extent is fear and lack of self-confidence rational and adaptive, in the sense that it stops performers becoming re-injured, and to what extent is it irrational and maladaptive, in the sense that it interferes with the recovery of their former performance levels? Specifically, can certain facets of confidence predict physical outcome measures in athletes rehabilitating from serious injury?
4) What interventions might be used to develop appropriate levels of confidence and how effective are such interventions? Possible interventions include psychological skills training interventions, such as relaxation, mental imagery or goal-setting that focus explicitly on the development of confidence with respect to reintegration and the resumption of normal performance behaviours.

The thesis is comprised of six chapters. A general introduction, followed by four research studies, each of which address one of the four research questions listed above, and a concluding general discussion. The first study investigated the importance of confidence with respect to different facets of the injury experience as identified by seriously injured high-level athletes and physiotherapists experienced in working with injured elite performers. This first study employed a qualitative methodology. The results of the first study were then utilised in the second study to develop a measure of various different facets of confidence during athletic injury rehabilitation. The structural validity of this measures was analysed using confirmatory factor analysis. The inventory of confidence developed in the second study, was used in the third study to examine whether certain facets of confidence, could predict physical outcome variables in athletes rehabilitating from anterior cruciate ligament reconstruction. Finally, in order to expand on the application of the

findings from this thesis, a population of patients rehabilitating from hip and knee replacement surgery were utilised in the forth study. Chapter 5 reports an investigation into the efficacy of a mental imagery intervention on the confidence and progress of patients rehabilitating from hip and knee replacement surgery. The final chapter of the thesis contains a general discussion of the main findings of the four studies.

Each chapter is written as an individual study that investigates a specific aspect of the role of confidence in injury rehabilitation and the recovery of motor performance. Due to the fact that each chapter is written as an individual study there may be some repetition between the introductions to the different chapters. Each of the four studies utilises a different methodological approach. Study 1 is a qualitative study that uses content analysis of interview data. Study 2 is a measurement study that utilises confirmatory factor analysis. Study 3 is a non-experimental field study that utilises quadratic regression analysis. Study 4 is a true experimental design that utilises multivariate analyses of variance.

Chapter 2

The Importance of Confidence with Respect to Different Facets of the Athletic Injury Experience: A Qualitative Study

ABSTRACT

The aim of this study was to examine the importance of confidence with respect to different facets of the injury experience and the extent to which confidence is affected by, or itself affects, different encounters during the injury experience. Since the role of confidence in injury was a relatively unexplored area, a qualitative methodology was chosen. Retrospective interviews were conducted with five high-level athletes and three physiotherapists with regard to their experience of the role of confidence during the entire injury and rehabilitation process. Content analysis was employed to analyse the interview data. Results revealed that the athletes and physiotherapists perceived confidence to be important with respect to a number of facets of the injury experience and confidence to be affected by different facets of the injury experience. The first order themes identified were: (a) Confidence in the Injured Body Part (IBP), (b) Confidence in Own Body, (c) Confidence in Rehabilitation Team, (d) Looking for improvement in the IBP, (e) Fear of Re-injury at Point of Re-Entry, (f) Confidence about Ability on Re-Entry into Sport, (g) Loss of Self-esteem, (h) Adherence Motivation, (i) Actively Seeking Skills to Develop Whilst Injured, and (j) Change of Approach to Sport. The results are discussed in terms of the fragility of athletic confidence during injury and rehabilitation along with the applied implications and future research directions.

INTRODUCTION

Major injury is one of the most traumatic events that can happen to a serious sport performer, and within the UK alone, it is estimated that there are over 29 million sports related injuries each year (Sperryn, 1994). The psychology of athletic injury has generated much interest within sport psychology research. However, the focus of the majority of this research has been on identifying the antecedents of injury (e.g., Andersen & Williams, 1988; Kerr & Minden, 1988; Hanson, McCullagh & Tonymon, 1992) and the psychological affect that accompanies serious injury (for reviews see Evans & Hardy, 1995; Pargman, 1999). Much less attention has been directed to the role that psychological factors play during injury rehabilitation and recovery (Gould, Udry, Bridges, & Beck, 1997a).

A key psychological factor that has been touched upon, but remains largely unexplored within the injury related sport psychology literature, is confidence. Some research (e.g., Bandura, 1990; Heil, 1993; Magyar & Duda, 2000; Taylor & Taylor, 1997; Weise-Bjornstal, Smith, Shaffer, & Morrey, 1998) has suggested that a decrease in confidence beliefs about returning to sport participation could be a major cognitive response to injury by athletes. However, confidence is widely acknowledged by researchers and practitioners as one of the most critical psychological characteristics influencing performance (e.g., Gould, Weiss, & Weinberg, 1981; Hardy, Jones, & Gould, 1996; Jones, Hanton, & Swain, 1994; Mahoney & Avener, 1977; Vealey, Hayashi, Garner-Holman, & Giacobbi, 1998). Consequently, it is somewhat surprising that there has been relatively little research conducted investigating the role of confidence during rehabilitation from athletic injury.

Conceptual constructs related to the study of confidence within the sport psychology literature, briefly include self-efficacy (Bandura, 1986; 1997), sport confidence (Vealey, 1986; Vealey, Hayashi, Garner-Holman, & Giacobbi, 1998), and movement confidence (Griffin & Keogh 1982). The conceptual construct underpinning confidence in the current study is not focused exclusively on any one of these three constructs. Rather, confidence in this study, is conceptualised as the subjective probability of an outcome occurring. In this regard our conceptualisation of confidence is situation specific, not unlike Bandura's conceptualisation of self-efficacy. However, we are not only concerned with self-confidence, as will become clear, we are also concerned with a number of other situations in which people's belief about the likelihood of events occurring might have an impact upon their behaviour and feelings.

Research has suggested that confidence may be an important factor in athletic injury; however, the importance of confidence with respect to different facets of the injury experience is not yet known. For example, several researchers have identified that athletes perceive self-confidence to be an important factor during injury rehabilitation. Qualitative studies by Evans, Hardy and Flemming (2000) and Johnston and Carroll (1998), have suggested that high-level performers often have low confidence in their previously injured body part for some time after they have been declared medically and physically fit. In an action research study with three severely injured athletes, Evans et al., (2000) found that when participants were physically fit and returned to competition, it took them at least six weeks before they were able to have confidence in their injured body parts to meet the demands of the game situation. During the period of re-entry into sport, gaining confidence in the injured body part and confidence to meet competition

demands were perceived by participants as the most important aspects to successful return to high-level competition.

In contrast, a number of studies (e.g., La Mott, 1994; Quinn & Fallon , 1999) have found confidence to increase at the end of rehabilitation on re-entry into sport. A possible reason for these contrasting results could be related to the different methodologies used in these studies. La Mott (1994), and Quinn and Fallon (1999), employed quantitative methodologies, whereas, Evans et al., (2000) used in-depth qualitative measures. The use of a qualitative methodology may have allowed more of the subtleties of the impact of specific situations to emerge.

Research by Magyar and Duda (2000) examined the impact of goal orientations, perceptions of social support, and sources of rehabilitation confidence, on the process of sport-confidence restoration during rehabilitation from athletic injury. Magyar and Duda (2000) found that sport-confidence restoration was related to goal-orientation; however, sport-confidence levels early in the rehabilitation process were by far the strongest predictor of later sport-confidence restoration levels.

While the above findings have provided a useful insight into the importance of confidence in athletic injury and have indicated that injury could have an effect on an athlete's self-confidence, they must be treated with some caution. The majority of quantitative studies (e.g., La Mott, 1994; Magyar & Duda, 2000; Quinn & Fallon, 1999) have employed the State Sports Confidence Inventory (SSCI; Vealey, 1986) to measure sport-confidence in injured athletes. While the SSCI (Vealey, 1986) has been well validated with non-injured athletes (see Vealey, 1986) it has not been validated for use with injured athletes. The 13 items on the SSCI invite the athlete to compare their

confidence to the most confident athlete they know with regard to various aspects of their performance, during an upcoming contest. For example, their ability "to make critical decisions during competition", or their ability "to execute successful strategy during competition". It is questionable how appropriate such questions are at measuring the confidence of a seriously injured athlete. Specifically, an athlete completing the SSCI a week after having an anterior cruciate ligament reconstruction, facing a probable six to twelve months before being able to compete again, may find a question measuring confidence in their ability to execute successful strategy during an upcoming sporting contest irrelevant. Furthermore, that athlete's perception of their confidence to successfully complete a task, which they will not be doing for six to twelve months, may be unrealistic.

Anastasi (1990) has suggested that the same test when employed for different purposes or with different subject populations should be validated in different ways. The focus of the SSCI is upon measuring current sporting performance. However, intuitively, it seems likely that during injury rehabilitation a number of different aspects of confidence might be as, if not more, important to athletes than current sport performance. Previous research has hinted at a number of aspects of confidence that might be important during the rehabilitation process. For example, the recovery of use (e.g., Evans et al., 2001; Johnston & Carroll, 1998), confidence in treatment (Duda, Smart, & Tappe, 1989; Shaffer & Wiese-Bjornstal, 1999; Taylor & May, 1996), confidence in rehabilitation adherence (e.g., Dolce , Crocker, Molatteire, & Doleys, 1986; Duda et al., 1989; Meichenbaum & Turk, 1987), confidence in the injured body part (Evans et al., 2001; Johnston & Carroll, 1998), and confidence in their readiness to return to sport (Evans &

Hardy, 1999; Heil, 1993) may all be important factors at different stages of the rehabilitation process. Confidence has been found to be higher in athletes who have experienced multiple injuries than in athletes who are injured for the first time (Johnson, 1996; Shaffer, 1991). Although, it is reasonable to assume that the this is not a linear relationship. None of the above facets of confidence are measured by the SSCI.

From the research conducted to date on injury and self-confidence it is apparent that little is known as to the precise role that confidence plays during the recovery process. Thus, the purposes of the present study were to examine the importance of confidence with respect to different facets of the injury experience and the extent to which confidence is affected by, or itself affects different encounters during the injury experience. Since the role of confidence in athletic rehabilitation is a relatively unexplored area, a qualitative methodology was selected for this study. Brewer, Van Raalte, Linder and Van Raalte (1991) suggest that retrospective psychological reports can be influenced by event outcomes (success and failure). In order to try to minimise this issue, both athletes and physiotherapists were included as participants. To allow the reader to share an in-depth understanding of participants' experiences, the present study will report substantial quotes from the raw data together with the main categories and raw data themes in order to illustrate the full range of issues involved (Woodman & Hardy, 2001).

METHOD

Ethical approval for the study was gained from the Ethics Committee of the School of Sport, Health and Exercise Sciences at the University of Wales, Bangor.

Participants

Participants were five high-level athletes, all male (mean age 30.06 years, SD ± 9.10) and three physiotherapists, all female (mean age 38.33 years, SD ± 5.86). The athletes competed in various sports: two were county level rugby players; one was a professional Australian Rules footballer; one a semi-professional golfer; and the final one was a professional flat-race horse jockey. When selecting the athlete participants, the major consideration was that they had sustained a serious injury, which had required surgery and was potentially career ending. Two participants had undergone anterior cruciate ligament reconstruction, one participant had had back surgery for ruptured discs, one participant had an operation for a severe tennis elbow, and one had had surgery for a broken fibula and tibia of the left leg. All athletes had returned to sport participation, although two of the participants had not recovered previous performance levels. The physiotherapists were selected on the basis of having had several years experience of working with injured high-level athletes (mean experience 14.0 years, SD ± 5.29). The three physiotherapists were all chartered physiotherapists (Member of the Chartered Society of Physiotherapy; MCSP) working at specialist sport injury clinics (mean 41 hours per week, SD ± 6.56) and had worked with athletes of all levels from elite and Olympic down to recreational athletes.

Establishing Trustworthiness

Several procedures were employed to maximize the trustworthiness of this study (Miles & Huberman, 1994). Procedures used to increase the internal validity included: a) triangulation of the data by interviewing not only the athletes, but physiotherapists experienced in working with injured elite athletes; b) providing meaningful descriptions of the findings with substantial quotes from the raw data; c) debriefing with a group of

peers on a regular basis; and d) authenticating interview transcripts (Miles & Huberman, 1994). Procedures employed to increase external validity included providing thorough descriptions of the participants, and procedures and methodology used, to allow adequate comparisons with other studies and samples (Miles & Huberman, 1994).

In order to ensure reliability criteria were met, during the data analyses, the two authors met frequently for discussion. During these discussions, each meaningful unit, raw data, and first order theme, was carefully discussed by the two authors.

Interview guide

A semi-structured interview guide was designed specifically for this study. In order to generate the items for the interview guide, an extensive review of the injury and self-efficacy literature was conducted. The interview questions were generated based on this review and through discussion between the researcher and supervisor, who had both experienced potentially career ending injuries, and had extensive psychological knowledge of the subject area. The supervisor also has over 20 years experience as an applied sport psychologist and has frequently worked with injured high-level athletes. The questions were initially developed for the athlete interviews and were then slightly modified for use with the physiotherapists. For example, "Could you describe for me any major setbacks you experienced in your rehabilitation?" was changed to "Could you describe for me any typical setbacks that athletes are likely to go through in their rehabilitation." for the physiotherapists.

Initially, participants were contacted by the researcher and asked if they would take part in the study. The purpose of the study and the structure of the interview was explained to them. All participants approached agreed to take part in the study.

Participants were informed that any information discussed would remain anonymous and that they could terminate the interview at any time.

The interview commenced with some general demographic questions, which included: (a) involvement in sport prior to the injury; (b) how their injury happened; (c) their current injury status; and (d) their current sport involvement. The interview guide then focused on 6 key areas: (1) the injured body part (IBP), including (a) feelings about IBP, (b) confidence in using the IBP, and (c) stability and strength of the IBP; (2) their rehabilitation experience, including (a) their rehabilitation program, (b) their adherence, and (c) their confidence in rehab team; (3) coping with difficult situations, including (a) daily life, (b) surgery, (c) social situation, (d) potential injury provoking situations, and (e) facing the situation in which injury occurred; (4) Setbacks and re-injury, including (a) psychological effects of setbacks and re-injury, and (b) effects on confidence of setbacks and re-injury; (5) readiness to return to sport, including (a) confidence in using the IBP in competition, (b) confidence in ability to return to previous performance levels, and (c) psychological readiness to return; and (6) point of re-entry into sport, including (a) thought patterns at point of re-entry, (b) thoughts and feelings leading up to first training and competition sessions, (c) confidence prior to first training and competition sessions. A final section invited participants to reflect on the overall injury experience and, in the case of the athletes, comment on any experiences not already covered that they believed had affected their confidence. The physiotherapists were asked to describe any cases that particularly stood out for them.

The interview questions were open ended and were followed up by clarification and elaboration probes when necessary to ensure an accurate and in-depth understanding

of what the participants were describing. Efforts were made to try to keep the sequence of questions similar for each participant; however, the order of questions did vary somewhat to allow the participants to follow the natural progression and development of their experiences. Participants were asked to be as honest as possible, to take their time responding to questions, and if they could not remember something to tell the interviewer.

The interviews were conducted by the researcher after receiving training in qualitative research methods. This training included discussions with the supervisor (an experienced qualitative researcher), reading several qualitative research books (e.g., Lincoln & Guba, 1985; Patton, 1990) and journal articles, and feedback on tape-recorded practice interviews. The interviewer had completed two years of supervised postgraduate sport psychology research and athlete support experience.

Three of the interviews were conducted in the researcher's office, two in participants' homes, and three in the physiotherapists' offices. The interviews took between 40 to 70 minutes to complete and were tape-recorded. Interviews were transcribed verbatim and checked for accuracy.

Pilot Study

A pilot study was conducted on a female artistic gymnast who had suffered a severely broken ankle. At the time of the interview the athlete had recovered from the injury, which had occurred two years previously, but had not regained the same level of performance as prior to the injury. The interview used the interview guide described above and was tape-recorded. The aim of the interview was to ascertain whether the questions in the interview guide were easily understandable by the athlete and allowed for

an open discussion of those issues that the athlete felt were important with regard her confidence during rehabilitation. Also, the pilot study allowed the interviewer to gain advice on her interview technique, specifically, the way that questions were asked and the way that clarification and follow up probes were utilized. The tape recording was listened to by an experienced qualitative researcher (the supervisor), who provided the interviewer with feedback on her interview technique. As a result of the pilot study, minor changes were made to the interview script and the interview technique.

Data Analysis

All interviews were transcribed verbatim and the investigator who conducted the interviews checked each transcript for accuracy. The transcripts were then content analysed by the two authors. The researcher and supervisor read and re-read the transcripts until they were familiar with them. The researcher then coded the transcripts into meaningful units using the following a priori codes based on the interview guide: the injured body part, rehabilitation, difficult situations, setbacks and re-injury, readiness to return to sport, and point of re-entry into sport. Using inductive analysis, the meaningful units in each a priori grouping were then categorised into raw data themes and first-order categories. In order to ensure reliability criteria were met, the researcher and supervisor met frequently for discussion. During these discussions the researcher and supervisor considered each meaningful unit, raw data theme, and first-order category, and when disagreement or inconsistencies arose, the researcher and supervisor studied the transcripts and raw data quotes and discussed any points of contention until consensus was reached between them.

In line with Greenleaf, Gould and Dieffenback (2001), no inter-rater reliability statistics were computed. The aim of this research was not to test the investigators' ability to identify common themes, rather it was to focus on gaining a common understanding of the athletes' experiences.

RESULTS

The full range of raw data themes and first order themes are illustrated in Figure 2.1, together with the number of athletes citing each raw theme. In order to allow the reader to gain an accurate and in depth understanding of the important issues and themes that emerged from the data, the results are reported together with a selection of direct quotes. (A full list of all the raw data quotes can be found in Appendix 1).

Although this study was investigating the role of self-confidence with regard to different facets of the injury experience, the participants actually identified a lack of confidence rather than the presence of confidence as being important during some facets of the injury experience. Consequently, some of the first order and raw data themes reflect a loss of confidence during the different facets of the entire injury experience. Loss of self-esteem kept emerging from the data and being cited by the participants as being important during the rehabilitation period in connection with confidence, suggesting that the participants identified some connection between these two constructs. As a consequence, loss of self-esteem was included as a separate first order theme in addition to those reflecting a loss of confidence. This decision will be re-visited and explored further in the discussion. Two other issues arose from the data that were not directly related to confidence, but seemed to be connected in some way and for that

reason have been included in the results. These are: actively seeking skills to develop whilst injured and change of approach to sport.

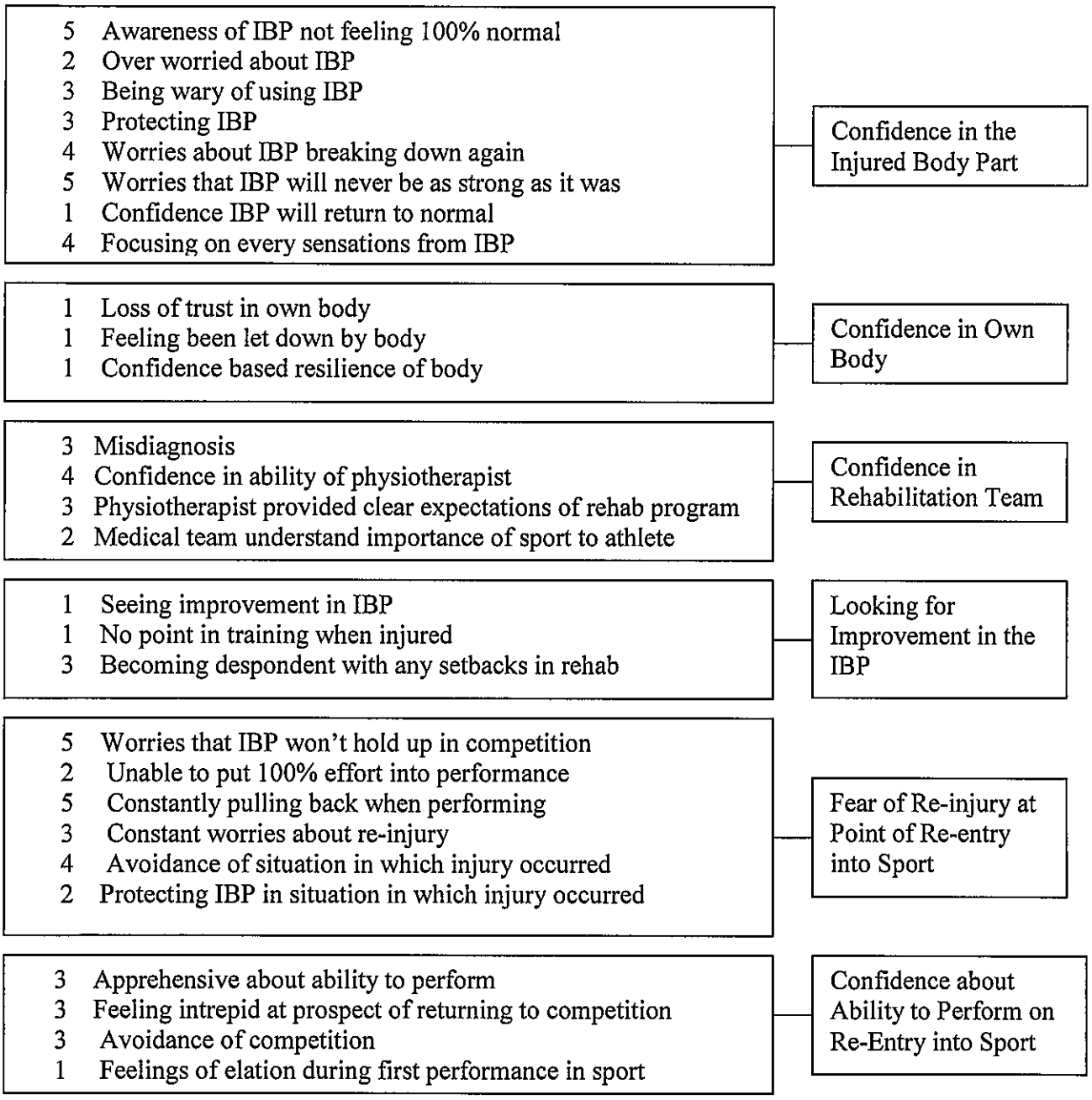


Figure 2.1 First-Order Categories and Raw Data Themes of facets of the injury experience in which confidence and/or a lack of confidence was identified as being important (the number of participants mentioning each raw theme is listed in the first column). The figure continues on the next page.

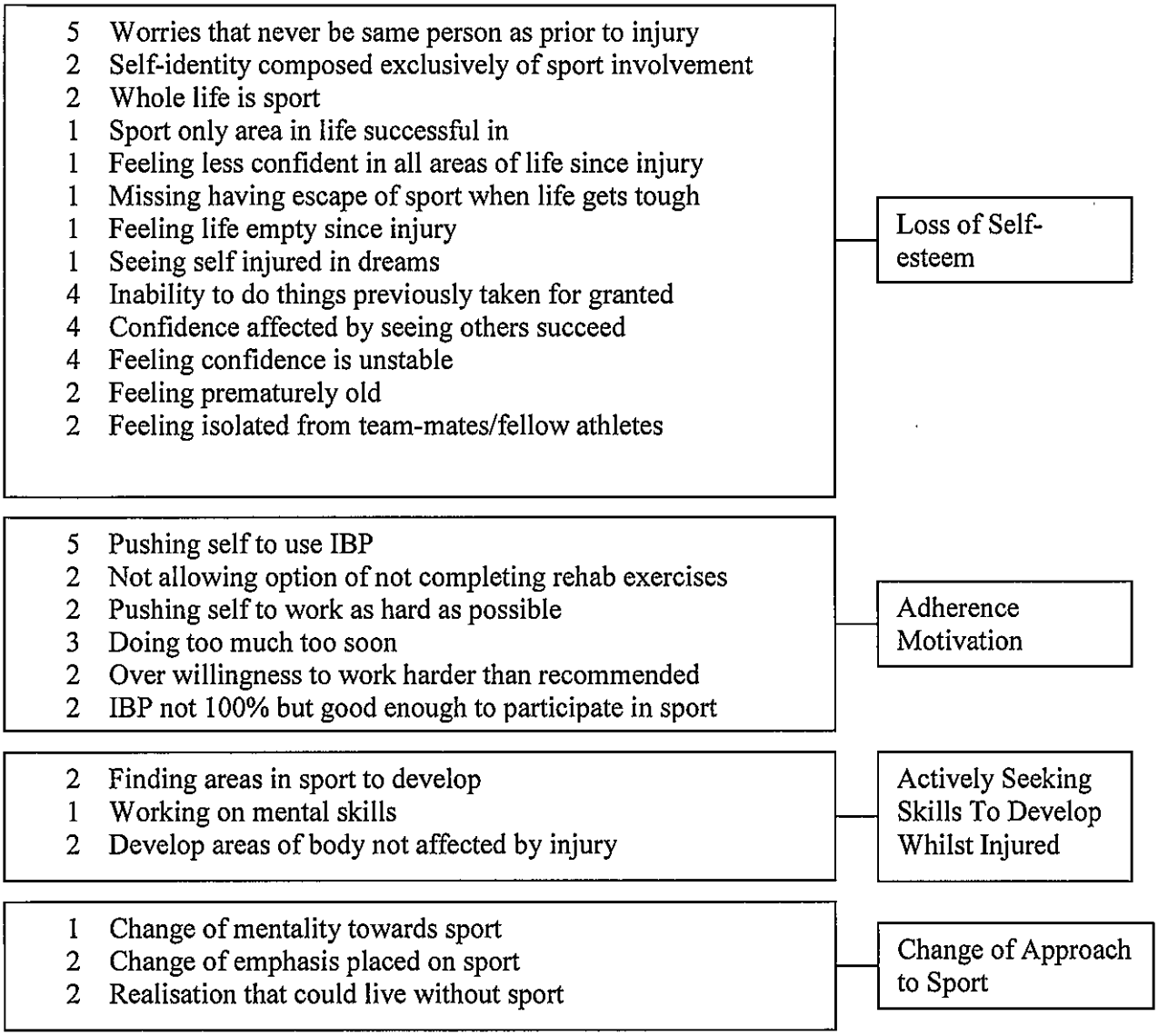


Figure 2.1 Continued. First-Order Categories and Raw Data Themes of facets of the injury experience in which confidence/ and or a lack of confidence was identified as being important (the number of participants mentioning each raw theme is listed in the first column).

As Figure 2.1 illustrates, the first order themes were: (a) Confidence in the IBP, (b) Confidence in Own Body, (c) Confidence in Rehabilitation Team, (d) Looking for improvement in the IBP, (e) Fear of Re-injury at Point of Re-Entry, (f) Confidence about Ability on Re-Entry into Sport, (g) Loss of Self-esteem, (h) Adherence Motivation, (i) Actively Seeking Skills To Develop Whilst Injured, and (j) Change of Approach to Sport.

Confidence in the Injured Body Part

All of the participants reported focusing on their IBP. The raw data themes can be seen in Figure 2.1. All of the athletes made comments about their IBP just not feeling quite right even at the time of the interview when they were back participating in their sport. One of the athletes stated "it's hard to describe, it just doesn't feel right." Another athlete stated "I still think there might be something wrong, but I don't think there is anything I could do about it." The athletes could not describe exactly why the IBP did not feel back to normal but they were all conscious of it not feeling quite right.

Several of the athletes reported lacking confidence in their IBP despite reassurances from the medical team, as the following two quotes highlight:

> I think it was about 6 weeks post op it suddenly swelled up and went quite dodgy and I got quite worried about it... I was aware of things that happen, and I went back to see [his surgeon] about that stage and he said I was fine, it's just because it was 6 weeks, that's when the knee starts getting the blood supply back.
>
> I did a side step and something like crunched inside it. It didn't collapse, but I kind of fell to the ground, probably partly protecting it, and then, I don't know, it didn't really swell up much, but I went to the hospital

anyway … And they kind of checked it and they said the knee and the ligaments were all right.

Three of the athletes discussed being wary of using their IBP:

I was a bit wary… I'm more aware of it because I've injured it before and when I do hit it, it's like 'oo' that maybe affected my confidence a bit.

Worries about the IBP breaking down again were mentioned by three of the athletes "I'm one shot away from messing up my elbow again. I'm one day away, or one silly incident" one of the athletes commented. Two athletes also voiced concerns that their IBP would never be as strong as it had been prior to the injury. As one of the athletes reported questioning himself "Would it be strong and stable enough for me to not walk but run and do things like that…I think the confidence sort of lacks, sort of falls out."

Two of the physiotherapists mentioned that some athletes worry about every little ache or twinge from their IBP "They focus on any little sensation they're getting from it, you know they'll zoom in on it."

Confidence in Own Body

Although only one athlete specifically mentioned issues related to confidence in their body, the following quote illustrates how fundamental to this athlete's confidence it was for him to trust his own body and the devastating effect losing that confidence had upon him:

> ...generally the confidence was low when you can't trust your body any more and when you get to that stage, I mean that's pretty fundamental to someone who considers themselves a sports person, if you can't trust your body and your body has let you down in pretty much all the endeavours that are important to you then it makes you down.

Interestingly, this athlete noted that, whilst injured, his confidence was based on how resilient he felt his body was, rather than performance accomplishments "The confidence was just proportional to what the body lets you actually do... confidence is a direct reflection on your body's resilience." However, this changed during the period of rehabilitation and once the athlete was back training and competing again his sources of self-confidence changed "now the confidence is a reflection of my form or vice verse."

Confidence in Rehabilitation Team

The complete list of raw data themes with regard to confidence in the rehab team can be seen in Figure 2.1. Three of the athletes had suffered serious misdiagnosis, which resulted in their not receiving appropriate treatment for up to 14 months. Two of the athletes highlighted how arduous the whole ordeal was in the following two quotes:

> Being mis-diagnosed loads of times, it was just such appalling... just being told different things all the time and never knowing where you stood

> I ruptured a couple of discs in my back ... it wasn't successfully diagnosed for about 14 months, so it sort of got worse and that was despite seeing a million people, I saw physios by the dozen, chiropractors, podiatrists, acupuncturists, doctors, surgeons, you name it.

All three physiotherapists talked about the importance of gaining the trust of the athletes they work with, as one of them described "one of the principal things you've got

to get early on is their confidence in you as a physio." One of the athletes talked about not having total trust in the physiotherapist he had used as the physiotherapist was not a specialist in sport injuries "I suppose I wanted someone who was probably the best...someone who knows your sport, a sport physio rather than just a general physio."

Quotes from some of the athletes suggest that the confidence the athlete had in the professional ability of their physiotherapist may have influences their adherence to rehabilitation. The athlete who was not totally confident in his physio mentioned that "They could have pushed me a bit harder... you are given exercises to do at home, I wasn't doing them at home." Interestingly, three of the athletes did not use a physiotherapist during their rehabilitation period, preferring to rehabilitate themselves, these three athletes were also the three who had been mis-diagnosed prior to having surgery.

Looking for Improvement in the IBP

Being able to see progress in the IBP was a key factor in influencing athletes' confidence as one of the physiotherapists pointed out "if they don't see an improvement from last week to this week then there is going to be a big change in their confidence." One of the athletes, the golfer, suggested that one thing that had helped increase his confidence was realising he could begin to do things again: "as soon as you get a hint that you might be able to swing a club again". Another athlete explained that realising he could begin to do things again had a huge impact on his confidence as the following quote highlights:

It makes you feel fantastic when you actually think well my body can do a bit more than I thought it could...just being able to bend and realise that yes I can do that, it makes an enormous impact.

Fear of Re-injury at point of Re-Entry into Sport

The entire range of raw data themes associated with fear of re-injury are listed in Figure 2.1. All of the athletes in this study reported worrying about their IBP holding up in competition. One of the athletes reported that he had "No confidence, not at all. I was very, I wasn't terribly keen to play because I just assumed that I would be injured."

Similarly all five athletes talked about being unable to put 100% effort into their sport at the point of re-entry and holding back:

I'm always conscious of it and you always have to sort of pull things back, I can't let go a hundred percent, I'm always guarded against it...until recently I was crapping myself continually, you know when's it going to go, when's it going to go...

Being preoccupied with the fear of re-injury was a problem for most of the athletes. When asked what thoughts were running through his head the first time he competed again, one of the athletes answered "Don't get injured...That's the thing I probably thought of every minute of every game I played..."

Avoiding the situation in which the injury occurred and protecting the injured body part in that situation was mentioned by three of the athletes and one of the physiotherapists. Two of the athletes, the rugby players, had both been injured in tackling situations and said that they still at the time of the interview avoided tackles, as one of them explained: "I'd kind of be going in and then at the last minute I'd sort of half

pull out and bottle it because I was kind of protecting my knee...I was kind of thinking better not happen again." One of the physiotherapists explained that this can be dangerous particularly in rugby "I've seen people go back with a shoulder injury, hesitating, going in with the other shoulder but they weren't quite confident enough in that shoulder and fracturing their cheek or rib."

Confidence about Ability to Perform on Re-Entry into Sport

Three of the athletes recalled that the nearer it got to their being ready to compete again the more apprehensive they felt at the prospect as the following quote illustrates:

> I remember thinking of [it] up to a week before, pushing everything trying to get back and everything revolves around getting back, and then sort of as it got nearer and nearer the time thinking 'I'm actually not fussed about riding again'. Not just riding but apprehensive about getting back.

For another athlete it was feelings of "just enormous trepidation, like what if I'm no good, still no good."

For three of the athletes the pressure was such that they avoided competition altogether "At one point I'd been training a bit and I got offered to play a game, but I wasn't that confident so I didn't play, I turned it down." This comment came despite the athlete's surgeon passing him physically fit to play. Another athlete excused his avoidance of competition by saying

> I felt there was no point in my trying to do that (compete), when I'm nowhere near playing the game at my best...I've just avoided competition because it would be a waste of time.

Loss of Self-Esteem

The full list of raw data themes regarding loss of self-esteem can be seen in Figure 2.1. The raw data themes in this category appeared to have been particularly traumatic for some athletes. It is clear from some of the raw quotes that certain issues were still painful for the athletes and had not been fully resolved.

Two of the athletes reported that issues in this category were the most difficult that they had to deal with throughout the entire rehabilitation experience sport. As one athlete explained:

> My whole life revolves around sport and I couldn't do that then I was, well I mean I had no confidence, as a young person as someone who was pretty athletic and good at sports, that bit's taken away from you so obviously in that area my confidence was probably non-existent or it was shattered...my whole identity at the time was probably that of an athlete/footballer, take that away and you undermine your identity so that has a huge impact on your confidence.

Similarly another athlete reported that sport was the one thing in his life he excelled at and prior to his injury he had used sport as an escape when other things in his life were not going well:

> I haven't had anything else to be successful at in life to give me that fillip of confidence that makes me feel good ...having something that you are really really good at makes a huge difference in life and when things are tough or you're not quite sure where they are going...having the one thing that you can go and escape to, to prop you up and say look you're still

great at this is really helpful...Taking that away means that I haven't got anything...

Four of the five athletes reported that being unable to carry out simple daily tasks had a huge impact on their self-esteem. As one athlete explained "I had to be more careful crossing roads and stuff." For another athlete, being unable to do "simple tasks just like unloading the shopping bags out of the car" were particularly frustrating. All of the athletes described how being unable to look after themselves undermined their self-esteem. One athlete stated "I wanted to do things rather than get people to run around for me with my little bell or whatever because I couldn't move." Another athlete felt like "a bit of a burden" and for another:

> Actually being treated like an invalid isn't great. You don't want to be waited on hand and foot. Sort of left on the sofa in a heap too much, you know you get up to fix something and somebody says 'it's all right, don't worry, don't move yourself, don't trouble yourself'. That sort of thing gets to you a bit.

When asked what were the most difficult situations to deal with one of the athletes replied "Just accepting that I couldn't do things that I took for granted".

Two of the participants found watching fellow athletes succeeding in their place was particularly difficult and lead to a decrease in confidence. One of the athletes reported how watching a fellow athlete who had taken his place whilst he was injured led him to ask himself "Will I ever get my job back?... for the last two months of my injury I thought, 'no I'm going to struggle to get back" to the extent that "certainly I ended up doubting my ability." Another athlete explained it as "Seeing friends who have maybe

got international honours now, and thinking that could have been me...that's probably the biggest confidence, taking away of confidence." Two of the physiotherapists also noted:

> It's a real struggle to try and convince them that the reason that they are not playing is because they are injured, but the reason that their place has gone is not because they are not good, its because they are injured.

Five of the participants referred to feeling as though they had lost something due to their injury that they might never regain, as if they would not be the same person as they had been prior to their injury. This was reflected by all the physiotherapists through their experience of working with athletes, one described it as:

> That general feeling of vulnerability, are they going to be able to do something that they were once very very good at, especially at that level, if that part of their life is taken away from them, they want assurances from you, right from the word go that they are going to be able to do that, and you can't always tell them.

All three physiotherapists and one of the athletes mentioned that there are many fluctuations in confidence throughout the rehabilitation period as one of the physios mentioned "they feel very vulnerable with regards they confidence." Two of the athletes reported that their confidence could "drop right down" and "chop and change" throughout the rehabilitation period. One of the athletes noted that his confidence in all areas of his life had been affected by his injury:

> at the time of the injury golf was very important to me as a general thing, then taking it out of my life made me lower in general self confidence about everything else that I was doing.

Two of the athletes talked about how their injury made them feel prematurely old "Certainly during those times your confidence was low because, well its like being prematurely old, its like being 70 years old when you're 26" and another commented "I had to go to Australia with a walking stick, like an 800 year old man."

Other Themes Not Directly Related to Confidence

Adherence Motivation

As well as discussing a confidence in using the IBP, several of the athletes reported pushing themselves to use their IBP, sometimes doing too much and not adhering their rehabilitation. One athlete stated "I went through a stage of making myself use it" and another "I didn't want to use it, but it was good to just push myself to do things." One of the physiotherapists also reported that "they'll actually push themselves to do more than they have to."

All three physiotherapists mentioned that many athletes are "extremely motivated to work." One of the athletes who did not use a physiotherapist acknowledged that for him this was dangerous:

> In my case that's always been dangerous because I always try and do too much too quickly...within a week of surgery (for 2 ruptured discs) I was in a pool swimming. Within two weeks of surgery I was rowing...you sort of think well if that's the best you can do that time I'll make sure I can do better...

One of the physiotherapists summed up this extreme motivation as "Its just the determination to say I'm going to make this work even if it hurts and that sometimes is a

lack of understanding...It isn't over confidence, its more an over willingness to work hard."

An interesting point that emerged from this section of the data was the notion of the IBP not being 100% but being 'good enough'. One of the athletes commented that his leg was probably only 80% better but "you could just about get away with it you know." Re-entry into sport before the IBP is 100% better could be related to financial concerns as the same athlete was losing money by not competing and explained:

> When you have injuries you tend to try and get back too soon. It's not something you can wait, other people win on your horses, and that's why you try and get back quicker.

One of the physiotherapists explained:

> You might have a patient that is 80% better and you feel that if they play, that'll make them worse...but, you know its not going to kill them its not going to damage them detrimentally in the future, you've got to weigh up the situation as well, so sometimes it might be a case of telling someone to actually compete or play with an injury.

Actively Seeking Skills To Develop Whilst Injured

One of the athletes mentioned several times throughout the interview the importance of focusing on those areas in sport he could develop whilst injured. He described "all through my life I've been doing 4 or 5 competitive sports a week" and that after his injury the only sport he was allowed to do was swim and "That kept me sane." Being able to develop an area in sport was vital to several of the athletes as the following quote from one athlete portrays:

It was crucial because it meant that I could still see that my body was progressing...When your confidence is so hooked up in what your body can do and you are losing confidence in other areas because you can't do things then having areas where you are actually improving is important.

The physiotherapists also acknowledged how important it is to:

allow the player to actually continue with as much as they can...if you actually stop anybody from doing any sport, there's a definite downward spiral of motivation.

Interestingly, only one of the athletes mentioned using mental skills whilst injured to enhance his confidence:

I did quite a lot of mental rehearsal in terms of imaging of when I got back to golf, I kept telling myself that when I did get back to playing golf I was going to be fantastic. So I tried to keep my hopes on all of that rehearsing what I was going to change about my swing...So I did a lot of work on that and the first time I actually got out and played nine holes of golf after I came back, I did strike the ball beautifully, virtually every shot I struck the ball beautifully and a week later I shot 5 over, which was 2 under my handicap.

Change of Approach to Sport

The full list of raw data themes in the approach to sport are listed in Figure 2.1. For two of the athletes in this study one of the hardest things for them to accept was the realisation that they might not be able to recover previous performance levels in their sport. One of the athletes described that he had to "change my mentality a bit from

playing champagne golf and trying to be the one who hits the ball the furthest… I have to become a different golfer." This was echoed in another athlete who reported having to change the emphasis placed on sport:

> I suppose I stuffed up always trying to do too much and pushing my body too hard and knackering my body and subsequent to that I was accepting that there were going to be restrictions on what you do… Sport is still very important, I still put a hell of a lot of effort into sport, but I suppose my general fitness the condition before was all sport related…whereas now fitness, is more sport and life.

An important turning point for some of the athletes was to accept that they could lead a life without sport. By accepting this, they relieved some of the pressure they had put on themselves to get back to their previous performance level at any cost and in turn this relief of pressure enabled them to perform much better as the following quote illustrates:

> Because I had accepted a worse case scenario and ultimately that made it all easier… I found the role that golf played in my life and accepted that actually I could live a life without golf. Life would be better if I could play golf, but it wasn't actually the total jump off bridge scenario that it had looked like at the beginning.

DISCUSSION

The purpose of this study was to examine the importance of confidence with respect to different facets of the injury experience and the extent to which confidence is affected by, or itself affects, different encounters during the injury experience. As

discussed in detail in the results section, the findings revealed that the athletes and physiotherapists perceived confidence to be important with respect to a number of facets of the injury experience and also perceived athlete confidence to be affected by different facets of the injury experience. These results provide support for a couple of suggestions made in the introduction. Firstly, that a number of different aspects of confidence may be important during injury rehabilitation, not just sport- or self-confidence. Secondly, they provide support for the argument against utilising non-population specific measures, such as the SSCI, in the context of athletic injury rehabilitation. Specifically, the SSCI focuses entirely on confidence for current sport performance and does not assess the many different facets of confidence that appear to be important during the injury experience.

The results of this study highlighted just how fragile athlete's confidence can be. Injury appeared to have a huge impact on the confidence of all the athletes interviewed in this study and, based on their experience of working with injured athletes, this effect was confirmed by the physiotherapists. One possible reason for the fragility of athletic confidence during injury could be athletes reliance on performance/mastery accomplishments as a source of confidence. The conceptual constructs of both self-efficacy (Bandura, 1986, 1997) and sport-confidence (Vealey, 1986; Vealey et al., 1998) suggest that athletes rely on performance accomplishments as a salient source of self-confidence. This was supported in the current study. For example, in the first order theme looking for improvement in the injured body part, participants described how identifying progress in the injured body part, however small, and being able to start to use their injured body part again had an enormous positive impact on their confidence. Conversely, being unable to carry out simple daily tasks or any kind of sporting activity

early on in their rehabilitation was highlighted as having a negative impact on confidence.

Previous research has found conflicting results with regard to athletic confidence at the point of re-entry into sport. Specifically, qualitative studies by Evans, Hardy and Flemming (2000), and Johnson and Carroll (1998) suggested that injured athletes often lacked confidence in the injured body part and, particularly in situations where the injury originally occurred, upon re-entry into sport. Conversely, quantitative studies by La Mott (1994) and Quinn and Fallon (1999) found sport-confidence to increase at the end of rehabilitation and point of re-entry into sport. Interestingly, participants in the present study identified that the closer to the point of re-entry they got, the lower they perceived their confidence to become. One of the athletes described how in the last week of his rehabilitation everything in his life revolved around getting back into sport. However, the nearer this time came, the more apprehensive he got to the point that he felt he did not really want to get back into sport at all. Another athlete described how at the point of re-entry he had "no confidence at all", and how he was not keen to play again because he just assumed that he would be injured again. Two of the athletes avoided going back into competition altogether even after being informed by their surgeon that they were physically fit to play again.

A possible reason for the differences in the results from the quantitative and qualitative methodologies could be because the studies were concerned with completely different aspects of confidence. The low confidence in both the injured body part and competitive situations identified by Evans et al., (2000) would not be measured by the SSCI. The only first order theme identified in this study that could be measured by the

SSCI is confidence in ability to perform on re-entry into sport. The raw data quotes in this theme described athletes' lack of confidence in their ability to perform and great trepidation about returning to competition. These issues might be picked up by the SSCI, which focuses on confidence for current sport performance.

An important finding to emerge from the data was a connection between loss of confidence and loss of self-esteem. Bandura (1997) argues that self-efficacy and self-esteem are not directly related. One of the reasons Bandura (1997) puts forward in his argument, is that a person may be completely inefficacious in a certain activity without losing any self-esteem, because they do not invest their self-worth into that activity. Whilst this may be true, it seems incontrovertible that there would be a strong relationship for domains that are important (Hardy & Moriarty, 2005). Since it is highly likely that sport would be an important domain for any serious athlete, Bandura's (1997) argument does not hold in the context of injury for serious athletes. Prior to analysing the results of this study, the authors had not considered loss of self-esteem and its relationship to confidence during injury. Consequently, none of the questions in the interview guide asked about loss of self-esteem during the different facets of injury rehabilitation. Nevertheless, loss of self-esteem kept emerging, when participants were discussing the role of confidence during injury rehabilitation.

The literature on the impact of injury on self-esteem is divided. Similar to this study, Leddy, Lambert and Ogles (1999) found that athletes exhibited lower post injury self-esteem. Participants in a qualitative study by Tracey (2003) identified a decrease in self-esteem following moderate to serious injury. However Smith et al., (1993) found no differences between pre and post measures of global self-esteem and Moriarty (2002)

found only minimal evidence of a negative impact on self-esteem in amateur athletes following serious injury. A possible reason for the differences between Moriaty's (2002) study and this one could be that the athletes in Moriaty's (2002) study were amateur, whereas in this study they were high-level or professional. Moriaty (2002) noted that the athletes in his study had a number of alternative sources of self-esteem, such as academic studies, work, and a range of social and recreational activities. Since the athletes in this study were high-level or professional, the injury may have had a more catastrophic impact on their self-esteem.

The results of this study demonstrate the fragility of athletic confidence at the point of re-entry into sport. It would be interesting for future research to investigate to what extent this lack of confidence at the point of re-entry into sport is rational and adaptive, in the sense that it stops performers becoming re-injured, and to what extent is it irrational and maladaptive, in the sense that it interferes with the recovery of their former performance levels.

Methodological Strengths and Weaknesses

A major strength of the present study was the fact that the participants consisted of high-level athletes and physiotherapists with a strong experience of working with high-level performers. Using a combination of both athletes and physiotherapists also allowed the researchers to gain a broader perspective of the topic in question. Brewer, Van Raalte, Linder and Van Raalte (1991) suggest that retrospective psychological reports can be influenced by event outcomes (success and failure). However, it is hoped this problem was at least partially overcome in the present study through the inclusion of physiotherapists' perspectives as well as the athletes' perspectives.

One of the methodological strengths of this study was the qualitative methodology employed. Since very little was known, regarding the influence of different facets of the rehabilitation process on confidence, it was constructive to allow participants to talk freely about their experiences rather than asking them to respond to predetermined questionnaires.

However, there were a number of limitations that are inherent in all studies employing qualitative methods, such as, purposeful sampling and small sample sizes, and the issue of generalizability (Greenleaf et al., 2001). Patton (1990) suggests that qualitative findings based on samples, however large, are often stripped of their context when generalizations are made and advocates that generalizability in qualitative research should not be used in the same way as it is in traditional quantitative research. Guba (1978) proposed a resolution of the generalisation problem in qualitative research by suggesting that each generalisation should be treated as a working hypothesis to be retested in each encounter. In the current study, the reader was provided with an in-depth understanding of the participants' experiences through the comprehensive portions of the interview transcripts included in the results section, consequently, the reader can retest the working hypotheses proposed and judge the application of these findings for use with other athletes and in other settings (Greenleaf et al., 2001).

In this study, all the athlete participants were male and all the physiotherapists female. It may have been advantageous to have employed an equal number of males and females in both the athletes and physiotherapist populations. However, to the best of the present authors knowledge there has been no research findings to suggest that there are major gender differences in the experience of athletic rehabilitation.

Applied Implications

At an applied level the present results suggest that sport psychologists working with high-level athletes would do well to help athletes develop multidimensional self-esteem. The athletes in the present study revealed that when sport was taken away from them they had little to support their sense of self worth. If the athletes had had a more multidimensional self-esteem, then being unable to participate in their sport may not have had such a devastating impact on their confidence and self-esteem (Hardy & Moriarty, 2005).

The athletes in the present study indicated that one of the key areas that helped to maintain their confidence was being able to see themselves achieve small successes. It could be beneficial for both sport psychologists and rehabilitation professionals to help athletes recognise improvements in their injured body parts and to maintain tasks associated with their performance. For example, to work on certain skills within their performance not affected by the injury, develop psychological skills, or develop areas of the body not affected by the injury. Athletes could also be encouraged to maintain rehabilitation diaries, in which they could monitor their progress. Only one athlete in this study reported working on psychological skills whilst injured. This athlete found using mental imagery very beneficial both to his recovery and performance when back in sport. Consequently, some athletes may find it valuable to develop psychological skills during the injury period. It is also important for coaches and sport psychology consultants working with athletes to realise that however "resilient" an athlete's confidence is prior to their injury, it is possible that the athletes' confidence will become extremely vulnerable

and fragile during the injury period. Thus, athletes need to be well supported, treated with sensitivity and assisted to identify progress during the entire injury experience.

In conclusion, the findings of this study have provided a valuable insight into the role of confidence in athletic injury rehabilitation. Future research might examine the role of confidence during injury in a variety of additional samples, including women, differing levels of competitiveness, and a greater variety of sports. Recent research (Gould, Dieffenbach, & Moffett, 2002; Jones, Hanton, & Connaughton, 2002), investigating the mental toughness of Olympic medallists identified an "unshakeable" sense of self-belief. It would be interesting for future research to examine whether such athletes exhibited any differences in the resilience of their confidence during injury rehabilitation. This study highlighted that confidence does indeed play an important role in rehabilitation, however, the qualitative methods employed do not allow any causal conclusions to be drawn. It would be advantageous for future researchers to use this study as a starting point to develop a measure of confidence during athletic injury rehabilitation. This would enable researchers to gain a more accurate assessment of the role of confidence, identify fluctuations in confidence, and facilitate the design and evaluation of psychological interventions strategies for injured athletes

Chapter 3

The Development of a Measure of Confidence during the Entire Athletic Injury Rehabilitation Process

ABSTRACT

Despite the existence of a plethora of research concerning the psychology of sport injury rehabilitation, there remains a dearth of psychological measures developed specifically for the sports injury rehabilitation context. The purpose of this study was to develop a measure of athletic confidence throughout the entire athletic injury experience. The results of a qualitative study (Chapter 2) were employed to develop an item pool. Each raw data theme was used to generate an item for the inventory and each first-order theme formed a subscale. The six subscales were: confidence in the injured body part; confidence in own body, confidence in rehabilitation team, fear of re-injury at point of re-entry; confidence about ability on re-entry into sport; and loss of self-esteem. Confirmatory factor analysis, using the sequential model testing approach (Jöreskog, 1993), of responses from 402 athletes of varying abilities from a wide range of sports provided acceptable support for the six factor 27 item model, χ^2 (963.12, df = 309) p = 0.00, RMSEA = 0.074, CFI = 0.94, and SRMR = 0.069. Further analyses needs to be conducted to assess both the predictive and discriminant validity of the measure. Implications of the results for sports psychologists are discussed, and future research projects recommended.

INTRODUCTION

Research investigating psychological aspects of sports injury rehabilitation has grown both in quantity and quality over the past three decades. In a review of the literature concerning the psychology of sport injury rehabilitation, Brewer (2001) acknowledged the advances in methodological rigour during the past ten years. However, Brewer (2001) concluded that the research conducted so far, was both eclectic in orientation, and fragmented across studies. Brewer (2001) recommended that the field would benefit from employing a more focused and unified research agenda. A reason for this conclusion appeared to be the lack of consistency in the measures and methods employed in the research. As yet, few psychological measures have been developed specifically for the sport injury rehabilitation context. Evans and Hardy (1999) advocated that greater consistency in both measures and methodologies employed would facilitate the development of a cohesive foundation of knowledge.

A prime example of a psychological factor within the sports injury research that lacks a standardised measure and a sound knowledge base is confidence. Self-confidence has been highlighted as an important factor by both athletes (e.g., Evans, Hardy, & Flemming 2000; Orlick, & Lee-Gartner,1993) and researchers (e.g., Bandura, 1990; Heil, 1993; Johnston & Carroll, 1998; La Mott, 1994; Magyar & Duda, 2000; Quinn & Fallon , 1999; Taylor & Taylor, 1997; Weise-Bjornstal, Smith, Shaffer, & Morrey, 1998); yet, very little is known regarding the precise role of confidence in athletic injury rehabilitation. In order to begin to develop our understanding of this area it is essential to first identify exactly how confidence is affected by injury and, to facilitate this an appropriate measure of confidence needs to be developed.

The main theoretical frameworks for the measurement of confidence within the sport psychology literature, include Bandura's (1977, 1986) theory of self-efficacy; Vealey's (1986) model of sport confidence; and Griffin and Keogh's (1982) model of movement confidence. Within the context of sports injury there is no standardised measure of confidence. A small number of studies have designed situation specific measures of self-efficacy explicitly for their study, for example, for football skills pre and post injury (Connelly, 1991), rehabilitation efficacy (Shaffer, 1991), and rehabilitation efficacy in connection with imagery usage (Sordoni, Hall, & Forwell, 2004). A number of studies have modified non-population specific measures of sport-confidence (e.g., State Sports Confidence Inventory; SSCI; Vealey, 1986) to the context of injury. A major concern with the modification of measures for athletic injury, is not so much what they measure, but what they do not measure (Evans & Hardy, 1999). Do studies that have employed the SSCI really provide a valuable insight into how confidence is affected by injury? Results from Study 1 of this thesis (Chapter 2) suggest that instruments such as the SSCI measure relatively few of the facets of confidence affected by injury.

Study 1 of this thesis (Chapter 2) employed qualitative methods to analyse in-depth interviews with five high-level athletes who had sustained potentially career ending injuries and three physiotherapists who had extensive experience of working with injured elite athletes. The results revealed a loss of confidence with regard to many facets of the injury experience as being an important factor. The findings indicated that the focus of a measure of confidence during injury rehabilitation, needs to encompass a number of different facets of confidence specific to the injury context. Confidence in this study, is conceptualised in the same way as in Chapter 2 of this

thesis, as the subjective probability of an outcome occurring. This definition is not completely dissimilar to Bandura's (1986, 1997) self-efficacy theory. However, as stated we are not interested only in self-confidence, but in a number of situations in which people's belief about the likelihood of events occurring might have an impact upon their behaviour and feelings.

The facets of confidence identified in Study 1 (Chapter 2) were: confidence in the injured body part; confidence in own body, confidence in rehabilitation team, fear of re-injury at point of re-entry; confidence about ability on re-entry into sport; and loss of self-esteem. Four other first order themes emerged that were not directly related to confidence, these were: looking for improvement in the injured body part; adherence motivation; actively seeking skills to develop whilst injured; and change of approach to sport. These four first order themes were perfectly valid as reported in the qualitative study, regarding what participant's perceived to be important to their confidence during rehabilitation. However, it was decided that there was insufficient theoretical support to suggest a direct relationship between these four first order themes and confidence to warrant their inclusion in the measurement tool devised in this study. Consequently, only the first six first order themes outlined above were employed to develop the instrument for this study. The items were constructed from the raw data themes.

Previous research has not specifically examined confidence in the injured body part (IBP) during injury rehabilitation. However, Evans, Hardy and Flemming (2001) identified that at the point of re-entry into sport athletes can lack confidence and can be protective of their IBP.

Confidence in own body contained raw data themes, which reflected athlete's feelings of losing confidence and trust in their body and feeling that their body had let

them down. Flint (1998) suggests that having a mind/body dichotomous cognition and a lack of trust in the body can create barriers to effective recovery. Raw data themes in the confidence in the rehabilitation team stressed the importance of the athlete's having confidence in the professional ability of their medical team and the capability of the medical team to communicate clear and specific expectations for recovery. Previous research has highlighted the importance of effective communication between sports medical team and the injured athlete (DeFranesco, Miller, Larson, & Roinson, 1994; Fisher & Hoisington, 1993; Petitpas & Danish, 1995; Wiese & Weis, 1987) and for the rehabilitation team to gain the trust and confidence of the injured athlete (Shaffer & Wiese-Bjornstal, 1999).

Fear of re-injury at the point of re-entry and confidence about ability to perform on re-entry both concerned the athletes feeling at the point of re-entry into sport. The former contained raw data themes describing athletes' fears with regard to re-injury and the latter their perceptions of their ability to perform upon re-entry into sport. Fear of re-injury has been identified by a number of researchers (e.g., Bianco, Malo, & Orlick, 1999; Evans et al., 2001; Gould et al., 1997a; Ievleva & Orlick, 1991; Johnston & Carroll, 1998; Udry, Gould, Bridges, & Beck, 1997) as an important factor towards the end of the rehabilitation period. Bandura (1997) argues that when the physical injury mends the athlete is left with nagging self-doubts about existing capabilities, which can mar performance long after physical functions have been fully regained.

The facet loss of self-esteem appeared to reflect the athletes' loss of having excelled at sport and then having this taken away from them by their injury, this was reflected in a low sense of self-worth. Some researchers have noted a decrease in global self-esteem following injury (Leddy, Lambert, & Ogles, 1994) or differences

as a function of injured/non-injured status (Chan & Grossman, 1988; Kleiber & Brock, 1992; McGowan, Pierce, Williams, & Eastman, 1994), whilst others have failed to find differences between pre and post injury measures of global self-esteem (e.g., Smith, Stuart, Weise-Bjornstal, Milliner, O'Fallon, & Crowson, 1993; Brewer & Petrie, 1995). Using domain specific measures of physical self-esteem, Leddy et al., (1994) and Connelly (1991) both found pre and post injury decrements in physical self-esteem.

It is quite possible that different facets of confidence may be either an independent or a dependent variable in the relationship between injury and athletic confidence. Specifically, how athletes feel about their chances of success in different areas may influence their rehabilitation, but also confidence could be an important marker of rehabilitation. For example, if a surgeon passes an athlete as physically fit, but the athlete has no confidence to return to sport then clearly that athlete has not fully recovered and the rehabilitation at that point has failed. It is likely that, during injury rehabilitation some of the facets of the injury experience explored in this study may have duel identity and some may be unidirectional.

In summary, there is a marked lack of specific measures of confidence for athletes during rehabilitation from injury. While some researchers have employed scales measuring self-efficacy for specific situations or skills during rehabilitation, there is a need for a measure of confidence that samples the full range of relevant facets of confidence over the rehabilitation period and that is suitable for use across the continuum from injury onset to re-entry into sport and competition. The purpose of this study was to develop such a measure of athletic confidence during injury rehabilitation. This should enable researchers to: a) gain a more accurate assessment of the effect of injury on athletic confidence; b) identify fluctuations in confidence

during this period; and c) provide a standardised measure that could facilitate the design and evaluation of psychological interventions strategies for injured athletes.

METHOD

Generation of Item Pool

The first stage in the development of the questionnaire was to generate a pool of items, which measured confidence with regard to the different facets of the injury and rehabilitation period identified by in Chapter 2. Since very little was known about the precise role of confidence in athletic injury or the different facets of confidence during the rehabilitation period the qualitative study reported in Chapter 2 was conducted.

This identified 57 raw-data themes, which were combined into 10 first order themes. Four of the first order themes were not directly related to confidence and it was decided not to include them in the development of the measurement tool. The six first order themes employed were: confidence in the injured body part; confidence in own body, confidence in rehabilitation team, fear of re-injury at point of re-entry; confidence about ability on re-entry into sport; and loss of self-esteem. In order to develop the item pool, each raw data theme was used to generate an item for the inventory and each first-order category formed a subscale for the inventory. Each item within the pool was based on a statement, which reflected a response by the athletes and/or physiotherapists during the interviews. The wording of each item was as close to the raw data quote as possible. The item pool contained both positively and negatively phrased items and a total of 42 items were developed (See Appendix 2 for item pool). Since the items were allowed to emerge from the raw data the number of items for each subscale varied.

In order to provide content and face validity, the item pool was scrutinised by a researcher who had extensive experience of developing measures of psychological factors within the sport psychology field. Based on feedback from this researcher, a number of items were re-worded. The 42 items were then randomised and placed on a Likert scale, anchored at (7) strongly agree and (1) strongly disagree with (4) being neutral.

The instrument designed also requested some demographic information regarding name, sex, age, date of injury, type of injury, anticipated length of time out of sport, level of sport participation, main sport and date upon which the inventory was completed.

Participants and Procedure

Participants were 402 injured athletes (306 male, 96 female; mean age 29.03, SD ± 10.61). All participants had sustained an injury that would prevent them from full training and sport participation for at least two weeks (mean 32.70 weeks, SD ± 29.01). In order to obtain data that would represent the total injury period and any differences at different stages of the injury period, participants were at different stages of the injury period, ranging from injury onset to the point of re-entry into competition. All participants were involved in competitive sport and competed at various levels: 26% recreational, 19% club level, 19% county/regional level, 20% professional, 10% international and 4% Olympic level. The sports that participants competed in included: athletics, rugby, football, netball, cricket, running, cycling, hockey, netball, gymnastics, climbing, squash, tennis, badminton, skiing, triathlon, golf, rowing, martial arts, horse-riding, motor racing, and swimming. Participants had a variety of injuries with 42% anterior cruciate ligament (ACL) reconstruction, 19%

general knee injuries, 10% ankle injuries, 9% shoulder injuries, 9% back injuries, 6% groin strain, 3% hip injuries, and 2% fractured legs.

Participants were approached at several sports injury clinics and asked if they would be willing to complete the questionnaire. The questionnaire took approximately ten minutes to complete. Participants were thanked for their time and effort.

Data Analysis

Confirmatory factor analysis procedures were conducted using Lisrel 8.54 (Jöreskog & Sörbom, 1993) with a covariance matrix as data input. Confirmatory factor analysis (CFA) was chosen rather than exploratory factor analyses (EFA) as an a priori model of factor structure had already been developed (Schutz & Gessaroli, 1993). Although CFA was employed it was utilised in an exploratory fashion. Specifically, results of the CFA together with the theoretical underpinnings of the items lead to the removal of items until a satisfactory model of fit was achieved. The sequential model testing approach to CFA was utilised as recommended by Jöreskog (1993) and Biddle, Markland, Gilbourne, Chatzisarantis and Sparkes (2001). Maximum likelihood estimation (ML) was used to estimate parameters specified in the model and to test the goodness of fit of the data. Hu and Bentler (1998) found that ML based indexes outperformed generalised least squares (GLS) and asymptotically distribution-free (ADF) for evaluating model fit.

The most common way of evaluating model fit are those that involve the chi-square goodness-of-fit statistic and the so-called fit indices that have been offered to supplement the chi-square (Hu & Bentler, 1998). Fit indexes can be classified into absolute and incremental fit indexes (Bollen, 1989; Gerbing & Anderson, 1993; Hu & Bentler, 1995; Marsh, Balla, & McDonald, 1988; Tanaka, 1993). An absolute fit

index measures how well an a priori model reproduces the sample data and the incremental fit index, assesses the proportionate improvement in fit by comparing a target model with a more restricted, nested baseline model (Hu & Bentler, 1999). The goodness of fit index (GFI) has been recommended (Jaccard & Wan,1996) as an absolute fit index. However, more recently, Hu and Bentler (1998) found the GFI to perform poorly and do not recommended it to evaluate model fit. Based on Hu and Bentler's (1998) recommendations, derived from their evaluation of the sensitivity of various incremental and absolute fit indexes, the absolute fit indices employed in this study were, the root mean squared residual (SRMR; Bentler, 1995) and the root mean square error of approximation (RMSEA; Steiger & Lind, 1980). The Comparative Fit Index (CFI; Bentler, 1990) was the incremental fit index employed.

The chi-square (χ^2) test statistic is an important indicator of model fit, with a non-significant chi-square indicating a good fit. However, researchers have recognised that the χ^2 test statistic is sensitive to non-norm data and is a direct function of sample size and that the larger the sample size, the more likely that χ^2 will be significant (Bentler & Bonett, 1980; Steiger & Lind, 1980). This has led to the recommendation that a non-significant χ^2 or a χ^2/df ratio of <2.00 indicate a good fit (Jaccard & Wan, 1996; Jöreskog & Sörbom, 1993). Due to a lack of adequate "rule of thumb" cutoff criteria for fit indexes used to evaluate goodness of fit of hypothesised models, Hu & Bentler (1999) examined the "rule of thumb" conventional cut-off criteria and various new alternatives for a range of fit indexes. Their results suggested that for ML method a cut-off value of close to .95 for CFI, a cut-off value of close to .08 for SRMR, and a cut-off value of close to .06 for RMSEA are needed in order to conclude that there is a good fit between the hypothesised model and the data.

The sequential model testing approach (Jöreskog, 1993) involved three stages. Firstly, tests of seperate single-factor models corresponding to each latent variable were conducted. The purpose of this stage of the analysis was to assess whether the items on each factor measured a single latent variable. The Satorra Bentler (1991) correction for non-normality in the data which generates a more robust or scaled χ^2 was employed. Secondly, each latent variable was analysed pair-wise with every other latent variable in two-factor models (a total of 15 pairings). This second stage of the analysis assessed the factors pairwise independence and allowed for the identification of any ambiguous items. The overall goodness of fit of each single factor model and each two factor model were examined as well as the standardised residuals and the modification indices for the covariances of the measurement errors. Specifically, a large positive standardised residual between two items indicates that these items share more in common than the model allows; a large negative standardised residual between two items would indicate that these items share less in common than the model suggests. The modification indices provided similar diagnostic information for the covariances between measurement errors. Based on the diagnostic information and theoretical underpinnings of the items from the single-factor and two-factor stages, items were removed on some subscales until a good fit was achieved for each single-factor model and then for each two-factor model. Finally, all six factors and a total of 27 items were included in a full model. This model was assessed in the same way as described in the first and second stage of the analysis.

RESULTS

Single Factor Models

Fit statistics for the original and final single-factor models are shown in Table 3.1. As can be seen from the original fit statistics a number of the single-factor models did not demonstrate a good fit. Specifically, Confidence in the Injured Body Part (IBP), Confidence in Own Body, Fear of Re-injury at the Point of Re-entry into Sport, Confidence about Ability to Perform at Re-entry into Sport and Loss of Self-esteem did not exhibit an adequate fit.

Following discussions concerning diagnostic statistical information and theoretical underpinnings of the items between the two authors, items were removed from the remaining single-factors models that did not demonstrate a good fit. This resulted in Confidence in the IBP being reduced from 8 to 5 items, Confidence in Own body from 5 to 4 items, Fear of Re-injury at the Point of Re-entry into Sport from 6 to 4 items, Confidence about Ability to Perform at Re-entry into Sport from 5 to 4 items, and Loss of Self-esteem being reduced from 14 items to 9. As each item was removed the single-factor models were reanalysed. This resulted in good model fits being obtained for all the remaining single-factor models.

Two Factor Models

Each pair of latent variables was examined in a similar fashion in a series of two factor models. Initial analyses of the two-factor models indicated that one item ("I focus on every little sensation that I get from my injured body part") from Confidence in the IBP, one item ("I believe the medical team fully understand the role sport has in my life") from Confidence in Rehabilitation Team and one item ("I cannot perform at my best, therefore, I avoid competition altogether") from Confidence about Ability to Perform on Re-entry into Sport, were problem items. These three items were removed and the two-factor models reanalysed. This resulted in good fit models for all pairwise analyses with one exception. The two-factor model

Confidence at the Point of Re-entry into Sport with Confidence in the IBP did not demonstrate a good fit χ^2 (93.86, df = 13) p = 0.00, SRMR = 0.064, RMSEA = 0.12, and CFI = 0.93. However, based on the fact that these two factors demonstrated good pairwise independence when paired with all other factors, it was decided to leave those factors unchanged and to include them in the full model. Thus, six factors and a total of 27 items were included in the full model.

A summary of the fit statistics for the 2-factor models is shown in Table 3.2. A full list of the fit statistics for the 2-factor models can be found in Appendix 3.

Full Eight-Factor Model

Fit statistics for the full six-factor model can be seen in Table 3.3. The χ^2 to degrees of freedom was slightly high, χ^2 (963.12, df = 309) p = 0.00; however, the SRMR (0.069) was better than the recommended cutoff point (0.08), the RMSEA was low enough (0.074) and CFI (0.94) high enough to demonstrate an acceptable fit of the model to the data.

Table 3.1

Fit measures for single-factor models

Factor/ Items	χ^2	d.f.	P(χ^2)	SRMR	RMSEA	CFI
Confidence in the Injured Body Part (5 items)	12.31	5	0.031	0.036	0.060	0.98
Original model of Confidence in the Injured Body Part (8 items)	184.35	20	0.000	0.83	0.14	0.86
Confidence in Own Body (4 items)	4.96	2	0.084	0.022	0.061	0.99
Original model of Confidence in Own Body (5 items)	24.75	5	0.000	0.048	0.099	0.96
Original model of Confidence in Rehabilitation Team (4 items)	4.23	2	0.12	0.027	0.053	0.98
Fear of Re-injury at Point of Re-entry into Sport (4 items)	1.59	2	0.45	0.016	0.0	1.00
Original model of Fear of Re-injury at Point of Re-entry into Sport (6 items)	75.72	9	0.00	0.082	0.14	0.87
Confidence about Ability to Perform on Re-entry into Sport (4 items)	6.15	2	0.046	0.026	0.072	0.98
Original model of Confidence about Ability to Perform on Re-entry into Sport (5 items)	48.21	5	0.00	0.060	0.15	0.91
Loss of Self-esteem (9 items)	61.20	27	0.001	0.040	0.051	0.98
Original model Loss of Self-esteem (14 items)	564.66	77	0.000	0.098	0.13	0.86

Note. n = 402

Table 3.2
Fit measures for 2-factor models

2 Factor Models	χ^2	DF	P(χ^2)	SRMR	RMSEA	CFI
Pairwise 10 pairs better than	145.17	53	0.00	0.055	0.064	0.96
Pairwise all better than	231.90	64	0.00	0.066	0.083	0.94

Note. n = 402

Table 3.3
Fit measures for Full Model

Full Model	χ^2	DF	P(χ^2)	SRMR	RMSEA	CFI
All six factors included	963.12	309	0.0	0.069	0.074	0.94

Note. n = 402

DISCUSSION

The purpose of this study was to develop and test the structural validity of a measure of athletic confidence during athletic injury rehabilitation. As a result of confirmatory factor analysis using the sequential model testing approach, the six factor 42 item model was reduced to a six factor 27 item model, which demonstrated acceptable model fit. The results indicate that the hypothesised model derived from Study 1 (Chapter 2) is sufficiently well supported by the data.

Loehlin (1992) suggests that one of the advantages of CFA is that it can guide model re-specification when a hypothesised model does not demonstrate adequate fit. This process of re-specification led to the removal of several items from the six original subscales, however, the six subscales were all supported by the CFA.

A number of researchers (e.g., Brewer, 2001; Evans & Hardy, 1999) have called for the development of population measures specific to athletic injury. The results of this study support this argument, since the majority of the six factors supported in this model would not be assessed in measures of confidence (e.g. State Sports Confidence Inventory; SSCI; Vealey, 1986) modified for the context of sports injury. This study highlights a number of facets of confidence during the rehabilitation process, that have not been accounted for in the measures employed in injury research to date. In order to progress our knowledge in this area, it is important for future researchers to begin to investigate exactly how these facets of confidence are actually affected by injury rehabilitation, or themselves affect the rehabilitation process.

Applied Implications

Although the measure developed in this study is still in the developmental stages and further validity research needs to be conducted, the results of this study provide support for the use of this instrument to measure confidence during sports injury rehabilitation. Sport psychologists working with injured athletes could employ the measure to monitor athletes' confidence during the injury process and potentially develop interventions to augment those facets of confidence where an athlete demonstrates low confidence.

Methodological Strengths and Weaknesses and Future Research Directions

Establishment of reliability and validity is essential in measures designed for the sport rehabilitation context (Evans & Hardy, 1999) using a large sample size of over 400 for the initial validation of the questionnaire provided a sound starting point for establishing the validity of this questionnaire. The sample comprised a good representation of different sports and levels of competition, from Olympic athletes down to recreational. The magnitude of participant injuries was a further strength of the research. Participants had sustained an injury, which precluded them from training/sport for a minimum of two weeks (mean 32.70 weeks, SD ± 29.01). A number of previous studies have reported on minor injuries requiring for inclusion only one days non-participation following injury occurrence (Evans & Hardy, 1999). Sampling from early to late in the rehabilitation period is another key strength (Weise-Bjornstal et al., 1998) of this study.

As with any research there were limitations to this research. One of the limitations of this study concerned the generation of the item pool. Specifically, the item pool contained only items that were developed from direct quotes taken from the raw data themes from Study 1 (Chapter 2). With hindsight it might have been

beneficial to have also developed a number of theoretically driven items for those subscales that contained only four or five items.

A second limitation of the study is that some of the subscales measure a lack of confidence not confidence itself. This was because the qualitative data dictated the items in each subscale and the qualitative data revealed an absence of confidence during some of the facets of the injury rehabilitation rather than the presence of confidence.

Concluding Remarks

This study reported the initial development of a population specific measure of confidence during athletic injury rehabilitation. The exploratory analysis provided support for the factor structure, but further confirmatory analyses are needed. In addition, further analyses needs to be conducted to assess both the predictive and discriminant validity of the measure.

The role of confidence in athletic injury rehabilitation has been mentioned a number of times in previous research, yet little is known regarding this area. Although it is acknowledged that the measure developed in this study is still in the developmental stages and further validity research needs to be conducted, the confirmatory factor analysis did provide some support for the use of this instrument to measure confidence during sports injury rehabilitation. It is hoped that this instrument will encourage researchers to begin to examine the different facets of confidence included in the subscales to develop our understanding of how these aspects of confidence are actually affected by, or themselves affect, injury rehabilitation.

Chapter 4

The Role of Confidence in Rehabilitation from Anterior Cruciate Ligament Reconstruction

ABSTRACT

The aim of this study was to investigate whether certain facets of confidence early in the rehabilitation period following anterior cruciate ligament (ACL) reconstruction, could predict physical recovery later on. A non-experimental field study design was employed. Participants were 30 athletes of varying abilities from a wide range of sports undergoing ACL reconstruction. The results demonstrated support for quadratice relationships between certain facets of confidence and physical outcome measures. Specifically, higher confidence in the body, higher confidence in the injured body part, less fear of re-injury at re-entry into sport and smaller lossses of self-esteem were significantly related to better susequent electromechanical delay and rate of force development outcomes and self perceived recovery rates. Inspection of the scatterplots indicated that these quadratic effects were ceiling effects rather than inverted 'U' effects. These findings are discussed in terms of the potential value of certain facets of confidence in enhancing certain aspects of the recovery process.

INTRODUCTION

An important question to emerge from the plethora of research investigating athletic injury is: what role does confidence play in sports injury rehabilitation? A number of different facets of self-confidence have been identified as important factors in athletic injury and rehabilitation including: a decrease in confidence beliefs about retuning to sport (Bandura, 1990; Heil, 1993; Taylor & Taylor, 1997; Weise-Bjornstal, Smith, Shaffer, & Morrey, 1998); low self-confidence in the injured body part when physically fit (Evans, Hardy, & Flemming, 2000; Johnston & Carroll, 1998); temporal differences in sport-confidence throughout the rehabilitation period (e.g., LaMott, 1994; Quinn & Fallon, 1999); previous experience of injury influencing self-confidence (Gould, Urdy, Bridges, & Beck, 1997b; Johnston, 1996); and, higher levels of self-confidence being associated with faster resumption of training and competition (e.g., Johnston & Carroll, 1998).

Whilst confidence has been identified as a potentially important factor in sports injury research, very little is known about its precise role within the athletic injury experience. In order to begin to address this, Study 1 (Chapter 2) a qualitative study was conducted, which suggested that confidence can be affected by many different facets of the injury experience. Study 1 (Chapter 2) identified a number of facets of confidence during injury rehabilitation that had not been accounted for in previous injury research. Although Study 1 provided a valuable starting point for research into this area, it did not investigate the nature of the relationship between these different facets of confidence and athletic rehabilitation.

Research by Waldrop, Lightsey, Ethington, Woemmel, and Coke (2001) found that self-efficacy (i.e., situation specific confidence) beliefs regarding ability to perform therapeutic activities predicted significant variance in rehabilitation outcome

following hip or knee replacement surgery. However, there were a number of limitations to this study. Specifically, Study 1 of this thesis (Chapter 2) found that there are a number of different facets of confidence that are important during rehabilitation; however, Waldrop et al's., (2001) study assessed only confidence beliefs with regard to adherence to rehabilitation exercises. More importantly, the outcome measures were collected at discharge from hospital between 1 and 4 weeks post-surgery. Given that most patients require at least 3-5 months or longer to gain full strength and functioning following hip or knee replacement (Harris & Sledge, 1990), the validity of Waldrop et al., (2001) results with regard to long term rehabilitation outcome is questionable.

For surgical treatments that involve considerable investment of time, effort, and money, establishing whether or not a significant relationship exists between confidence and recovery rates could have important implications for both injured athletes and medical teams. A good example of one such surgical treatment is acute tearing of the anterior cruciate ligament (ACL). The ACL is the principle ligamentous restraint to anterior tibio-femoral displacement (Butler, Noyes, & Grood, 1980) and tearing of the ACL is one of the most prevalent and debilitating sport related injuries (Dersheid & Feiring, 1987; Roos, Ornell, Gardsell, Lohmander, & Linstrand, 1995). It is estimated that approximately 30 per 100,000 of the British population suffer ACL injuries each year (Bollen, 1998). Injuries to the ACL range from partial to complete rupture and result in varying degrees of joint instability. Despite advances in surgical treatment and rehabilitation programs, ACL injury still presents extensive physiological and psychological challenges to the athlete (Doyle, Gleeson, & Rees, 1998).

Reconstructive surgery followed by a protracted period of physical therapy (i.e., 6 to 12 months) is the usual procedure recommended for ACL tears (Blair & Wills, 1991; DeCarlo Sell, Shelbourne, & Klootwyk, 1994). A contemporary rehabilitation programme as followed by participants in this study can be found in Appendix 4. The rehabilitation programme follows clinic and home-based activities designed to develop strength in both hamstrings and quadriceps and enhance flexibility, normal walking gait and range of motion to facilitate an early return to normal physical activity (Blair & Wills, 1991; DeCarlo Sell, Shelbourne, & Klootwyk, 1994). Rehabilitation programmes are typically rigorous and require a considerable amount of time and effort from the patients (Hayes et al., 1979).

The qualitative study conducted as Study 1 (Chapter 2) of this thesis identified six facets of confidence that athletes and physiotherapists perceived to be important during athletic injury rehabilitation: confidence in own body; confidence in injured body part (IBP); confidence in rehabilitation team; fear of re-injury at point of re-entry into sport; confidence in ability to perform at re-entry into sport; and loss of self-esteem. In order to provide a coherent theoretical rationale for the role confidence could play during rehabilitation from ACL reconstruction, it was considered necessary to examine each of these facets. In order to avoid repetition, those facets for which a similar theoretical rational is proposed will be discussed together.

Confidence in the Injured Body Part, Confidence in Own Body and Confidence in Ability to Perform at Re-entry into Sport

It is well established that self-confidence can facilitate physical performance (Feltz, 1988, 1994; Roberts & Vealey, 1992; Vealey, 1986). Studies employing within subject designs, where performance has been operationalised ideographically, have provided support for the positive relationship between confidence and

performance (e.g., Burton, 1988; Jones, Swain, & Hardy, 1993; Martens, Burton, Vealey, Bump, & Smith, 1990). Since an athlete's body is of fundamental importance to their physical performance, it would seem logical to suggest that the confidence an athlete has in their body could influence how they perform both during their rehabilitation and on re-entry into sport.

Self-efficacy refers to a situation-specific micro level of self-confidence as opposed to global self-confidence. Within the self-efficacy literature there is an ongoing argument concerned with whether very high levels of self-efficacy can have a negative influence on performance. It is generally accepted that self-efficacy and performance are positively related (e.g., Bandura, 1982; Bandura & Wood, 1989; Stajkovic & Luthans, 1998). However, recent research by Vancouver and his colleagues (Vancouver, Thompson, & Williams, 2001; Vancouver, Thompson, Tischner, & Putka, 2002) contends that high levels of self-efficacy can also have a negative influence on performance. In a decision task, Stone (1994) found that participants high in self-efficacy were less attentive and effortful than their low self-efficacy counterparts. Bandura and Jourden (1991) found similar results and suggested that "complacent self-assurance creates little incentive to expend the increased effort needed to attain high levels of performance" (p. 949). Vancouver et al., (2001) suggest that too much self-efficacy can lead athletes to become complacent. Bandura (2003) disputes the possible negative influence of self-efficacy on performance, however, at present the discussion continues.

In the context of athletic rehabilitation, it was expected that low confidence in the IBP, the body and in ability to perform at re-entry into sport, would decrease the amount of effort, time and persistence athletes would allocate to their rehabilitation. However, too much confidence could lead to athletes exceeding their safe activity

limits or becoming complacent. Consequently, it was hypothesised Confidence in the IBP and Confidence in Own Body during the early post-surgery period and Confidence in Ability to Perform at re-entry into Sport would have quadratic relationships with the physical outcome measures assessing the quality of rehabilitation.

Confidence in Rehabilitation Team

The importance of establishing a rapport and effective communication between the injured athletes and their medical team is well established in the rehabilitation literature (DeFrancesco, Miller, Larson, & Robinson, 1994; Fisher & Hoisington, 1993). Interactions between injured athletes and their rehabilitation team can exert an important influence on the athletes' psychological state, rehabilitation adherence and rehabilitation outcome (Brewer, Van Raalte, & Petitpas, 1999).

Brewer, Van Raalte, and Petitpas, (1999) suggest that adherence may be compromised when injured athletes are not confident in and comfortable with their rehabilitation team. The belief that injured athletes have in the efficacy of their treatment has been highlighted as a factor related to greater rehabilitation adherence (Duda et al., 1989; Noyes et al., 1993; Taylor & May, 1996). It is likely that athletes who have little confidence in the professional ability of their rehabilitation team may question the efficacy of the treatment they are receiving, which in turn could lead to a decrease in rehabilitation adherence.

Consequently, it was hypothesised that Confidence in the Rehabilitation Team during early post-surgery period would have a positive linear relationship with physical outcome measures later in rehabilitation.

Fear of Re-injury at the Point of Re-entry into Sport

The processing efficiency theory, (Eysenck, 1982, 1992) postulates that cognitive anxiety serves two principle functions. First, worry or fear reduces the effective working capacity available to performers by wasting resources on worry, self-concern, and other task irrelevant activities. Second, anxiety signals the importance of the task to individuals and, as such, can have a motivational effect. Eysenck (1982) argued that because the individual is anxious they will invest more effort into the task, provided they perceive at least a moderate probability of succeeding. In the context of ACL rehabilitation, *some* fear of re-injury, may signal to the athlete the importance of adhering to their rehabilitation programme. However, too much fear could lead to defensive avoidance. Specifically, defensive avoidance is a motivated resistance to the source of fear, such as denial or avoidance of the threat (Creyer & Kozup, 2003). In the context of rehabilitation, individuals could defensively avoid information regarding their IBP, become inattentive during rehabilitation sessions, or suppress any thoughts about their IBP and rehabilitation in an attempt to reduce the fear and worry.

Further, fear of re-injury could lead to increased tension in the area. Muscle guarding is an adaptive response during the initial phase of injury; however, it can lead to increased muscle tension (Heil, 1993). Increased muscle tension can restrict blood flow to the injured area and increase pain (Cousins & Phillips, 1985). More importantly the greater blood flow, the faster injured tissues are repaired (Benson, 1975; Bresler, 1984a, 1984b). Muscle tension can also interfere with normal coordination and increase the chance of re-injury (Smith, Ptacek, & Patterson, 2000). Some fear may signal the importance of rehabilitation adherence and help protect the knee, but too much fear could distract the athlete from completing their rehabilitation exercises correctly, and lead to muscle tension.

In light of the above arguments, it was hypothesised that fear of re-injury at the point of re-entry into sport would have a quadratic relationship with the physical outcome measures later on in the rehabilitation.

Loss of Self-Esteem

Although some researchers (e.g., Bandura, 1997) have argued that self-esteem and self-confidence are not directly related, loss of self-esteem was identified as an important factor with regard to confidence during rehabilitation in Study 1 (Chapter 2). For further discussion of this issue see Chapter 2. For the present, it is sufficient to note that loss of self-esteem was included as a factor in Study 2 (Chapter 3) measure of confidence during athletic rehabilitation and was consequently included in this study.

Research has demonstrated significant differences between individuals high vs. low in self-esteem. High self-esteem is associated with greater persistence in the face of failure, suggesting that self-esteem facilitates resilience (Shrauger & Rosenberg, 1970; Shrauger & Sorman, 1977). High self-esteem individuals appear to be less vulnerable to the psychological impact of everyday events, as indicated by smaller mood swings and affective reactions (Cambell, Chew, & Scratchley, 1991). High self-esteem appears to buffer people against feelings of anxiety, enhance coping, and promote physical health (Baumeister, 1993; Greenberg et al., 1992; Taylor & Brown, 1988), whereas low self-esteem has been identified as one of the symptoms of learned helplessness (Peterson, Maier & Seligman, 1993).

There are also motivational orientation differences between high self-esteem and low self-esteem individuals (Baumeister, Tice, & Hutton, 1989). Specifically, people with high self-esteem have a self-enhancing orientation, in that they seek to capitalise on their good traits and pursue successes even under risky conditions.

Conversely, people with low self-esteem have a self-protective orientation, by which they seek to correct their inadequacies and to avoid failures and other setbacks (Baumeister, 1999). High self-esteem in athletes rehabilitating from ACL reconstruction could encourage them to work hard, but too high self-esteem could lead them to undertake risks, which might lead to setbacks or instances of re-injury. Those low in self-esteem may avoid difficult but important aspects of their rehabilitation in order to protect their self-esteem from further loses.

Although it is appealing to characterise self-esteem in unequivocally positive terms, recent research suggests that this is not always true (Kernis & Paradise, 2002). High self-esteem can also be linked with arrogance, egotism, conceitedness, narcissism and an unwarranted sense of superiority (Baumeister, Smart, & Boden, 1999). Baumeister et al., (1999) argued that people with high self-esteem tend not to show strong self-protection (against losing self-esteem) compared to those low in self-esteem. However, when threats to esteem do arise, individuals high in self-esteem respond in ways that are often drastic and irrational (see Blaine & Crocker, 1993, for review; also Baumeister, Heatherton, & Trice, 1993; McFarlin & Blascovich, 1981). On the basis of the above arguments, it was expected that Loss of Self-esteem in the early post-surgery period would have a quadratic relationship with the physical outcome measures later on in the rehabilitation.

METHOD

Prior to commencing this research project, ethical approval was gained from the Ethics Committee of the hospital from which participants were recruited.

Participants

Participants were 30 (24 male & 6 female) patients with knee injuries who had elected to undergo ACL reconstructive surgery from one of two surgeons participating

in a larger project, and who met the following criteria: a) arthroscopic verification of complete ACL disruption, b) demonstrated no evidence of other acute lower extremity trauma, c) expected to engage in postoperative rehabilitation for at least six months, and d) participated in sport. The mean age of participants was 29.3 (± = 8.4) years with a range of 16 – 42 years. Participants competed at a number of different competitive levels including: international (2), national (3), university (5), regional/club (10) and recreational (10). Participants competed in a variety of sports including: football (14), rugby (5), cricket (2), hockey (2), athletics (1), badminton (1), karate (1), kiteboarding (1), sailing (1), squash (1) and, water polo (1).

Measures

Indices of Neuromuscular and Musculoskeletal Physical Outcome:

Neuromuscular and musculoskeletal factors, which contribute both to the performance capability for rapid dynamic stabilisation of knee joint and suitable control of such performance potential include: peak force (PF) or strength, rate of force development (RFD), electromechanical delay (EMD) and joint laxity (Gleeson, Mercer, Morris, & Rees, 1997; Zhou, McKenna, Lawson, Morrison & Fairweather, 1996; Gleeson, Reilly, Mercer, Rakowski & Rees, 1998). The PF, EMD & RFD performance measures were assessed on both the knee extensors (quadriceps) and knee flexors (hamstrings).

Participant and dynomometer orientation: Within each testing session, the participant's injured and asymptomatic limbs were tested in random order. Following habituation procedures, participants completed a standardised warm-up consisting of five minutes cycle ergometry (90 Watts for males, 60 Watts for females) and a further five minutes of stretching of the involved musculature prior to testing.

Participants were secured to the testing apparatus (Rev9000), seated in an upright position with the angle between the back and seat of the dynamometer chair set at 0.26 rad. To localise the action to the proper muscles groups, participants were securely strapped at the hip, waist, chest and shoulders with an additional restraint applied to the thigh close to the involved joint. The dynamometer's lever arm was strapped to the involved leg just above the ankle joint. A knee flexion of 25 degrees (0.44 rad) identified during muscle loading, was maintained for both knees throughout testing, this has been recognised as a functionally relevant angle where key ligamentous structures are under greatest mechanical strain (Beynnon & Johnson, 1996).

Volitional muscle activation: Participants were directed through a further standardised warm-up procedure involving sub-maximal activations of the knee flexors/extensors against the resistance offered by the static immovable structure incorporating the load cell (3 x 50% maximal voluntary muscle activations (MVMA), 2 x 75% MVMA, 1 x 95% MVMA). The requirements for muscular relaxation prior to the test and the need to initiate the maximal force as rapidly as possible after receipt of stimulus to start the muscle activation were explained to the participant prior to each testing session.

After the warm-up participants were requested to complete three 100% MVMAs. After a verbal warning, an auditory signal was delivered to the participant

randomly within 1-4 seconds. On hearing the signal, the participant attempted to flex/extend the knee joint as quickly and forcefully as possible against the immovable restraint offered by the apparatus, to produce a MVMA of 100% effort. Participants were required to maintain the maximal force against the immovable restraint until a further auditory signal was given (approximately two seconds later), at which point they were required to withdraw the force as rapidly as possible. A total of three MVMAs were collected, each separated by approximately 10 seconds to enable neuromuscular recovery (Moore & Kukulka, 1991).

Index of electromechanical delay: EMD is defined as the time delay between the onset of electrical activity to the onset of force. The processes of EMD include: conduction of the action potential through the muscle and the t-tubule system, release of calcium ions from the sarcoplasmic reticulum, formation of the actin-myosin cross-bridges and the lengthening of the series eleastic component (SEC) (Cavanagh & Komi, 1979; Komi, 1979). Estimates of EMD were calculated for each MVMA. The methodology employed to measure EMD in this study, was based upon that recommended by Gleeson (2001). Electromyographic activity (EMG) was recorded with bipolar surface electrodes (self-adhesive, silver-silver chloride, 10mm diameter), which were applied following standard skin preparation (i.e. shave, alcohol wipes, light abrasion with sandpaper), which yielded an interelectrode impendance of <5000 Ω. Electrodes were placed either: longitudinally distal to the belly of the biceps femoris muscle, on the line between the ischial tuberosity and the lateral epicondyle of the femur for knee flexor assessment, or: longitudinally over the distal aspect of the muscle for the vastus lateralis muscle for the knee extensor assessment. The inter-electrode distance was 3 cm and a reference electrode was placed 3 cm lateral and equidistant from the recording electrodes. The raw EMG signals underwent

amplification (gain = 1000) and analogue to digital conversion at 2000 Hz (ME3000P; EGA Systems, Kuopio, Finland).

To ensure the same electrode placement at subsequent trials, a map of the thigh of each participant was made. This was done by marking on acetate paper the position of the electrodes, anatomical landmarks, moles and small anigomas. Software (Spike 2, version 2.01, Cambridge Electronic Design Ltd., U.K.) was used to interrogate the force and electromyographic data records of volitional muscle activation.

Indices of volitional neuromuscular performance: Estimates of volitional neuromuscular performance were calculated for each MVMA. The mean values across intra-trial replicates were calculate for every index and were used to describe performance. Participants were not given feedback of the results until after completion of the testing.

Volitional static peak force (PFv) was described as the mean response associated with the prescribed number of intra-trial replicates where the highest force was recorded in each MVMA. The average rate of force increase associated with the force-time response between 25 percent and 75 percent of peak force was calculated for each MVMA and the index of rate of force development (RFDv) was defined as the mean rate across the intra-trial replicates.

Index of knee laxity: At each testing session, assessments of anterior tibio-femorial displacement (TFD) were undertaken in the participant's injured and asymptomatic limbs using a laboratory instrument constructed specifically to measure anterior TFD (Gleeson, Rakowski, Rees, & Reilly, 1995; Gleeson, Rees, & Rakowski, 1996).

The protocol adhered to, in measuring anterior TFD, was based upon that employed by Gleeson, Reilly, Mercer, Rakowski, and Rees (1998). Participants were secured to the testing apparatus (Rev9000). Participants were seated in an upright position with the angle between the back and seat of the dynamometer chair set at 0.26 rad. The involved leg was secured with self-adhesive straps and a clamping device at the distal femur and tibia, respectively. The knee joint was maintained at 0.44 rad of flexion (0 rad= full extension) and foot position at 0.26 rad of external rotation (Markolf, Kochan & amstutz, 1984) and 0.35 rad of plantar flexion.

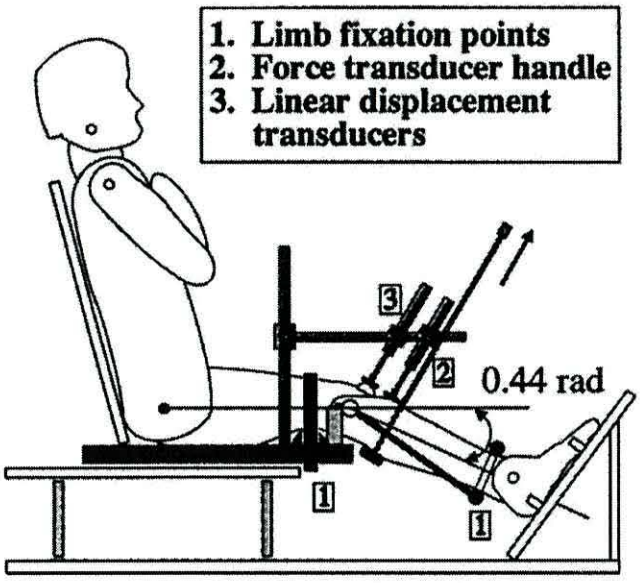


Figure 4.1 Subject and anterior tibio-femoral displacement (TFD) measurement apparatus orientation.
From: Gleeson et al.,: Med Sci Sports Exerc, Volume 30(4). April 1998.596-608

The instrumentation employed to measure TFD consisted of two linear inductive displacement transducers (DCT500C, RDP Electronics Ltd., Wolverhampton, UK 0.025m range). The displacement transducers incorporated spring-loaded plungers, which were adjusted accurately in three planes to provide perpendicular attachment to the patella and tibial tubercle (Gleeson et al., 1998). Both transducers were secured to the skin surface using tape and during measurement were

allowed to move freely only in the anterior-posterior plane relative to the supporting framework. The relative motion between the patella and tibial sensors was the only movement monitored by the instrument, thus facilitating the exclusion of measurement artefacts caused by extraneous movements of the leg during the application of anterior displacement forces.

Anterior force of 160N was applied in the sagittal plane in a perpendicular direction relative to the tibia by an instrumented force-handle incorporating a load cell (Model 31E500NO, RDP Electronics Ltd., Wolverhampton, U.K.: range 500N). This device was positioned behind the leg at a level of 0.02 m distal to the tibial tubercle. The transducers were interfaced to an IBM compatible microcomputer via a 16 channel A/D 12 bit converter (Model PC-28A, Amplicon Liveline Ltd., Brighton, U.K.). Data from all transducers were sampled at 50 HZ.

Two practice trials were conducted, followed by three measurements on each knee. During the measurements participants were instructed to relax the musculature of the involved limb. Indices of anterior TFD were calculated as the mean of three intra session replicates of the net displacement of the patella and tibial tubercle transducers at anterior tibial displacement forces of 160N applied in the sagittal plane.

Psychological Measures

Confidence: was measured using the Self Evaluation Inventory developed in Chapter 3. This instrument was developed explicitly to measure the six facets of confidence during rehabilitation that were discussed in the introduction, and form the basis for the hypotheses tested in this study. The Self Evaluation Inventory (SEI) contains 50 items combined into six subscales that measure: confidence in own body, confidence in rehabilitation team, confidence in the injured body part, fear of re-injury at point of return to sport, confidence about ability to perform at re-entry into sport,

and loss of self-esteem. Each item in the Self Evaluation Inventory is rated using a seven point Likert response scale that is anchored at (7) strongly agree and (1) strongly disagree, with (4) being neutral. Initial structural validation of the questionnaire using confirmatory factor analysis (Chapter 3) has indicated that the inventory has adequate structural validity χ^2 (963.12, df = 309) p = 0.00, RMSEA = 0.074, CFI = 0.94, and SRMR = 0.069.

Patient Self-Perception of Rehabilitation: Performance profiling (Butler, 1989) based on (selected aspects of) personal construct theory (Kelly, 1955) was employed to measure participants' perception of their rate of rehabilitation progress. Performance profiling is a simple means of eliciting patients' perception of their progress. Both personal construct theory and performance profiling take the perspective of the individual to be fundamental and emphasise that each individual differs in his/her perception and interpretation of situations and their importance. The performance profile allows participants to construct a visual display of their symptoms throughout rehabilitation in terms that make sense to them, rather than requiring them to respond to predetermined items. To elicit the profile, participants were asked to consider the question: "What, in your opinion, are the elements of your injured body part in need of rehabilitation or improvement to obtain full recovery?" Contributions from the medical team were included to generate a broad range of qualities. The ten most important qualities as identified by the participant were mapped onto the profile by the researcher. Participants were then asked to complete their performance profile by considering the question: "Please respond by marking on the profile your perceived current state using the following scale: 1 = extremely different to before the injury to 10 = the same as before the injury."

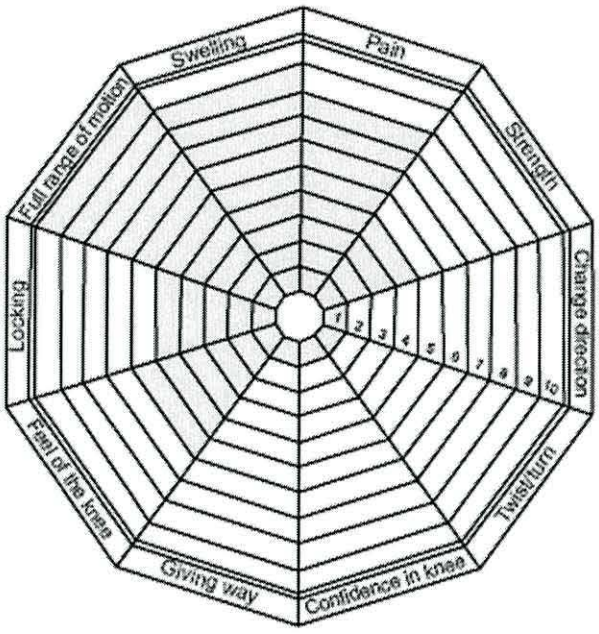


Figure 4.2: Example of a completed profile the qualities chosen by the athlete displayed around the perimeter of the profile. The shaded area represents the athlete's perceived current state of the injured limb (1 = extremely different to before the injury to 10 = the same as before the injury).
Adapted from: Doyle, J., Gleeson, N.P., and Rees, D. : Sports Medicine, Volume 26(6).December1998.379-393

The knee profiles took approximately 30 minutes to complete during the initial session and five minutes to complete in the sessions thereafter. Previous research by Doyle, Gleeson and Rees, (1998) utilised the performance profile to monitor changes during rehabilitation from (ACL) reconstruction. Doyle, Gleeson and Rees (1998) suggested that research into the measurement utility of the technique suggests that the profile offers the potential to accurately monitor changes in athletes' perceptions of physical state during rehabilitation from ACL reconstruction.

Rehabilitation Adherence: An ad hoc measure of adherence motivation was developed. Single factor confirmatory factor analysis was conducted using the sample of participants from Study 2 (Chapter 3). This seven-item single factor model demonstrated very good model fit χ^2 (21.91, df = 14) p = 0.08, RMSEA = 0.038, CFI

= 0.96, and SRMR = 0.041. The mean Cronbach's Alpha across the data collection points was .72.

Participants were asked to maintain daily diaries for the duration of the study. They were requested to record all rehabilitation and training activities and any other information they felt was important in their rehabilitation. Participants were asked to note any setbacks in rehabilitation or training. Participants were asked to write any instances of re-injury into their training diaries and to describe how the re-injury occurred, the nature of the re-injury and the severity of the re-injury. Participants were also asked to note if the injury occurred in the currently injured body area or on a different area of the body. Finally, participants were requested to note down in their diaries any psychological interventions or training that they partook in

Experimental procedure

Participants who met the selection criteria, were telephoned by the researcher approximately one week before they were due to attend their pre-surgery assessment. The researcher described the procedures of the study to the patients and those who expressed an interest to take part were sent a patient information sheet (see Appendix 5). It was arranged that they would meet with the researcher to complete a pre-surgery assessment on the same day that they attended the pre-surgery assessment clinic at the hospital (approximately two weeks prior to their surgery).

Participants were initially asked to read and complete an informed consent form (see Appendix 6). Following habituation procedures, participants completed the standardised warm up as described above. Participants were then secured in a seated position on the Rev 9000 dynamometer. The evaluation of volitional neuromuscular performance of the knee flexors and extensors of either the pathologic or asymtomatic leg (randomly allocated) were undertaken in accordance with the protocols and

experimental conditions outlined above. Anterior tibio-femoral displacement measures were also undertaken in accordance with the protocol outlined above.

After completion of neuromuscular and musculoskelatol measures on the first limb, participants were asked to complete the psychological measures (the SEI and Performance Profile). The researcher was on hand at all times to answer any questions the participants may have with regard to the completion of these instruments. After completion of the functional performance measure and the psychological measures, participants were secured back in the Rev9000 the volitional neuromuscular performance of the knee flexor and extensors and the anterior tibio-femoral displacement measures were taken for the second limb. All participants were assessed on all dependent variables on four assessment occasions and completed the psychological measures nine times (please see flow diagram below).

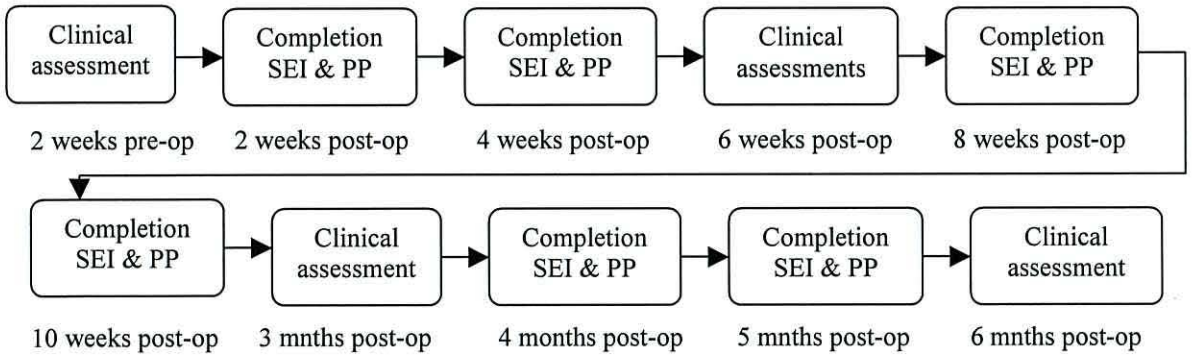


Figure 4.3: Flow diagram for protocol of assessment pre and post surgery
(SEI = self-evaluation inventory; PP = performance profile; Clinical assessment = assessment of all psychological and physical outcome measures)

At the end of the preoperative, 1.5 month post-surgery, and three month post-surgery testing sessions participants were given a pack containing two copies of the self-evaluation inventory, performance profile, and two stamped addressed envelopes. Participants were requested to complete the measures and post them back to the researcher fortnightly during the initial three months postoperative, then monthly

during the final three months. To facilitate adherence to completion of the measures at home, the researcher telephoned all participants the day that they were due to complete the measures to remind them. Participants were also reminded both at assessment sessions and during telephone reminders to maintain their rehabilitation diaries.

RESULTS

Preliminary data screening and analysis

Statistical analysis was carried out using the SPSS 9.0 statistical package (SPSS). Descriptive statistics for all the psychological and physical outcome measures were calculated and are reported in tables 4.1 to 4.4 below. The data from the physical outcome measures (e.g., strength, EMD, laxity & RFD) was standardised within gender to remove gender differences. The mean Cronbach's Alphas for each of the SEI subscales across all the data collection points are shown in Table 4.1 below.

Table 4.1
Mean Cronbach's Alphas for each SEI subscale score across all the data collection points

	Mean Cronbach's Alpha
Confidence in Injured Body Part	.70
Confidence in own Body	.76
Confidence in Medical Team	.75
Fear of re-injury at Re-entry into Sport	.68
Confidence in Ability at Re-entry into Sport	.63
Loss of Self-Esteem	.84

Table 4.2
Descriptive Statistics Regarding the Adherence Motivation Measure

	Pre-surgery	6 weeks post-surgery	3 months post-surgery	6 months post-surgery
Adherence Motivation	5.16 (± 0.82)	5.33 (± 0.92)	5.19 (± 1.00)	5.33 (± 1.15)

Table 4.3
Descriptive Statistics Regarding Independent Variables

Variable	Pre-surgery	6 weeks post-surgery	3 months post-surgery	6 months post-surgery
Confidence in own Body	3.92 (± 1.25)	4.09 (± 1.16)	4.32 (± 1.25)	4.70 (± 1.27)
Confidence in the IBP	2.66 (± 1.06)	3.04 (± 1.18)	3.20 (± 1.19)	3.58 (± 1.28)
Confidence in Medical Team	5.07 (± 0.99)	5.72 (± 1.02)	5.32 (± 1.34)	5.75 (± 0.96)
Fear of Re-injury	4.90 (± 1.04)	4.67 (± 1.12)	4.55 (± 1.17)	4.16 (± 1.36)
Confidence in Ability	2.76 (± .96)	2.89 (± 1.08)	2.84 (± 1.25)	3.44 (± 1.47)
Loss of Self-Esteem	3.59 (± 1.11)	3.23 (± 1.02)	3.23 (± 1.10)	2.96 (± 1.02)

Mean values with standard deviation values in parentheses.

Table 4.4
Descriptive Statistics Regarding Dependent Variables for Injured Leg

Dependent Variable	Pre-surgery	6 weeks post-surgery	3 months post-surgery	6 months post-surgery
Ham & Quad Strength	239.25 N (± 85.36)	-	220.87 N (± 68.76)	282.82 N (± 87.15)
Ham & Quad EMD	65 ms (± 26.82)	-	64.48 ms (± 30.28)	54.12 ms (± 28.03)
Ham & Quad RFD	742.16 n.s (± 667.29)	-	746.03 n.s (± 618.73)	1001.58 n.s (± 559.71)
Laxity	8.09 mm (± 3.09)	5.38 mm (± 2.57)	6.45 mm (± 2.54)	7.33 mm (± 2.29)
Performance Profile Mean Discrepancy	5.99 (± 1.80)	5.34 (± 1.90)	3.74 (± 2.02)	2.11 (± 1.43)

N = Newtons, ms = Milliseconds, n.s = Newtons per second, mm = millimeter.

Table 4.5
Descriptive Statistics Regarding Dependent Variables for Non-Injured Leg

Dependent Variable	Pre-surgery	6 weeks post-surgery	3 months post-surgery	6 months post-surgery
Ham & Quad Strength	269.08 N (± 86.09)	-	270.15N (± 82.41)	329.57 N (± 185.98)
Ham & Quad EMD	60.68 ms (± 25.60)	-	71.53 ms (± 30.65)	56.18 ms (± 25.98)
Ham & Quad RFD	875.53 n.s (± 673.04)	-	887.62 n.s (± 712.18)	1270.60 n.s (± 800.76)
Laxity	4.52 mm (± 1.86)	4.37 mm (± 1.90)	4.06 mm (± 1.88)	4.79 mm (± 2.03)

N = Newtons, ms = Milliseconds, n.s = Newtons per second, mm = millimeter.

Preliminary Analysis

A series of repeated measures analysis of variance (ANOVAs) were conducted on the four physical outcome measures measured (e.g., strength, EMD, laxity, & RFD) at pre-surgery, 6 weeks, 3 months and 6 months post-surgery, to examine changes in physical outcome over the course of surgery and rehabilitation.

The repeated-measures ANOVAs performed on the physical outcome variables indicated that there was a significant effect for time on injured leg laxity $F(3, 87) = 11.04, p < 0.001$. Post hoc pairwise comparisons using Bonferroni's adjustment for multiple comparisons, revealed a significant decrease in laxity between pre-surgery and 6 weeks post ($p = <0.001$), and between pre-surgery and 3 months post ($p = 0.02$), together with a significant increase from 6 weeks post–surgery to 6 months post-surgery. The repeated-measures ANOVA performed on the hamstring and quadriceps strength data revealed that Mauchly's test of sphericity was significant $\chi^2 (2) = 11.80, p = .003$, so the Greenhouse-Geisser correction factor was employed to adjust the degrees of freedom. A significant effect for time was found for strength $F(1.49, 43.16) = 11.96, p = <.001$. Post hoc comparisons using the Bonferroni adjustment for multiple comparisons, revealed a significant increase in strength between pre-surgery and 6 months post-surgery ($p = .030$), and between 3 months and six months post-surgery ($p = <.001$), but not between pre-surgery and 3 months post-surgery ($p > .05$).

The repeated measures ANOVA performed on the injured leg EMD data showed that Mauchly's test of sphericity was significant $\chi^2 (2) = 9.21, p = .010$, so the Greenhouse-Geisser correction factor was employed. A significant effect for time was found on EMD $F(1.56, 45.30) = 3.60, p = .046$. Post hoc pairwise comparisons using the Bonferroni adjustment for multiple comparisons, revealed a significant

decrease in EMD between pre-surgery and 6 months post-surgery (p = .039), and between 3 and 6 months post-surgery (p = .039), but not between pre-surgery and 3 months post-surgery (p >.05).

Finally, the repeated measures repeated measures ANOVA on the RFD data revealed a significant effect for time on RFD ($F(2, 58) = 4.04$, p = .023. Post hoc pairwise comparisons showed the only significant increase in RFD was between 3 and 6 months post-surgery (p = .023).

Main Analysis

Separate quadratic regression analyses were conducted on those subscales hypothesised to predict physical recovery in a quadratic relationship and linear regression analyses were conducted on those subscales for which a linear relationship had been hypothesised. The quadratic regression was calculated by entering the mean subscale score (X) and the squared mean subscale score (X^2) into the regression equation (Cohen, Cohen, West & Aiken, 2003).

Although several analyses were conducted on the same hypothesis across the different phases of rehabilitation, the authors decided that they would have confidence in those results where a relationship between the independent and dependent variables was demonstrated in clear patterns across time. However, where there were no clear patterns in the results across time and only apparently random significant results were found, such results were rejected as Type 1 errors.

The dynamic muscle stabilisers of the knee joint include both the quadriceps and hamstring muscle groups. Quadriceps contraction extends the knee joint and the role of the hamstring muscle is to flex the knee joint (Kvist, 2004). In order to reduce the number of dependent variables and provide single measures of PF, RFD and EMD for each leg, those measures that were conceptually similar were combined.

Specifically, the PF for the hamstring and quadriceps were combined into a single measure of strength for each individual leg. The same principle was followed for EMD and RFD.

Analyses on Strength and RFD data. To control for individual differences in both the strength and RFD data, in each regression analysis, the pre-operative injured leg measure and current non-injured leg measures were first entered into the regression equation as covariates, and then the SEI subscale score (and where a quadratic relationship was hypothesised the squared subscale score) were entered in the second step.

Analyses on Laxity Data. Initially following ACL reconstruction, the graft undergoes necrosis and revascularisation (Arnoczky, Tarvin, Marshall, 1982; Ballock, Woo, Lyon, Hollis, & Akeson 1989; Beynnon, Johnson, Toyama, Renstrom, Arms, & Fischer 1994; Falconiero, DiStefano, & Cook, 1998). Personal communication with the surgeon participating in this study, suggested that revascularisation generally starts to occur around ten weeks post-surgery and the knee can often feel quite lax at this point (Rees & Gleeson, 1999). In order to control for natural changes in laxity due to the healing process, it was decided that only the end point (six months post-surgery) laxity outcome measure would be utilised. In order to control for individual differences in knee laxity the laxity measure for the injured knee pre-surgery and the laxity measure for the non-injured knee six months post surgery were entered into the regression equation first as covariates. The SEI score was entered second and where a quadratic relationship was hypothesised the squared SEI subscale score was included with it.

Analyses on Electro Mechanical Delay (EMD) Data. Laxity effects may have an influence on EMD, in order to account for this laxity was also controlled for. As

mentioned it was decided to employ laxity outcome measure at six months post surgery, owing to this, only EMD outcome measures at six months post surgery were the employed. In order to control for laxity effects on EMD results, in each regression analysis, the laxity measure for the injured leg at six months post surgery and the EMD measure for the non-injured leg at six months post surgery were entered into the regression equation first as covariates, and the subscale score was entered in the second step. In order to reduce the number of covariates, the EMD measure at pre-surgery for the injured leg was dropped as a covariate.

Regression Analyses

None of the six SEI subscales significantly predicted strength or laxity outcomes. Four significant results were found in the strength data, but, these were dismissed as Type 1 errors due to their apparent randomness and lack of confirming support in the rest of the findings.

Table 4.6 illustrates the independent variables (i.e., the SEI subscales) and the post-surgery stages when they significantly predicted EMD outcome at six months post–surgery. In order not to overwhelm the reader with too many results, the data collection points where the independent variables did not significantly predict EMD at 6 months post-surgery are not shown. However, a summary table of the non-significant findings can be found in Appendix (8). All of the significant relationships between the independent and dependent variables are quadratic relationships. None of the analyses involving Confidence in the Rehabilitation Team significantly predicted EMD at 6 months post-surgery.

Table 4.7 indicates the independent variables that significantly predict RFD at six months post-surgery. Interestingly, despite Loss of Self-Esteem significantly predicting EMD at 6 months post-surgery, it did not significantly predict RFD at six

months post-surgery. The significant relationships between the SEI subscales and RFD were all quadratic relationships. Similar to the results for EMD, none of the analyses conducted on Confidence in the Rehabilitation Team significantly predicted RFD at 6 months post-surgery.

Table 4.6
Multiple Quadratic Regression Analysis of Self-evaluation Inventory Subscales on EMD 6 Months Post-operation, Controlling for individual differences and laxity effects

Predictor	Data collection point in weeks post-operation	R^2 Totals all better than	R^2 Change all better than	F change all better than	Significant F change all better than	β all better than	Overall F all better than
Loss of Self-Esteem	6 wks, 8 wks, 10 wks, 12 wks, 16 wks	.671	.068	5.338	.029	.39	17.67**
Confidence in the IBP	2 wks, 4 wks, 6 wks, 8 wks, 10 wks 12 wks, 16 wks	.711	.107	9.654	.005	.39	21.30**
Confidence in Own Body	2 wks, 6 wks, 8 wks, 10 wks, 12 wks 16 wks	.666	.063	4.91	.036	.32	17.31**
Fear of Re-injury at Point of Re-entry into Sport	4 wks, 6 wks, 8 wks, 10 wks, 12 wks, 16 wks	.688	.085	3.41	.049	.148	13.81**
Confidence in Ability to Perform at Re-entry into Sport	4 wks, 10 wks, 12 wks, 16 wks	.686	.083	3.33	.05	.022	13.71**

* p <.05 ** p < .001
Wk = weeks
β = Unstandardized Coefficients
The effects listed are all quadratic effects

Table 4.7

Multiple Quadratic Regression Analysis of Self-evaluation Inventory Subscales on RFD 6 Months Post-operation, Controlling for individual differences and laxity effects

Predictor	Data collection point in weeks post-operation	R^2 Totals all better than	R^2 Change all better than	F change all better than	Significant F change all better than	β all better than	Overall F all better than
Loss of Self-Esteem	None significant						
Confidence in the IBP	2 wks, 6 wks, 10 wks, 12 wks 16 wks	.613	.121	3.91	.033	-.287	9.89**
Confidence in Own Body	12 wks 16 wks	.599	.107	3.34	.050	-.220	9.32**
Fear of Re-injury at Point of Re-entry into Sport	10 wks	.617	.125	4.08	.029	.333	10.25**
Confidence in Ability to Perform at Re-entry into Sport	8 wks, 10 wks, 16 wks	.602	.111	3.48	.046	-.365	9.46**

* p <.05 ** p < .001

Wk = weeks

β = Unstandardized Coefficients

The effects listed are all quadratic effects

Inspection of the scatterplots with the quadratic line of best fit suggested that the quadratic relationship effects were plateau effects, not inverted U effects (see examples below).

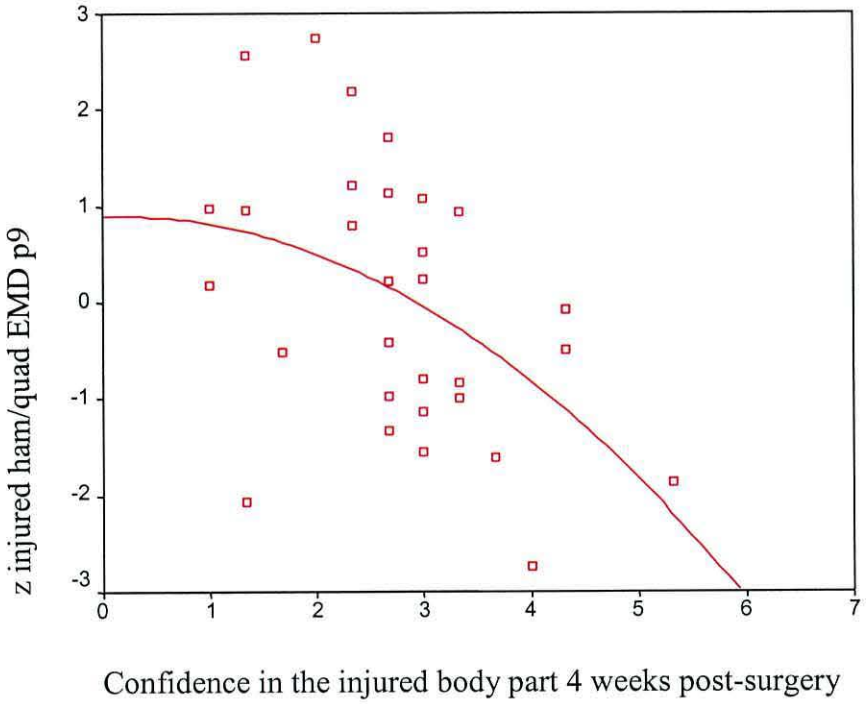


Figure 4.4 Scatterplot with quadratic line of best fit for Confidence in the injured body part 4 weeks post-surgery on Electromechanical delay at 6 months post-surgery

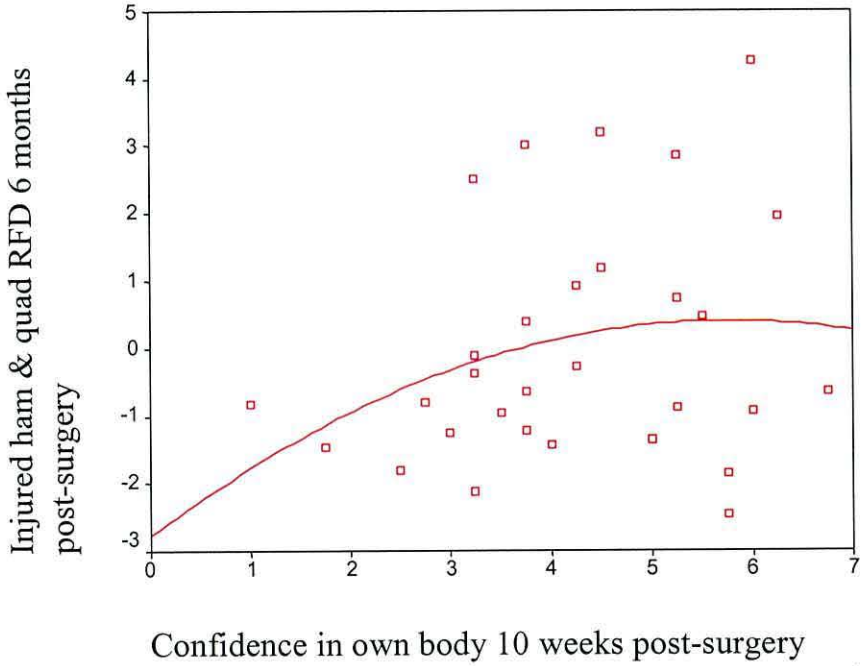


Figure 4.5 Scatterplot with quadratic line of best fit for Confidence in own Body 10 weeks post-surgery on rate of force development at 6 months post-surgery

The Performance Profile mean discrepancy data was also analysed in a series of regression analyses. Quadratic regression analyses were conducted where a quadratic relationship had been hypothesised between the SEI subscale and the outcome measures and a linear regression analysis where a linear relationship had been hypothesised. The six SEI subscales were entered individually as the independent variables against the Performance Profile discrepancy at each data collection point as the dependent variable. Table 4.8, demonstrates those independent variables between 2 weeks and 10 weeks post-surgery that significantly predicted the Performance Profile discrepancy at 3 months post-surgery. Table 4.9 shows those independent variables between 2 weeks and 16 weeks post-surgery that significantly predicted the Performance Profile discrepancy at 6 months post-surgery. Interestingly, as with the neuromuscular and musculoskeletal performance measures, the linear regression analyses conducted with Confidence in the Rehabilitation Team and the Performance Profile mean discrepancies at 12 weeks and 6 months post-surgery, did not yield any significant results.

Correlations were conducted between the dependent variables at pre-surgery and 6 months post-surgery are shown in Tables 4.10 and 4.11. At pre-surgery significant correlations were found between hamstring and quadriceps strength and RFD, strength and laxity, and EMD and RFD. At the six months post-surgery stage, two significant correlations between the dependent variables were found. Hamstring and quadriceps RFD was significantly correlated with EMD and RFD was significantly correlated with strength.

Correlations were conducted between the adherence motivation measure and the SEI subscales. The only significant correlation was between adherence motivation and confidence in the rehabilitation team.

Table 4.8
Quadratic Regression Analysis of Self-evaluation Inventory Subscales on Performance Profiles at 3 Months Post-operation

Predictor	SEI Data collection point in weeks post-operation	R^2 Totals all better than	F change all better than	Significant F change all better than	β all better than	Overall F all better than
Loss of Self-Esteem	4 wks, 6 wks, 8 wks, 10 wks	.215	3.70	.038	.203	3.70*
Confidence in the IBP	2 wks, 4 wks, 6 wks, 8 wks 10 wks	.215	3.71	.038	.144	3.71*
Confidence in Own Body	2 wks, 4wks, 6 wks, 8 wks, 10 wks	.203	3.43	.047	.039	3.43
Fear of Re-injury at Point of Re-entry into Sport	2 wks, 4wks, 6 wks, 8 wks, 10 wks	.255	4.62	.019	.016	4.62*
Confidence in Ability to Perform at Re-entry into Sport	2 wks, 4wks, 6 wks, 8 wks, 10 wks	.260	4.75	.017	.132	4.75*

* p <.05 ** p < .001
Wk = weeks
β = Unstandardized Coefficients
The effects listed are all quadratic effects

Table 4.9
Quadratic Regression Analysis of Self-evaluation Inventory Subscales on Performance Profiles at 6 Months Post-operation

Predictor	SEI Data collection point in weeks post-operation	R^2 Totals all better than	F change all better than	Significant F change all better than	β all better than	Overall F all better than
Loss of Self-Esteem	16 wks	.253	4.56	.020	.027	4.56*
Confidence in the IBP	6 wks, 8 wks, 10 wks, 12 wks, 16 wks	.224	3.89	.033	.186	3.89*
Confidence in Own Body	4 wks, 6 wks, 8 wks, 10 wks, 12 wks, 16 wks	.260	4.74	.017	.069	4.74*
Fear of Re-injury at Point of Re-entry into Sport	2 wks, 4 wks, 6 wks, 8 wks, 10 wks, 12 wks, 16 wks	.211	3.61	.041	-.168	3.60*
Confidence in Ability to Perform at Re-entry into Sport	2 wks, 4 wks, 6 wks, 8 wks, 10 wks, 12 wks, 16 wks	.221	3.83	.034	-.143	3.82*

* p <.05 ** p < .001
Wk = weeks
β = Unstandardized Coefficients
The effects listed are all quadratic effects

Inspection of the scatterplots with the quadratic line of best fit suggested that the quadratic relationship effects were plateau effects, not inverted U effects (see example below).

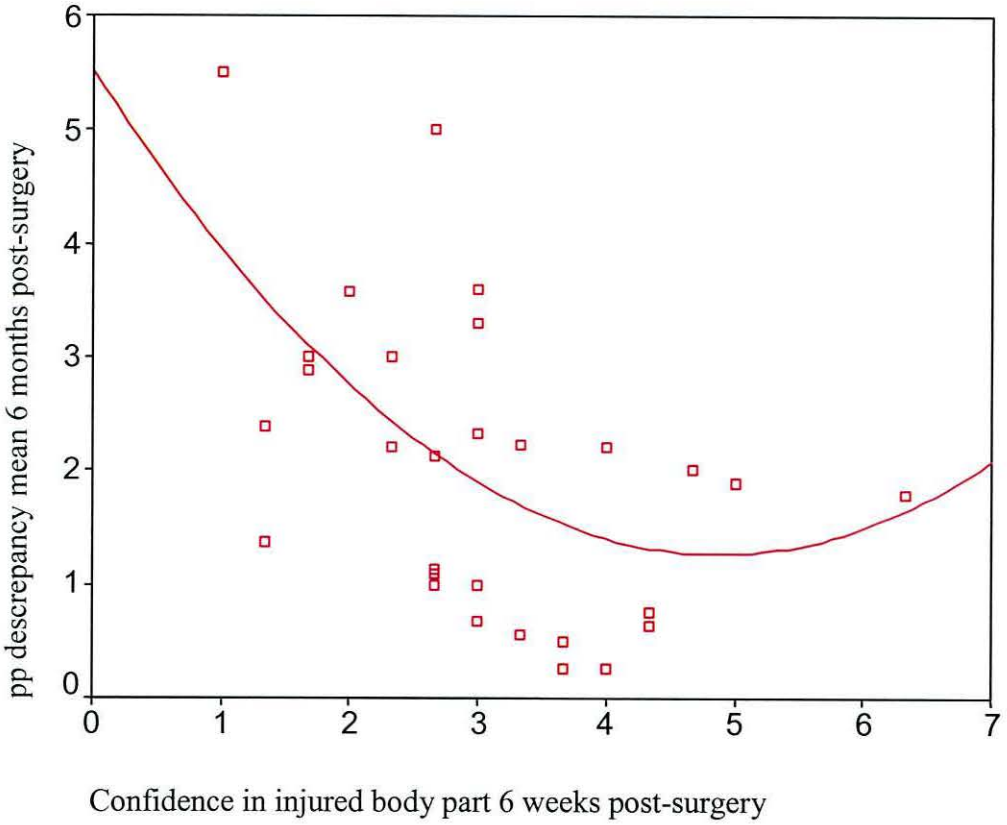


Figure 4.6 Scatterplot with quadratic line of best fit for Confidence in the injured body part 6 weeks post-surgery on performance profile mean discrepancy at 6 months post-surgery

Table 4.10
Correlations for the Dependent Variables on the Injured Leg at Pre-surgery

Variable	Ham & quad Strength Pre-surgery	Ham & Quad EMD Pre-surgery	Ham & Quad RFD Pre-surgery	Laxity Pre-surgery	PP Mean Discrepancy Pre-surgery
Ham & quad Strength Pre-surgery	-				
Ham & Quad EMD Pre-surgery	-.243				
Ham & Quad RFD Pre-surgery	.667**	-.523**			
Laxity Pre-surgery	-.369*	-.123	-.043		
PP Mean Discrepancy Pre-surgery	.034	.065	-.167	-.110	-

* p <.05, ** p<.01, EMD = Electromechanical delay, RFD = Rate of Force Development, PP = Performance Profile

Table 4.11
Correlations for the Dependent Variables on the Injured Leg at 6 Months Post-surgery

Variable	Ham & Quad Strength 6 months Post-surgery	Ham & Quad EMD 6 months post	Ham & Quad RFD 6 months Post-surgery	Laxity 6 months post-surgery	PP Mean Discrepancy 6 months post-surgery
Ham & quad Strength 6 months post-surgery	-				
Ham & Quad EMD 6 months post-surgery	-.240				
Ham & Quad RFD 6 months post-surgery	.646**	-.409*			
Laxity Post-surgery	-.264	.005	.015		
PP Mean Discrepancy 6 months post-surgery	-.029	.213	-.098	.100	

* p <.05, ** p<.01, EMD = Electromechanical delay, RFD = Rate of Force Development, PP = Performance Profile

Table 4.12 Correlations between the Self Evaluation Inventory subscales and the Adherence Motivation Measure at 6 Months Post-surgery

Variable	1.	2.	3.	4.	5.	6.	7.
1. Adherence Motivation	-						
2. Confidence in the injured body part	-.080	-					
3. Confidence in own body	.212	-.818**	-				
4. Confidence in rehabilitation team	.490**	.502**	.502**	-			
5. Fear of re-injury at point of re-entry into sport	-.147	-.808**	-.808**	-.421*	-		
6. Confidence in ability to perform at re-entry into sport	.028	.775**	.775**	.409*	-.828**	-	
7. Loss of self-esteem	.112	-.664**	-.664**	-.232	.422*	-.652**	-

DISCUSSION

The purpose of this study was to investigate whether different facets of confidence early in rehabilitation from ACL reconstruction could predict physical outcome measures later on in the rehabilitation. Specifically, it was hypothesized that confidence in own body, confidence in the injured body part (IBP), fear of re-injury at point of re-entry into sport, confidence in ability to perform at re-entry into sport, and loss of self-esteem would have a quadratic relationship with the physical outcome variables and that confidence in rehabilitation team would have a positive linear relationship. The results demonstrate some support for the hypotheses. In particular, the SEI subscales, confidence in own body, confidence in the IBP, fear of re-injury, confidence in ability at re-entry into sport and loss of self-esteem early in the rehabilitation period significantly predicted the outcome measures electromechanical delay (EMD) and rate of force development (RFD) at six months post-surgery. Further, the same SEI subscales significantly predicted athletes perceived rate of recovery as measures by the performance profiles, at three and six months post-surgery. No significant results were found for the hypothesised linear relationship between confidence in the rehabilitation team and the physical outcome measures. No significant results were found with regard to the strength or laxity data.

The results suggest that higher confidence in the body, higher confidence in the IBP, higher confidence in ability at re-entry into sport, less fear of re-injury at re-entry into sport and smaller losses of self-esteem were significantly related to better subsequent EMD and RFD outcomes and self perceived recovery rates. Inspection of the scatterplots with the quadratic lines of best fit demonstrated that these quadratic effects were plateau effects rather than inverted 'U' effects. The fact that various facets of confidence did predict EMD, RFD and self-perceived recovery rates,

provides support for the positive relationship between confidence and rehabilitation progress. However, the lack of hypothesised inverted 'U' effects are contrary to previous research by Vancouver and colleagues (Vancouver, Thompson, & Williams, 2001; Vancouver, Thompson, Tischner, & Putka, 2002), which has suggested that too much confidence could lead individuals to become complacent and consequently have a negative influence on performance. Although this study was not concerned with performance per se, it was hypothesised that confidence might influence performance in the context of quality of rehabilitation adherence and subsequent re-entry into sport. In hindsight, the performance in this study might have been too important to allow the possibility of negative effects. Specifically, the research conducted by Vancouver and his colleagues involved studying participants completing mundane laboratory tasks, whereas in this study, the performance would be of great importance to any serious athlete. The results of this study are based on only 30 participants; it is possible that lack of inverted 'U' effects may also have been due to the small sample size.

The results of this study are consistent with previous research findings that self-efficacy (i.e., situational specific confidence) beliefs can significantly predict variance in outcome following orthopaedic surgery (e.g., Waldrop et al., 2001). The results also provide some support for Johnston and Carroll's (1998) suggestion that higher confidence is associated with faster resumption of training and competition. Specifically, in the present study higher confidence in certain areas was associated with better EMD and RFD outcomes and patients self-perception of recovery, indicating that the athletes higher in certain facets of confidence may perceive themselves to have recovered more quickly and hence would return to full training and competition faster. Some caution needs to be heeded with this suggestion, however, since it is based on speculation regarding the findings.

The significant relationship found between subjective reports of certain facets of confidence and EMD and RFD in this study supports previous suggestions by Wojtys and Huston (2000). In a study examining longitudinal effects of ACL reconstruction on neuromuscular performance Wojtys and Huston (2000) found that although muscle function improved during the 18-month post-surgery period, it did not reach the level of a control group in most areas. The authors concluded that quadriceps and hamstring muscle reaction times appeared to be the best objective indicators of subjective knee function.

Interestingly, although there was a significant change in strength from pre-surgery to six months post-surgery, none of the SEI subscales significantly predicted strength as a physical outcome measure at three or six months post-surgery. Clear patterns were observed in the results for the relationships between the SEI subscales discussed above and EMD, RFD and patient self-report recovery rates, however, there were no clear patterns with regard to strength in any of the results. Four random effects concerning strength were found, however, these were dismissed as Type I errors.

There are two potential reasons for the lack of significant results with regard to the strength data. Firstly, it is possible that strength is a somewhat crude measure that may not detect some of the more subtle changes in the recovery process. Secondly, 3 and 6 months post surgery might be too early in the rehabilitation stage to detect the differences. Although patients often return to contact sports around six months post-surgery, in a review of the literature on ACL rehabilitation, Kvist (2004) found that studies reported 19-44% quadriceps muscle strength deficit at 6 months post- surgery (Keays, Bullock-Saxton, Newcombe, & Keays, 2003; Henriksson, Rockborn, & Good, 2002; Mikkelsen, Werner, & Ericsson, 2000; Risbery, Holm, & Tjomsland,

Ljunggren, & Ekeland 1999; Wojtys & Huston, 2000). At 18 months post-surgery, Niga, Yamamoto, & Furuya, (1996) found approximately 20% quadriceps strength deficits. Inspection of the descriptive data in this study at 6 months post-surgery indicates that there was a 15% deficit in mean quadriceps and hamstring strength in the injured leg, compared with the non-injured.

None of the SEI subscales predicted laxity outcome at six months post-surgery. Brewer et al., (2004) found a negative relationship between adherence and laxity six months after ACL reconstruction. In the present this study laxity was measured whilst the patient was in a relaxed state. Some other previous research has failed to find a correlation between laxity measured when the patients is resting and outcome (Eastlack, Axe, Snyder-Mackler, 1999; Risbery, Holm, Tjomsland, 1999) or participation restriction (Ross, Irrgang, Denegar, McCloy, & Unangst, 2002). In a study examining the relationship between objective assessment of ligament stability and subjective assessment of symptoms and function following ACL reconstruction, Kocher, Steadman, Briggs, Sterett, & Hawkins (2004) found that objective physical examination of ligament stability did not necessarily correlate with worse symptoms or function from the patient's perspective and vice versa. Other previous research (e.g., Cross, Wootton, Bokor, & Sorrenti, 1993; Harter, Osternig, & Singer, 1989; Hrubesch, Rangger, Reichkendler, Sailer, & Gloetzer, 2000) has found little or no relationship between instrumented knee laxity and functional outcome following ACL reconstruction.

The lack of relationship between the SEI subscales and strength and laxity is consistent with the general lack of correspondence among measures of ACL rehabilitation outcome (Brewer et al., 2000; Brewer et al., 2004; Sekiya, Muneta, Ogiuchi, Yagishita, & Yamamoto, 1998; Snyder-Mackler, Fitzgerald, Bartolozzi, &

Ciccotti, 1997). Consequently, Kvist (2004) has recommended several criteria that should be fulfilled following ACL reconstruction rehabilitation, before allowing patients to return to sport. These include: adequate muscle strength, full range of motion, functional knee stability, static knee stability, as well as various psychological factors.

No significant results were found for the SEI subscale confidence in the rehabilitation team. In the present study, much of the data collection was undertaken at the hospital. Whilst every attempt was made to assure the participants that their individual results would be kept confidential, it is possible that participants responded to items in this subscale in ways they perceived to be more socially desirable, rather than true reflections of their confidence in the rehabilitation team.

Interestingly, the adherence motivation measure was only significantly correlated with one of the SEI subscales and that was confidence in the rehabilitation team. This finding contradicted some of the arguments put forward in the introduction that certain facets of confidence might influence the athlete's quality of adherence to their rehabilitation exercises. However, as with the subscale discussed above (confidence in the medical team), participants completed the adherence motivation measure at the hospital and their responses might have been subject to social desirability bias.

The patterns observed in the results of this study suggest that there are temporal differences in the effects of the confidence variables (as measured by the subscales of the SEI), and their relationship with the physical outcome variables. Specifically, with the exception of loss of self-esteem, the SEI subscales that significantly predicted EMD at six months post-surgery, predicted this relationship from 2 and 4 weeks post-surgery through to 4 months post-surgery. Whereas with

the exception of confidence in the IBP, the SEI subscales that significantly predicted RFD at 6 months post-surgery, predicted this relationship from 8 weeks to 4 months post-surgery. These results suggest that confidence exerts its influence on EMD from early on in the rehabilitation period, whereas it is only later that the effects are found with RFD. A potential explanation for this finding comes from the rehabilitation protocol. It is well established that improvements in force production capacity can be achieved either by enhancement of the muscular protein mass (MacDougall, Elder, Sale, Moroz, & Sutton 1980; Narici, Hoppeler, Kayser, Landoni, Claassen, Gavardi, Conti, & Cerretelli, 1996; Staron, Malicky, Leonardi, Falkel, Hagerman, & Hikida,1990) or by adaptations in the neural control of the muscle (Moritani 1993; Aagaard, Simonsen, Andersen, Magnusson, & Dyhre-Poulsen 2002). RFD may be influenced by neural activation (Grimby, Hannerz, & Hedman, 1981) muscle size and fiber-type (myosin heavy chain isoform) composition (Harridge, 1996). Research (e.g., Hakkinen & Komi, 1986; Van Cutsem, Duchateau, & Hainaut, 1998) has demonstrated that resistance training primarily leads to enhanced maximum force, whereas neural adaptations caused by an explosive type of training are primarily responsible for an increased RFD. In the accelerated ACL rehabilitation protocol, it is only approximately 12 weeks post-surgery that patients begin to correct deficits in quadriceps through isokinetic quadriceps work and commence dynamic explosive types of strength training. Therefore, the effects on RFD would only be detected later on in the rehabilitation process.

Interestingly although the subscale loss of self-esteem significantly predicted EMD at 6 months post-surgery, unlike with the other subscales where significant relationships were found, it did not predict RFD at 6 months post-surgery. After much careful consideration there does not appear to be an obvious explanation for this

finding. This finding is consistent across the data, which suggests that it is an important point and consequently warrants further investigation in future research.

A strong relationship was found between the confidence variables and the self-perception measure of rehabilitation, the performance profiles. The same patterns were found in the results between the SEI subscales and the performance profiles, as for the objective measures of physical outcome, EMD and RFD (with the exception of loss of self-esteem). These clear patterns in the results supported by both the objective and subjective measures of physical outcome serve to enhance the researchers' confidence in the reliability of the results and decrease the possibility that they are Type I errors.

Although significant correlations were found between the EMD and RFD data, neither of these dependent variables correlated with the performance profile data. The lack of correlation between the performance profile mean discrepancy data and the other dependent variables, questions previous suggestions by Doyle, Gleeson and Parfitt (1998) regarding validity of the performance profile as a tool to monitor changes in athletes' perceptions of physical state during treatment. However, prior to dismissing the validity of the performance profile, a possible explanation for the lack of correlation between the performance profile data and the objective dependent variables should be considered. Wojtys and Huston (2000) suggest that although at 6 months post-surgery there are still deficits in muscle function, most patients appear to do well structurally (in terms of stability of the graft) and functionally (in terms of daily living and return to sport). This finding suggests that although the patient may not be completely back to normal with regard to objective neuromuscular assessment results, this level of functioning is adequate for most patients (Wojtys & Huston, 2000).

There are two main applied implications from this study. Firstly, the results suggest that interventions designed to augment certain facets of confidence in patients rehabilitating from ACL reconstruction might have a favourable effect on rehabilitation outcomes. Sport psychologists working with athletes rehabilitating from ACL reconstruction would do well to enhance athletes' confidence in their body, in their IBP and in their ability to perform at re-entry into sport, decrease fear or re-injury, and try to limit losses in self-esteem. Secondly, based on the findings of this study and previous research (e.g., Kvist, 2004) measures of neuromuscular, musculoskeletal as well as confidence and patient self-perceived rate of recovery should be employed to monitor rehabilitation progress following ACL reconstruction. Research that focuses solely on strength or laxity for example, may miss some of the subtle changes that occur during recovery.

There are two main limitations to this research. Firstly, the small sample size. It would be advantageous for future researchers to replicate this study employing considerably more participants. Whilst it is difficult to obtain large numbers of participants in longitudinal studies such as this, a possible way forward would be to involve a multi-disciplinary team of researchers operating at multiple centres, rather than operating at a single centre, as was the case in present study. Secondly, since only half of the participants completed their rehabilitation diaries it was not possible to compare participants' responses on the adherence motivation measure, which could have been subject to social desirability bias, with actual rehabilitation adherence. This is an important point, because many of the arguments proposed in the introduction as the theoretical underpinnings of the role of confidence in rehabilitation, focused on how certain facets of confidence might influence patient's quality of adherence to their rehabilitation exercises. It would be advantageous for

future research to address this issue in order to begin to understand how confidence might mediate the recovery process.

In conclusion, this research has illustrated the role of certain facets of confidence in rehabilitation from ACL reconstruction. Due to the small sample size used in this study, more research is needed to substantiate the findings. It is important for future research to begin to examine the mechanisms through which confidence may influence rehabilitation. Further, future research might also examine the efficacy of empirically validated interventions to augment the confidence of patients rehabilitating from orthopaedic surgery.

Chapter 5

The Efficacy of an Imagery Intervention on the Confidence and Progress of Patients Rehabilitating from Hip and Knee Replacement Surgery

ABSTRACT

The purpose of this study was to examine the effectiveness of an imagery intervention on the confidence and progress of patients rehabilitating from hip and knee replacement surgery. A true experimental design was employed. Thirty participants were randomly assigned to either an experimental group or a control group. The intervention consisted of six relaxation and imagery training sessions for each treatment participant, fortnightly during a six week period; and six relaxation and social support sessions for the control group participants. Both groups completed the WOMAC (Bellamy, 1982), Self Evaluation Inventory (Waters & Hardy, Chapter 3), and Performance Profiles (Butler, 1989) two weeks and six months post-surgery. Results demonstrated that the intervention enhanced participant's confidence in their bodies, confidence in ability to perform at re-entry into normal activities, increased confidence in their injured body part and decreased fear of re-injury. In addition participants in the intervention group had less stiffness and difficulty performing daily activities than their control group counterparts. The results are discussed in terms of the potential value of imagery as a tool in rehabilitation from orthopaedic rehabilitation and future research directions are put forward.

INTRODUCTION

Over the past decade researchers have identified confidence as an important factor in injury and rehabilitation. However, it has only been recently that researchers (e.g., Waldrop, Lightsey, Ethington, Woemmel, & Coke, 2001; Chapters 2, 3, & 4) have begun to investigate the precise role of confidence in rehabilitation. This research has suggested that in certain situations, confidence can play a significant role in predicting rehabilitation outcome. Specifically, Study 3 of this thesis (Chapter 4) found certain facets of confidence significantly predicted both objective and self-report measures of physical outcome six months post-surgery, in patients rehabilitating from anterior cruciate ligament reconstruction. The particular facets of confidence were: confidence in the injured body part, confidence in own body, fear of re-injury, confidence in ability to perform at re-entry into sport, and loss of self-esteem early in the rehabilitation period. Similarly, Waldrop et al., (2001) found that self-efficacy beliefs (i.e., situational specific confidence), regarding ability to perform therapeutic activities, predicted significant variance in rehabilitation outcome in patients following hip and knee replacement surgery. However, to the best of the authors knowledge there has been no psychological intervention focusing explicitly on the development of confidence with respect to rehabilitation, reintegration and resumption of normal performance behaviours.

Researchers (e.g., Altmaier, Russell, Kao, Lehmann & Weinstein, 1993; Waldrop et al., 2001) have advocated the use of empirically validated psychological interventions to augment the confidence of rehabilitation patients. A prime example of a one such intervention, that has found support in the sports psychology literature for enhancing confidence, is an intervention focusing on imagery. In particular, researchers have demonstrated that mastery imagery and imaging skills (e.g., Callow,

Hardy & Hall, 2001; Short, Bruggeman, Engel, Marback, Wang, Willadesen, & Short, 2002) and kinaesthetic imagery (Callow & Waters, 2005) can enhance confidence in healthy athletes.

Although imagery interventions have not been used explicitly to enhance confidence during rehabilitation, psychological interventions featuring imagery components have been used quite extensively in rehabilitation and chronic illness. A growing body of research has been established supporting the efficacy of imagery interventions in enabling patients to cope with a number of medical conditions including burns (e.g., Patterson, Everett, Burns, & Marvin, 1992), cancer (e,g, Liossi & Hatira, 1999; Simonton, Simonton, & Creighton, 1978) fibromyalgia (e.g, Haanen, Hoenderdos, Van Romunde, Hop, Malle, Terwiel, & Hekster, 1991) psoriasis (Gaston, Crombez, & Dupuis, 1989) and various forms of chronic pain and surgery (e.g., Lambert, 1996; Malone, & Strube, 1988; Mauer, Burnett, Oulette, Ironson, & Dandes, 1999). When compared to other cognitive behavioural techniques, guided imagery has been related to lower pain intensities and less psychological distress (e.g., Baider, Uziely, De-Nour, 1994; Syrjala, Cummings, & Donaldson, 1992; Syrjala, Donaldson, Davis, Kippes, & Carr, 1995).

One type of imagery has been used in rehabilitation (e.g., Achterberg, 1985; Cousins, 1989a, 1989b; Epstein, 1986, 1989; Krippner, 1985; Olness, 1995; Rossman, 1984, 1995) and with cancer patients (e.g., Gregson, Roberts & Amiri, 1996; Jasnowski, & Kugler, 1987; Simonton et al., 1978; Simptom & Shook, 1983). This type of imagery involves imaging the disease or injury, the physiological coping mechanisms, and the effects of treatment, such as white blood cells attacking and overcoming cancer cells. Patients perform this imagery several times daily and it is believed to work by influencing immune responses (Walker, et al., 1999).

An early study by Simonton, Simonton and Creighton (1978) reported positive findings as a result of implementing a relaxation and healing imagery intervention with patients diagnosed as having medically incurable cancer. In total, 41% showed improvement, with 22% demonstrating total remission and 19% demonstrating tumour regression. It was argued that the practice of relaxation and healing imagery enhanced the immune system (Simonton et al., 1978). A later study by Hall (1983) provided support for Simonton et al's (1978) research. Hall (1983) examined the effects of hypnosis together with imagery on lymphocyte function. Findings demonstrated an increased immune response, however, only for those participants who scored high on hypnotisability. Within the athletic domain, in a retrospective design, Ievela and Orlick (1991) found positive correlations between recovery rates and healing imagery. In a follow up study, Loundagin and Fisher (1993) similarly found healing imagery to be related to faster healing rates.

Researchers have also employed interventions featuring relaxation and guided imagery in rehabilitation. Cupal and Brewer (2001) examined the effects of relaxation and guided imagery on knee strength, re-injury anxiety and pain in patients rehabilitating from anterior cruciate ligament reconstruction. The intervention consisted of ten relaxation and guided imagery sessions for participants in the treatment group; attention, encouragement and support for participants in the placebo group and no intervention for control group participants. Results demonstrated significantly greater knee strength and significantly less re-injury anxiety and pain for the treatment group at 24 weeks post-surgery, than for placebo and control groups. However, there were a number of limitations to Cupal and Brewer's (2001) study, for example, the use of single-item scales to measure re-injury anxiety and pain and the use of strength as the only measure of physical outcome. Study 3 (Chapter 4) found

strength to be a rather inconclusive measure of physical outcome following ACL reconstruction. Whilst the research discussed above has provided a valid and important insight into the use of imagery during rehabilitation, none of the studies have focused on the potential mediating role of confidence.

Paivio (1985) proposed that imagery can be used for both cognitive and motivational purposes and each of these functions operate at specific and general levels. Within the context of rehabilitation, the cognitive functions of imagery might include the enhancement or redevelopment of movement skills via the mental rehearsal of specific rehabilitation exercises or various plans and strategies. The motivational general function is further divided into two categories (Hall, Mack, Paivio, & Hausenblas, 1998). The motivational general-arousal function involves imagery relating to arousal, stress and anxiety of performing (rehabilitation exercises or normal physical activities), while the motivational general mastery function relates to images of being confident, and in control. Bandura (1997) proposes that performance accomplishment is the strongest antecedent of self-efficacy (i.e., situational specific self-confidence), thus imagery could enhance confidence by providing performance accomplishment information during rehabilitation. Specifically, the patient is provided with an experience of success through their imagery of successful performance accomplishments.

The theoretical rationale discussed so far focuses upon *self*-confidence, however, this study is concerned with a number of different facets of confidence during the rehabilitation experience, not just *self*-confidence. This research concentrated on the different facets of confidence measured by the Self Evaluation Inventory (SEI; Chapters 2, 3, & 4). The conceptualization of confidence employed to develop the SEI was defined as the subjective probability of an outcome occurring.

Defined in this way, confidence was expressed with respect to the injury experience. The aim of this research was not only to try to enhance the *self*-confidence of participants, but also their confidence in a number of other situations in which their beliefs about the likelihood of events occurring might have an impact upon their behaviour and feelings. Specifically, the SEI measures: confidence in own body, confidence in rehabilitation team, confidence in the hip/knee, fear of re-injury on re-entry into normal daily activities, confidence about ability on re-entry into normal daily activities, and loss of self-esteem. The focus of this study will be on all of these facets of confidence.

Hip and knee replacements are one of the most common major surgical procedures performed in the National Health Service in the UK with over 43,000 hip replacements and nearly 35,000 knee replacements being carried annually (National Audit Office, 2003). Total hip replacement involves replacing the femoral head of the femur and socket with an artificial prosthesis. Total knee replacement is the replacement of the articular surfaces of the femoral condyles, tibial plateau, and patella. Following surgery, most patients require at least 3-5 months to gain full strength and energy and some take considerably longer. Depending on the type of prosthesis and technique used, rehabilitation may include a period of 6-12 weeks requiring protected weight-bearing on two crutches, followed by gradual transition to walking with a stick (Harris & Sledge, 1990).

Orbell, Espley, Johnston and Rowley (1998) examined the extent of change in psychological, functional and social health after knee and hip joint replacement surgery. Findings suggested that although surgery seemed to be effective in reducing need for task assistance in the majority of patients, paradoxically the number of hours of formal and informal support received by patients increased over the 9 month period

of follow up. Orbell et al., (1998) also found that within subject analysis demonstrated considerable variability in the effectiveness of joint replacement surgery. The authors suggested this variability might be attributable to psychological factors such as patients' beliefs about their condition or its treatment. Consequently, an imagery intervention that could enhance patient's confidence in the resumption of normal performance behaviours with regard to their physical activity could be of benefit. To the best of the authors knowledge, no imagery intervention research has been conducted with a population of patients recovering from hip and knee replacement surgery.

In summary, previous research has found some support for the use of imagery as part of a psychological intervention to facilitate rehabilitation. However, no research has been conducted to date that has examined the sole use of imagery as an intervention or the potential mediating role of confidence in rehabilitation. Nor has any imagery intervention been employed with patients rehabilitating from hip and knee replacement surgery. The purpose of this study was to examine the effectiveness of an imagery intervention on the confidence and progress of patients rehabilitating from hip and knee replacement surgery. It was hypothesised that: a) participants in the imagery intervention group will have higher levels of confidence following the imagery intervention than participants in the control group who do not receive the imagery intervention; and b) participants in the imagery intervention group will rehabilitate more quickly than participants in the control group.

METHODOLOGY

Prior to commencing this research project, ethical approval was gained from the Ethics Committee of the hospital from which participants were recruited.

Participants

Four orthopaedic surgeons at one hospital in Wales provided waiting lists for total hip and knee replacement. All patients with a diagnosis of osteoarthritis (OA) were eligible to participant in the study. Participants were 30 individuals (11 male and 19 female) aged between 57 years and 84 years (Mean = 69.93, ±SD = 7.03). Thirteen participants were undergoing total knee replacement and seventeen total hip replacement. Participants were recruited weekly from waiting lists supplied by the orthopaedic surgeons. Stratified random sampling was employed, whereby patients undergoing knee replacement were randomly assigned and patients undergoing hip replacements were separately randomly assigned to one of two groups, an experimental group that received an imagery intervention and a control group

Measures

Demographic Data: Certain demographic data were collection from participants including age, gender, date of onset of hip/knee problems and level of physical activity.

Mini-Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975): Due to the participants being older persons who might be at risk for developing dementia, and because such impairment could result in invalid protocols, all volunteers were screened for cognitive impairment using the MMSE. The MMSE assesses orientation, attention and calculation, short-term memory, visual construction, and language and is scored by totalling the number of correct responses. Scores below 23 (out of 30) indicate cognitive dysfunction (Tombaugh & McIntyre, 1992). Consequently, only persons scoring 23 or above were included (for review see Tombaugh & McIntyre, 1992).

Confidence: confidence was measured using the Self Evaluation Inventory (Chapter 3). This questionnaire was originally developed to measure confidence during athletic rehabilitation and was modified for use with patients rehabilitating from hip and knee replacement. The Self Evaluation Inventory contains 50 items combined into six subscales which measured: confidence in own body, confidence in medical team, confidence in the hip/knee, fear of re-injury on re-entry into normal daily activities, confidence about ability on re-entry into normal daily activities, and loss of self-esteem. Initial structural validation of the questionnaire using confirmatory factor analysis (Chapter 3) indicated that the inventory demonstrated adequate structural validity χ^2 (963.12, df = 309) p = 0.00, RMSEA = 0.074, CFI = 0.94, and SRMR = 0.069. The Self Evaluation Inventory contained a seven point Likert response scale that was anchored at (7) strongly agree and (1) strongly disagree with (4) being neutral.

Physical Outcome Measure: Physical functioning and quality of life was measured using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC; Bellamy, 1982). The WOMAC is a multidimensional, self-administered outcome measure, developed by Bellamy (Bellamy, 1982) for standardized assessment of osteoarthritis symptoms in hip and/or knee joints. The WOMAC contains 24 items measuring three dimensions: pain (5 items), stiffness (two items), and function (17 items) and has been extensively validated (Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988) and tested for reliability, feasibility and responsiveness for measuring changes after different OA interventions (Bellamy, Goldsmith, & Campbell, 1988; Bellamy, Goldsmith, Campbell, & Stitt, 1988). More recently, Bachmeier, March, Cross, Lapsley, Tribe, Courtenay, and Brooks (2001) provided support for the ability of WOMAC to detect significant and clinically

meaningful changes in outcome following hip and knee replacement. The OMERCAT III conference (Bellamy, Kirwan, Boers, Brooks, Strand, & Tugwell, 1997) and the Osteoarthritis Research Society (Hochberg, Altman, Bradt, & Moskowitz, 1997) guidelines have both recommended the WOMAC as a valid outcome measure in OA research.

Patient Self-Perception of Rehabilitation: Performance profiling (Butler, 1989) based on selected aspects of the personal construct theory (Kelly, 1955) was used to measure participant's perception of their rate of rehabilitation. Performance profiling takes the perspective of the individual to be fundamental and emphasises that each individual differs in his/her perception and interpretation of situations and their importance. The profile allowed participants to construct a visual display of their symptoms throughout rehabilitation in terms that made sense to them, rather than responding to predetermined measures. To elicit the profile, participants were asked to consider the question: "What in your opinion, are the elements of your hip/knee that need to improve, to enable you to perform your normal physical activities?" Contributions from the medical team were included to generate a broad range of qualities. The exact qualities generated by the participant were mapped onto the profile by the researcher. Participants were asked consider "Ideally, where would you like to be on all the qualities that you have listed?" A response scale ranging from *not at all like this* (1) to *very much like this* (10) was employed. Participants then completed their profile by considering the question: "Please respond by marking on the profile your perceived current state, using the following scale: 0 = extremely different to my ideal level, 10 = the same as my ideal level". The Profiles of the hip/knee took approximately 30 minutes to complete during the initial session and five minutes to complete thereafter. The performance profile has been used to

monitor changes during rehabilitation from anterior cruciate ligament (ACL) reconstruction (Doyle, Gleeson, & Rees, 1998; Chapter 4).

Imagery Ability: Imagery ability was assessed using 12 items selected from the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973) and 10 items selected from the Vividness of Movement Imagery Questionnaire (VMIQ; Isaac, Marks & Russell, 1986). The items selected from the VVIQ involved the participant bringing certain images to mind (e.g., the sun rising above the horizon) and were rated with a 5 point Likert scale in which 1 = *Perfectly clear and vivid as normal vision,* and 5 = *no image at all, you "only" know that you are thinking of the image.* The ten items selected from the VMIQ involve participants imaging an action (e.g., walking up stairs). Participants then rated the vividness of the action in two ways: a visual rating and a kinaesthetic rating. The visual rating is as above for the items from the VVIQ, and the kinaesthetic rating used a 5 point Likert scale in which 1 = *Perfect feeling as when actually performing the action,* and 5 = *no feeling at all, you "only" know that you are thinking of the action.* (See Appendix 9 for a copy of the questionnaire).

Imagery Usage: An ad hoc questionnaire was developed for this study to measure imagery usage by participants in the intervention group at the beginning of the intervention, midway through and at the end of the intervention. Participants were given an introduction to imagery, which included a verbal description of internal and external visual imagery, healing imagery and ways in which imagery could be used during rehabilitation based on the subscales of the self-evaluation inventory. Imagery usage was then measured using seven questions, with a 7 point Likert scale in which 1 = *never* and 7 = *often*. The seven questions were: (a) How often do you use internal visual imagery? (b) How often do you use external visual imagery? (c) How often do

you use healing imagery? (d) How often do you image yourself using your (new) hip/knee? (e) How often do you image yourself completing your normal daily activities? (f) How often do you image yourself completing physical activities? (g) How often do you image yourself being physically ready to engage in your normal physical activities? (See Appendix 10 for a copy of the items)

Participants were provided with diaries and asked to note in the diaries the date they practiced, the length of the imagery session, what imagery scripts they had used and any comments they had regarding their imagery use (see below).

Rehabilitation Adherence: Participants were asked to complete a rehabilitation diary. In order to facilitate adherence to completing the diary and ensure that it was easy and quick to complete, each day was divided into boxes to be completed detailing rehabilitation exercises completed, any setbacks or instances of re-injury and imagery sessions completed as outlined above.

Post-experimental Questionnaire: Approximately one week after completing the final data collection point participants in the intervention group were given a post experimental questionnaire to complete. This questionnaire contained 13 questions and was designed to examine participant's adherence to the intervention and perceived effects and how useful, easy or difficult the intervention had been. In order to gain more information regarding the impact of the intervention one of the questions asked "With regard to your rehabilitation, to what extent did the imagery affect you confidence?" Participants were also asked to report how easy or difficult the Self-Evaluation Inventory, WOMAC and Profiles were to complete on a regular basis. (see Appendix 11 for a copy of this questionnaire).

Procedure

Participants were recruited from the waiting lists of 4 orthopaedic surgeons from the same hospital. Approximately two weeks prior to having the hip/knee replacement, patients were contacted by researcher by telephone and asked if they would be willing to take part in the research. After agreeing to participate, an initial meeting during the two weeks prior to surgery was arranged. Participants were sent a patient information sheet (see Appendix 12 for a copy) to read prior to the initial meeting. During the preliminary meeting, the outline of the study and requirements of their involvement was explained to the patients, and participants were encouraged to ask questions. To avoid possible contamination, participants in the intervention group were advised that the study was examining different methods of delivering imagery training during rehabilitation from hip or knee replacements, and participants in the control group were advised that the study was examining psychological response to rehabilitation following hip and knee replacements. The true purpose of the study was not explained to participants, but they were assured that any information provided in the study would be treated confidentially. In accordance with ethical guidelines (University of Wales, Bangor) it was deemed acceptable to withhold the true nature of the study from the participants, since it was unlikely that withholding the information would cause harm once debriefed and participants were provided with sufficient information regarding their involvement in the study.

Initially, the MMSE was administered. For patients scoring below the cut-off point, the researcher read out the demographic questionnaire, which requested information regarding name, gender, age, date of onset of hip/knee problems and level of physical activity, so that no patient would attribute premature cessation of research

to poor MMSE performance. These patients were then informed that they had completed all that was requested of them in the research and thanked for their time.

Participants who scored above the cut-off point on the MMSE were advised that their involvement would require them to complete the Self Evaluation Inventory, the WOMAC Index and the Performance Profile two weeks post-surgery and six months post-surgery, and maintain a rehabilitation diary. Participants were also informed that the researcher would call round and see them regularly and would help the participant complete the Self Evaluation Inventory, WOMAC and Profile. After participants agreed to take part in the research they were asked to sign a written consent form and complete a demographic questionnaire.

The researcher visited participants in both groups fortnightly for the first three months and once a month for the following three months. In order to aid adherence to the study, a completion schedule was given to each participant outlining the dates (subject to participant availability) on which the researcher would be visiting them and when they needed to complete the Self Evaluation Inventory, WOMAC and Profile. To ensure that participants completed their training diaries accurately they were advised that any information provided during their involvement in the study would not be revealed to their physiotherapist.

Participants in the intervention group were required to complete the imagery usage questionnaire during the two week post-surgery visit from the researcher. Lest completing the imagery usage questionnaire led participants in the control group to begin using imagery, they did not complete the imagery usage questionnaire until the end of the data collection period, this also served as a manipulation test for the intervention. Participants in the intervention group completed the imagery usage questionnaire twice more during the study mid-intervention and post-intervention.

The post experimental questionnaire was administered to the participants approximately one week after the last data collection point. Following completion of the questionnaire, participants were debriefed and the true nature of the study explained to them.

Imagery Intervention Group.

Participants in the imagery intervention group met with the researcher (a British Association of Sport and Exercise Psychology accredited sport psychologist) fortnightly during the three months following their hip/knee replacement surgery. Strict instructions for the intervention were written down, and scrutinized by an experienced researcher to avoid the possible occurrence of experimenter bias. The instructions were adhered to throughout the intervention.

Relaxation: One of the reasons why relaxation and healing imagery can be helpful in rehabilitation is that injured people often brace the injured area to immobilise the muscle or joint in order to limit pain. Increased muscle tension can restrict blood flow to the injured area and increase pain (Cousins & Phillips, 1985). More importantly the greater blood flow, the faster injured tissues are repaired (Benson, 1975; Bresler, 1984a, 1984b). Muscle tension can also interfere with normal coordination and increase the chance of re-injury (Smith, Ptacek, & Patterson, 2000). The relaxation technique taught to participants was based on progressive muscle relaxation (PMR; Jacobson, 1938). PMR entails the systematic focus of attention on various muscle groups throughout the body. The participant progresses through the body tensing and then releasing the tension from each muscle group in turn. During the initial session the researcher went through the PMR technique with the participants and participants were provided with a tape recorded script of the PMR technique to practice in their own time.

Imagery Training: Using Hardy and Fazey (1990) Mental Rehearsal Program as a template, participants were introduced to general imagery training. Since many of the participants were not familiar with imagery, the session focused on basic imagery training and the researcher only moved onto more specific examples of healing imagery and how imagery could be used in rehabilitation once the participants felt comfortable in their imagery skills.

It has been suggested (Hall, Buckholz, & Fishbourne, 1989) that imagery ability effects the success of imagery interventions and therefore, it was necessary to ascertain the imagery ability of the participants. As described previously, selected items of the VVIQ and the VMIQ were used to determine this. Research, however, has not identified an imagery ability level at which imagery interventions become effective. In light of this, it was decided that participants should score at least a mean of 36 for the selected VVIQ items and a mean of 30 for both visual and kinaesthetic items selected from the VMIQ. This means that each participant scores an average of at least "moderately clear and vivid/moderately vivid feeling" for each item. All participants scored above this.

Once participants felt comfortable in their imagery skills and had scored above the criterion imagery ability level, they were introduced to healing imagery. This involves creating vivid images of disease or injury, the physiological coping mechanisms, and the effects of the treatment (Heil, 1993). For example, a cancer patient may image chemotherapy as a series of molecular structures following through the bloodstream attacking the enemy cancer cells and washing them away. Healing imagery for the current study focused on participants being shown anatomy pictures of the hip/knee joint, surrounding muscles and the main arteries and veins in the body. Participants then imaged the inside of their hip/knee, focusing on the new hip/knee

joint and surrounding tissues and muscles. Participants imaged blood flowing through the arteries bringing nutrients and oxygen to the area, with the veins taking away the injured cells. Participants also imagined the new hip/knee being accepted and the surrounding tissues and muscles growing together and healing. Images of the hip/knee and surrounding tissue and muscles becoming healthy, stronger and more flexible were also employed. (See Appendix 13 for transcripts of healing imagery scripts). Participants were provided with cassette tapes of the imagery scripts for their imagery practice. They were asked to practice for fifteen minutes each day. Participants were provided with an imagery-training diary in which to record their imagery practice.

The foci of the following imagery sessions were based on the subscales of the Self Evaluation Inventory. Specifically, participant's ratings on the Self Evaluation Inventory were used to modify the intervention for each individual participant. For example, if a participant had a high score on loss of self-esteem the focus of the imagery session was on the participant imaging themselves being competent in domains that are important to them, such as, imaging themselves successfully completing their rehabilitation exercise and imaging themselves feeling confident and positive. The emphasis on the different subscales changed for each participant during the intervention depending on what stage of rehabilitation the participant had reached. Since the rate of rehabilitation was different for each participant and the situations facing each participant differed, the intervention was individually tailored during every imagery training session, for each participant. Participants received a total of six imagery training sessions over a three month period. During the intervention sessions any questions and/or problems that arose were be dealt with. Following the intervention phase, the researcher met with the participants once a month for a further

three months. During the six-month post-surgery session participants completed the Self Evaluation Inventory, WOMAC and Profile.

Control Group.

In order to control for experimenter bias the researcher met with the participants in the control group on the same schedule as the intervention group. In order to ensure that it was the imagery intervention that had an effect and not the relaxation training, participants in the control group were also given the same relaxation training session as the intervention group during the first session following the hip/knee replacement surgery. Participants in the control group were also provided with a tape recording of the PMR technique to practices in their own time. During the following sessions the researcher provided social support to the participants and reminded them to maintain their rehabilitation diaries. In the six-month post-surgery visit participants were required to complete the Self Evaluation Inventory, WOMAC, and Profile.

Data Analysis

Confidence data: To test whether confidence differed over time for the two groups, data were analysed using a 2 x 2 (Group x Data Collection Point) multivariate factorial analyses of variance (MANOVA) with repeated measures on the second factor.

Physical Outcome Measure: To test whether physical functioning and quality of life differed over time for the two groups, data were analysed using a 2 x 2 (Group x Data Collection Point) MANOVA with repeated measures on the second factor.

Patient Self-Perception of Rehabilitation: The individualized nature of the performance profile meant that the ten elements included in each participant's profile was unique to that participant and different to those included on the profiles of the

other participants. The profile data was analysed using profile analysis. A mean discrepancy score for each data collection point was calculated from the discrepancy scores on each of the profile constructs. A repeated measures ANOVA was conducted on the mean discrepancy data across the data collection points.

Imagery usage and imagery diary data: The imagery usage data was analysed through visual inspection of mean visual, kinaesthetic and healing imagery data. Weekly examination of the diaries were conducted by the researcher to ensure participants were adhering to the imagery intervention, then at the end of the data collection period the diaries were analysed to calculate mean imagery usage data. Imagery usage data was correlated with the dependent variables at six months post-surgery.

Postexperimental Data: The postexperimental questionnaire data were analysed through examination of the mean data of participants' responses to the postexperimental questionnaire. Responses relevant to the dependent variables, (i.e., confidence and physical outcome), the amount of time spent practicing, and the perceived utility of the intervention were also examined in more detail.

RESULTS

Preliminary Analysis

Table 5.1 represents the demographic information for the intervention and control groups. A multivariate analysis of variance (MANOVA) utilising Wilks' Lambda indicated no significant differences at pre-surgery with regard to age, gender, or MMSE score between the intervention and control groups [$\lambda = .865$, $F(4, 25) = .977$, $p = .438$].

Table 5.1
Demographic Data for Intervention and Control Groups

Participant Characteristic	Intervention Group (n = 15)	Control Group (n = 15)
Age (years)	71.27 ± 6.69	68.60 ± 7.32
Gender (male/female)	6/9	5/10
Joint Replacement (Hip/Knee)	9/6	8/7
MMSE score	29.13 ± 0.99	28.80 ± 1.01

NOTE. Values are mean ± standard deviation except for gender and joint replacement

The Self-Evaluation Inventory (SEI). Descriptive statistics for all the SEI subscales were calculated and are reported in Table 5.2. Cronbach's alphas were calculated for the seven SEI subscales. The mean Cronbach's alpha for each of the SEI subscales across the data collections points are shown in Table 5.3. A MANOVA utilising Wilks' Lambda on the Self Evaluation Inventory indicated no significant differences between the intervention and control groups [λ = .654, F(7, 22) = 1.662, p = .177] at two weeks post-surgery.

Table 5.2
Descriptive Statistics Regarding the SEI

	2 Weeks Post-surgery		6 Months Post-surgery	
Variable	Intervention Group	Control Group	Intervention Group	Control Group
Confidence in own Body	3.11 (± 1.00)	3.82 (± 1.21)	5.89 (± 0.52)	4.44 (± 1.47)
Confidence in the IBP	3.83 (± 0.95)	3.12 (± 0.80)	5.57 (± 0.57)	4.07 (± 1.17)
Confidence in Medical Team	5.98 (± 0.65)	5.71 (± 0.72)	5.76 (± 0.62)	5.78 (± 0.52)
Fear of Re-injury	4.24 (± 1.23)	5.00 (± 0.89)	2.71 (± 0.85)	4.42 (± 1.15)
Confidence in Ability	4.33 (± 1.01)	4.86 (± 1.48)	5.90 (± 0.39)	4.36 (± 1.54)
Loss of Self-Esteem	3.46 (± 1.11)	4.23 (± 0.85)	2.14 (± 0.32)	3.21 (± 1.20)

Mean values with standard deviation values in parentheses

Table 5.3
Mean Cronbach's Alphas for each SEI subscale score across the data collection points

	Mean Cronbach's Alpha
Confidence in hip/knee	.79 (±.01)
Confidence in own Body	.65 (± .14)
Confidence in Medical Team	.78 (± .01)
Fear of re-injury	.73 (± .15)
Confidence in Ability	.79 (± .13)
Loss of Self-Esteem	.82 (± .14)

Mean values with standard deviation values in parentheses

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Descriptive statistics for all the WOMAC subscales were calculated and are reported in Table 5.4. The mean Cronbach's alpha for each of the WOMAC subscales across the data collections points are shown in Table 5.5. A MANOVA utilising Wilks' Lambda indicated no significant differences in WOMAC subscale scores pain, stiffness and difficulty performing daily activities at two weeks post-surgery between the intervention and control groups [$\lambda = .867$, $F(3, 26) = 1.331$, $p = .286$].

Table 5.4
Descriptive Statistics Regarding the WOMAC

	2 Weeks Post-surgery		6 Months Post-surgery	
Variable	Intervention Group	Control Group	Intervention Group	Control Group
Pain	6.33 (± 3.11)	8.06 (± 3.43)	0.27 (± 0.59)	1.67 (± 2.19)
Stiffness	3.87 (± 1.30)	4.00 (± 1.00)	0.73 (± 0.88)	2.07 (± 1.16)
Difficulty Performing Daily Activities	39.67 (± 11.19)	44.00 (± 8.21)	1.27 (± 1.44)	12.73 (± 11.37)

Mean values with standard deviation values in parentheses

Table 5.5
Mean Cronbach's Alphas for each WOMAC subscale score across the data collection points

	Mean Cronbach's alpha (standard deviation in parenthesis)
WOMAC Pain	.74 (± .10)
WOMAC Stiffness	.60 (± .15)
WOMAC Difficulty Performing Daily Activities	.90 (±.01)

Mean values with standard deviation values in parentheses

All participants scored above the mean criterion level of 36 for the selected VVIQ items and 30 on the selected VMIQ. The Cronbach's alpha for the selected VVIQ items was .82 and for the selected VMIQ items .76.

Main Analysis

Confidence Data from Self-Evaluation Inventory (SEI): A 2 x 2 (Group x Data Collection Point) MANOVA with repeated measures on the second factor was conducted. The independent variable group consisted of the intervention and control groups, and the data collection points were 2 weeks post-surgery and 6 months post-surgery. The dependent variables were the SEI subscales: confidence in own body, confidence in the rehabilitation team, confidence in the hip/knee, fear of re-injury on re-entry into normal daily activities, confidence about ability on re-entry into normal daily activities, and loss of self-esteem. The analysis revealed a significant multivariate main effect for Group, Wilks' Lambda [$\lambda = .522$, $F(6, 23) = 3.51$, $p = .013$, $\eta^2 = .48$], a significant multivariate main effect for Time, Wilks' Lambda [$\lambda = .192$, $F(6, 23) = 16.11$, $p = .001$, $\eta^2 = .80$] and a significant interaction effect between Group and Time [$\lambda = .465$, $F(6, 23) = 4.406$, $p = .004$, $\eta^2 = .54$].

Given that interaction effects supersede main effects, only the univariate follow up tests for the interaction effects will be reported. Post-hoc univariate F tests revealed significant interaction effects for confidence in own body $F(1,28) = 11.10$, $p = .002$, $\eta^2 = .28$, confidence in the hip/knee $F(1,28) = 3.94$, $p = .05$, $\eta^2 = .12$, fear of re-injury on re-entry into normal daily activities, $F(1,28) = 4.61$, $p = .04$, $\eta^2 = .14$, and confidence in ability on re-entry into normal daily activities $F(1,28) = 10.32$, $p = .003$, $\eta^2 = .27$. No significant interactions were found for loss of self-esteem $F(1,28) = 0.61$, $p = .43$, $\eta^2 = .02$, or confidence in the medical team $F(1,28) = 1.84$, $p = .186$, $\eta^2 = .06$. The significant interaction effects are illustrated in Figures 5.1 to 5.4 below. Bonferroni multiple comparison tests showed that these interaction effects were due to no significant differences between the intervention group and the control

group at 2 weeks post-surgery, but a significant difference between the intervention and control groups at six months post-surgery.

Figure 5.1 Estimated Marginal Means of Confidence in Own Body

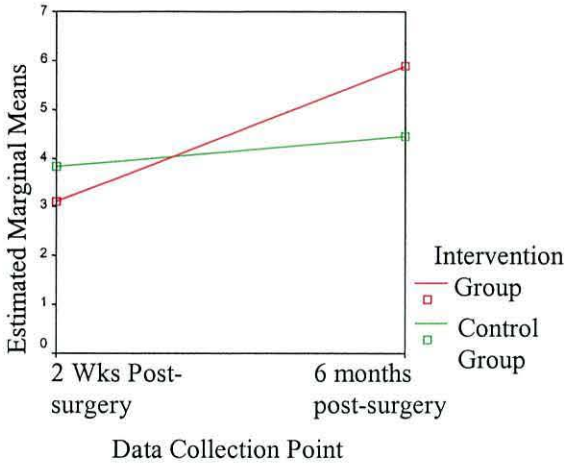


Figure 5.2 Estimated Marginal Means of Confidence in the hip/knee

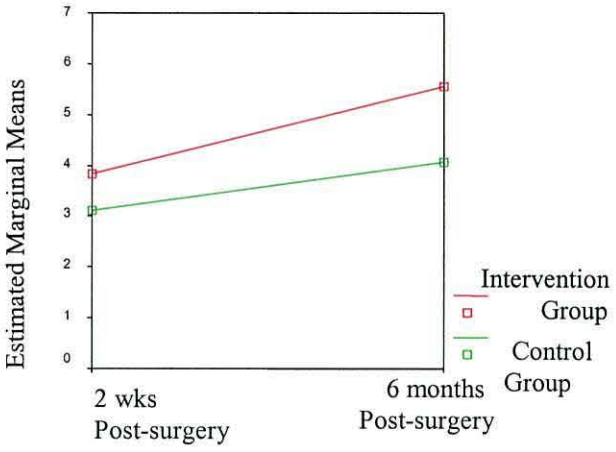


Figure 5.3 Estimated Marginal Means of Fear or Re-injury at Re-entry into Normal Physical Activities

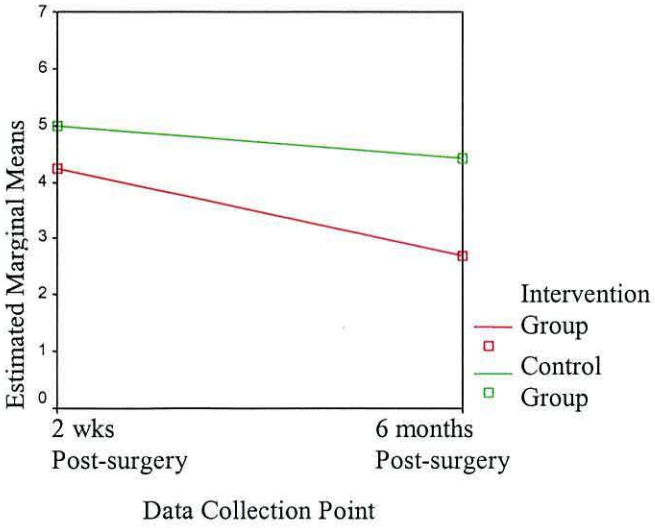
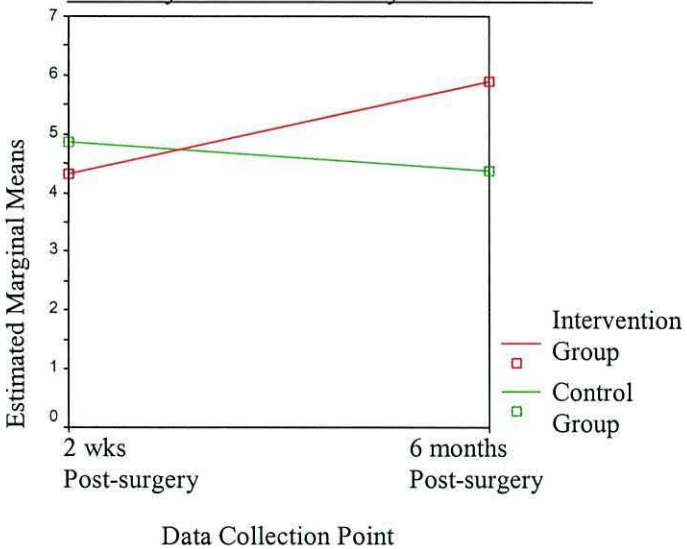


Figure 5.4 Estimated Marginal Means of Confidence in Ability to Perform on Re-entry into Normal Physical Activities



Physical Outcome Measure WOMAC: A 2 x 2 (Group x Data Collection Point) MANOVA with repeated measures on the second factor was conducted. The independent variable group comprised the intervention and control groups, and the

data collection points were 2 weeks post-surgery and 6 months post-surgery. The dependent variables were the three WOMAC subscales (pain, stiffness, and difficulty performing daily activities). The MANOVA employing Wilk's lambda demonstrated a significant Group main effect [λ = .722, F(3, 26) = 3.33, p = .035, η^2 = .29], a significant main effect for Time, Wilk's lambda [λ = .045, F(3, 26) = 185.30, p = .001, η^2 = .96],and a significant interaction effect [λ = .670, F(3, 26) = 4.26, p = .014, η^2 = .33]

The follow-up univariate F tests indicated a significant interaction for stiffness F(1,28) = 5.96, p = .021, η^2 = 18, difficulty performing daily activities approached significance F(1,28) = 3.27, p = .081, η^2 = 11. However, the interaction for pain was non-significant F(1,28) = 0.102, p = .752, η^2 = .01. The interaction effects are illustrated in Figures 5.5 and 5.6 below. Bonferroni multiple comparison tests showed that these interaction effects were due to no significant differences between the intervention and the control groups at 2 weeks post-surgery, but a significant difference between the intervention and control group at six months post-surgery.

Figure 5.5 Estimated Marginal Means of Stiffness

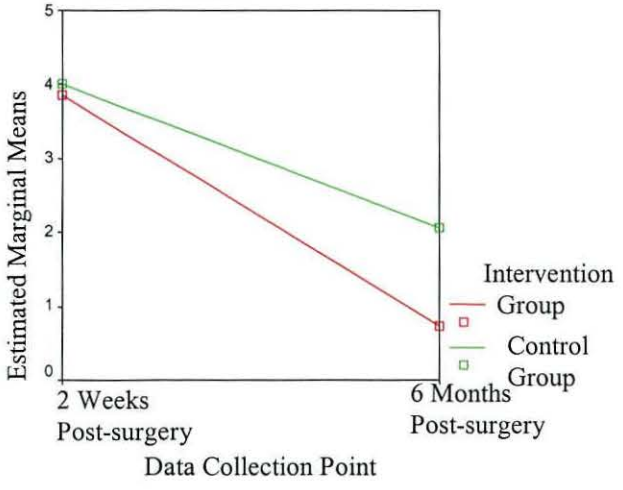
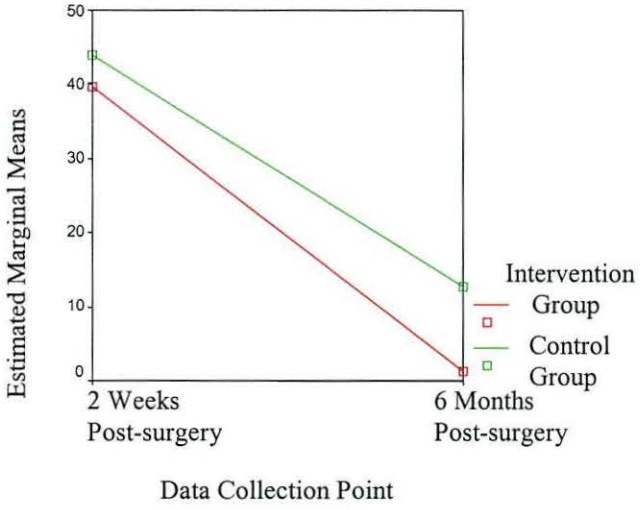
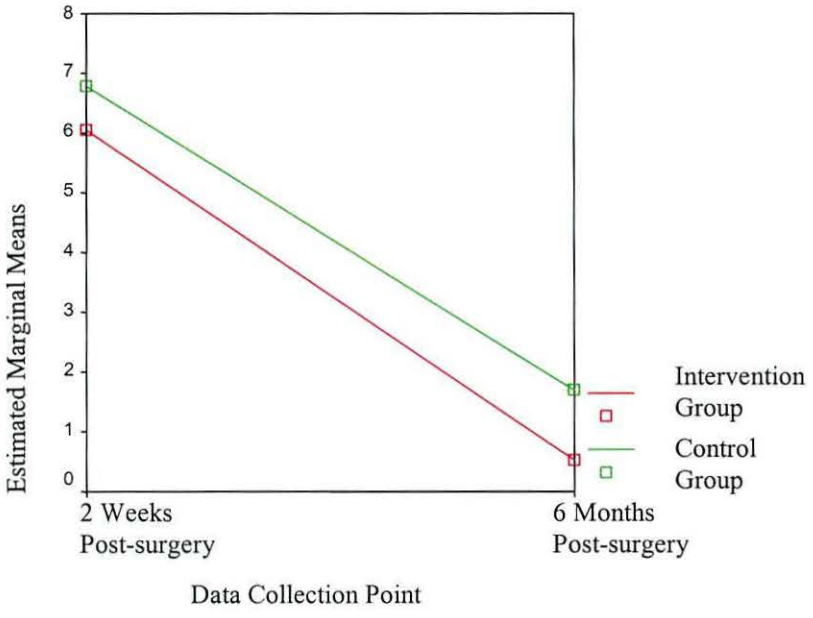


Figure 5.6 Estimated Marginal Means of Difficulty Performing Daily Activities



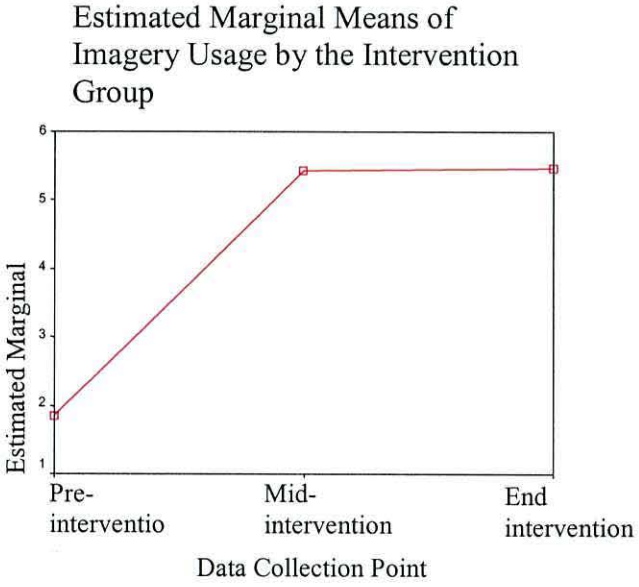
Patient Self-Perception of Rehabilitation: The performance profile data was analysed using a 2 x 2 (Group x Data Collection Point) ANOVA with repeated measures on the second factor. The group contained the intervention and control groups and the data collection points were: 2 weeks post and 6 months post-surgery. The dependent variable was the mean performance profile discrepancy reduction. The analysis revealed a significant main effect for group $F(1,28) = 285.97$, $p = .001$, $\eta^2 = .91$. The test of interaction did not reach significance $F(1,28) = 0.49$, $p = .492$, $\eta^2 = .01$. Figure 5.7 below indicates the main effect and highlights the lack of a significant interaction effect for the performance profile discrepancy reduction data.

Figure 5.7 Estimated Marginal Means of Performance Profile Discrepancy Reduction



Imagery Usage Data: A mean imagery usage score was calculated from the seven items measuring imagery usage completed at pre-intervention, mid-intervention and at the end of the intervention for the intervention group and at the end of participation in the study for the control group. A t-test revealed no significant

difference between the intervention group's use of imagery pre-intervention and the control group's use of imagery collected at the end of participation in the study (t_{28} = -1.00, p = .326). A repeated-measures ANOVA was conducted on the intervention group imagery usage data at pre-intervention, mid-intervention and end of intervention. Mauchly's test of sphericity was significant, consequently Greenhouse Geisser correction factor was applied. The analysis revealed a significant difference in imagery usage across time F(1.068, 14.934) = 279.248, p <.001. Post-hoc comparisons using the Tukey HSD test indicated that imagery usage score for pre-intervention (M = 1.84, ± = .38) was significantly different from mid-intervention usage (M = 5.43, ± = .74) and end of intervention imagery usage (M = 5.47, ± = .74). Mid-intervention imagery usage did not differ significantly from end of intervention imagery usage.



Correlations were conducted separately for the intervention group and the control group regarding imagery usage and the dependent variables the WOMAC subscales, self-perceived rate of recovery the performance profiles, and the SEI subscales at 6 months post-surgery. Results of the correlations are shown in Tables

5.6 to 5.9 below and indicate no significant relationships between imagery use and any of the dependent variables.

Table 5.6
Correlations for the Intervention Group between Imagery Usage and Dependent Variables the WOMAC subscales and Performance Profile Discrepancy Reduction Data at 6 Months Post-surgery

	1.	2.	3.	4.	5.
1. Imagery Usage	-				
2. WOMAC Pain	.082	-			
3. WOMAC Stiffness	-.398	.508	-		
4. WOMAC Difficulty Performing Daily Activities	-.064	.646**	.517*	-	
5. Performance Profile Discrepancy Mean	-.194	.759**	.595*	.909**	-

* p <.05, ** p<.01

Table 5.7
Correlations for the Control Group between Imagery Usage and Dependent Variables the WOMAC subscales and Performance Profile Discrepancy Reduction Data at 6 Months Post-surgery

	1.	2.	3.	4.	5.
1. Imagery Usage	-				
2. WOMAC Pain	-.052	-			
3. WOMAC Stiffness	-.318	.814**	-		
4. WOMAC Difficulty Performing Daily Activities	-.155	.855**	.798**	-	
5. Performance Profile Discrepancy Mean	-.133	.694**	.439	.680**	-

* p <.05, ** p<.01

Table 5.8
Correlations for the Intervention Group between Imagery Usage and Dependent Variables the Self Evaluation Inventory subscales at 6 Months Post-surgery

	1.	2.	3.	4.	5.	6.	7.
1. Imagery Usage	-						
2. Confidence in Body	.084	-					
3. Confidence in the IBP	.385	.826**	-				
4. Confidence in Rehabilitation Team	-.347	.415	-.024	-			
5. Fear of Re-injury	-.416	-.754**	-.936**	-.28	-		
6. Confidence in Ability to perform	.314	.825**	.954**	-.014	-.812**	-	
7. Loss of Self-esteem	.113	-.753	-.625*	-.344	.573*	-.698**	-

* p <.05, ** p<.01

Table 5.9
Correlations for the Control Group between Imagery Usage and Dependent Variables the Self Evaluation Inventory subscales at 6 Months Post-surgery

	1.	2.	3.	4.	5.	6.	7.
1. Imagery Usage	-						
2. Confidence in Body	.128	-					
3. Confidence in the IBP	.333	.714**	-				
4. Confidence in Rehabilitation Team	-.031	.310	.570*	-			
5. Fear of Re-injury	-.381	-.738**	-.755**	-.211	-		
6. Confidence in Ability to perform	.122	.795**	.529*	-.053	-.572*	-	
7. Loss of Self-esteem	-.071	-.880**	-.675**	-.443	.677*	-.719**	-

* p <.05, ** p<.01

Post Experimental Questionnaire Data: Table 5.8 on the following page illustrates the intervention group mean responses to the post-experimental questionnaire. Responses suggest that participants reported practising the imagery often and that the imagery affected their confidence a great deal. Further, participants reported that the imagery had been very useful during their rehabilitation and the intervention had helped them to overcome any difficulties that came up during their rehabilitation.

Table 5.8
Descriptive Statistics for Post-experimental Questionnaire (Intervention Group Only)

Questionnaire Item	Mean	Standard Deviation
How often did you manage to practice the imagery in general?	7.27	1.22
How often do you use healing imagery?	6.33	1.67
How often do you image yourself using you (new) hip or knee?	7.47	.83
How often do you image yourself completing your rehabilitation exercises?	6.47	.92
How often do you image yourself as physically ready to engage in your normal physical activities?	7.33	1.11
How often do you image yourself engaging in your normal physical activities?	7.47	.92
How easy was it to fit into your daily schedule?	7.60	1.12
To what extent did you manage to develop a routine of using imagery?	7.93	.88
With regard to your rehabilitation, to what extent did the imagery affect you confidence?	8.40	.63
To what extent, if any did the imagery motivate you towards engaging in your normal physical activities again?	7.40	.63
To what extent if any did the imagery help you to overcome any difficulties that came up during your rehabilitation?	7.27	.80
How useful did you find the imagery during your rehabilitation?	8.27	.80
How easy did you find completing the questionnaires?	8.40	.83

Items were scored on a 9 point Likert scale in which for items 1-6 1 = *never* and *9* = *often*; item 7, 1 = *not at all* and 9 = *easy*; item 8, 1 = *no routine* and 9 = *A routine*; items 9-12, 1 = *not at all* and 9 = *a great deal*; and item 13, 1 = *not at all* and 9 = *easy*.

DISCUSSION

The aim of this study was to examine the efficacy of an imagery intervention on the confidence and progress of patients rehabilitating from hip/knee replacement surgery. The results demonstrate some support for the hypotheses that participants in the imagery intervention group would have higher levels of confidence following the imagery intervention and would rehabilitate more quickly than participants in the control group. Specifically, the results showed a significant multivariate interaction effect on the measure of confidence (the SEI), the physical outcome measures (the WOMAC), but no significant interaction effect on the performance profiles. Post-hoc

analyses of interaction effects revealed that participants in the intervention group had significantly more confidence in their own bodies, more confidence in their ability to perform at re-entry into normal activities, more confidence in their new hip/knee and, less fear of re-injury than the control group at six months post-surgery. Further, participants in the intervention group had less stiffness and less difficulty performing daily activities than the control group at six months post-surgery, although the latter effect only approached significance.

Participants in the control group received approximately the same relaxation training and social support as the intervention group, consequently, the significant interaction effects found in this study suggest that the imagery intervention was effective in enhancing participant's confidence in their bodies, confidence in their ability to perform at re-entry into normal activities, confidence in their new hip/knee, and decreasing fear of re-injury. The results also indicate that the imagery intervention was efficacious in reducing stiffness and difficulty performing daily activities. These are important findings, because, although a growing body of research has supported the efficacy of imagery interventions in enabling patients to cope with a number of medical conditions, no previous research had specifically examined the effectiveness of an imagery intervention to enhance the *confidence* of patients in rehabilitation. Additionally, no previous research had investigated the effects of an imagery intervention in a population of patients rehabilitating from hip/knee replacement surgery.

A possible reason for the lack of interaction effects for the WOMAC pain subscale could be due to the fact that at six months post-surgery patients levels of pain would be expected to be low (Bachmeier, March, Cross, Lapsley, Tribe, Courtenay, & Brooks, 2001). This suggestion is supported by the descriptive statistics (Table 5.4),

which shows that out of a maximum 20, the mean WOMAC pain score at six months post-surgery was 0.27 for the intervention group and 1.67 for the control group. Indicating that at six months post surgery pain scores are very low, regardless of whether or not participants were involved in an intervention. Bachmeier et al., (2001) found that following hip and knee replacement surgery, the greatest improvements (as measured by WOMAC) were observed in the first three months following surgery. It is possible that the intervention may have had an effect on levels of pain earlier in the rehabilitation period. Future research might investigate this.

Interestingly, although significant interactions were found for some of the SEI and WOMAC subscales, no significant interaction effect was found for the patient self-perception of rehabilitation, the performance profiles. There are three potential reasons for this. Firstly, the performance profile has not been employed with a population of patients rehabilitating from hip/knee replacement surgery prior to this study, consequently, validation analysis should be conducted to assess its validity with this population in the future. Secondly, completing the performance profiles was an entirely new experience for the participants. Although the researcher made every attempt to explain the nature of the profiles and how to construct them, given that the mean age of the participants was 69.93, it is possible that some of the participants had difficulty constructing and understanding the profiles. Finally, it could be that the intervention had an effect on participant's perception of recovery at an earlier stage in the rehabilitation period, rather than at the six month post-surgery stage. As with the WOMAC pain subscale, future research might investigate this.

The results of this study provide some support for previous imagery intervention studies for both enhancing confidence (e.g., Callow, Hardy, & Hall, 2001; Callow & Waters, 2005; Short, Bruggeman, Engel, Marback, Wang,

Willadesen, & Short, 2002) and facilitating recovery for painful medical conditions (e.g., Haanen et al., 1991; Lambert, 1996; Malone & Strube, 1988; Mauer, Burnett, Oulette, Ironson, & Dandes, 1999; Syrjala, et al., 1992).

The findings also add to previous research supporting the use of psychological interventions in rehabilitation from orthopaedic surgery. Cupal and Brewer (2001) found a treatment consisting of relaxation and guided imagery in patients rehabilitating from ACL reconstruction, produced significantly greater knee strength and lower levels of re-injury anxiety and pain relative to placebo and control conditions. Consistent with Cupal and Brewer (2001), the results of this study indicated that the imagery intervention group had less fear of re-injury than the control group.

Examination of the post-study questionnaire suggests that participants in the intervention group perceived the intervention to be beneficial to their rehabilitation. In particular, participants reported a mean of 8.4 (out of 9) for the perceived effect the intervention had on their confidence, 7.4 on the perceived effect on their motivation towards engaging in their normal activities and 8.27 on how useful the intervention was to their rehabilitation in general. These findings suggest that the participants perceived the intervention to have impacted on their confidence, motivation and to have been generally helpful in their rehabilitation.

Further examination of the post-experimental questionnaire alludes to some of the mechanisms by which the imagery may have exerted its effects on both confidence and recovery. One of the open-ended items at the end of the post-experimental questionnaire invited participants to note down the most important thing they got out of participating in the research. The responses to this question revealed that the participants perceived the imagery intervention to have served both cognitive

and motivational functions. Several participants noted that the imagery reminded them daily of the need to exercise and work on their rehabilitation, and helped them to focus on their rehabilitation, suggesting that the imagery had a meta-cognitive function. Several other participants reported the intervention had enhanced their confidence, aided them in remaining positive about the rehabilitation process, motivated them towards their rehabilitation and return to normal physical activities, and enhanced their motivation during any difficult periods during the rehabilitation, suggesting a motivational function. These results are similar to previous research by Driediger, Hall and Callow (in press). Based on their interviews with injured athletes regarding their use of imagery during rehabilitation, Driediger, et al., (in press) found that athletes believed their imagery usage served cognitive, motivational and healing purposes in effectively rehabilitating from injury. Examining the cognitive and motivational functions of imagery in athletic injury rehabilitation, Sordoni, Hall, and Forwell (2002) also found that injured athletes reported using the motivational, cognitive and healing functions of imagery to about the same extent.

Delivering the intervention to participants in their own homes facilitated adherence and decreased the amount of effort needed from the participants, however, it was time very consuming for the researcher. The cost-effectiveness of the relaxation and imagery intervention was not assessed and it may be that it would not be cost-effective to run such a program on a larger scale in the future. A possible way round this would be to for the psychologist to work with physiotherapists and the physiotherapists then incorporate the relaxation and imagery training into their sessions with the patients. Research in health psychology has found such methods to be successful in certain patient populations. For example, health education and counselling programmes offered to myocardial infarction patients during and after

hospital stays, are often designed by psychologists, but delivered by nurses and/or social workers and this does not appear to decrease their effectiveness (Van Eldersen, Maes, & Van den Broek, 1994). Future research could investigate the efficacy of this method of delivering a relaxation and imagery program to patients rehabilitating from hip and knee replacement surgery.

There were three main limitations to the study. First, the researcher conducted the intervention. The study was long-term and involved interaction between the researcher and participants over a period of six months, thus, the researcher had a good deal of contact with the participants. It is possible, therefore that experimenter expectancies or the Hawthorne effect could have influenced the results of the study. However, since both groups received the relaxation training and the researcher spend approximately equal amounts of time with the intervention and control groups this seems not to be the most parsimonious explanation of the findings.

A second limitation involved the timing of the delivery of the intervention. In hind-sight, it would have been beneficial to have delivered the basic imagery training before participants had their surgery so that they could start with the healing imagery during the first few days following surgery. In the protocol used in this study, participants were only introduced to the healing imagery a month after surgery. A number of participants suggested that they would have found the healing imagery especially beneficial during the initial few weeks following surgery. Further, Shambrook and Bull (1996) suggest that psychological interventions are subject to a temporal lag, because there will be a period of learning of the skill resulting in a possible period of latency before the skill reveals its effect. Thus, the impact of the intervention might not be instant. However, in order to have delivered the basic imagery training prior to surgery, the researchers would have required access to

participants approximately six weeks prior to their surgery and have visited them during their hospital stay. At the time of this research this was not feasible.

The third limitation concerned the lack of a traditional control group. In order to control for social support and relaxation effects the control group in this study was in fact more of a placebo group, since they too received the relaxation training and social support. Retrospectively, it may have been beneficial to have employed a third condition where members were simply asked to complete the inventories, so that they did not receive the relaxation training or the social support from the researcher during the rehabilitation period. This would have provided some insight into the effects of the relaxation training and social support on the confidence and rehabilitation outcomes.

Future research could investigate the efficacy of a similar relaxation and imagery intervention in a variety of different populations. In particular, it would be interesting to examine the effects in an athletic population, who might already be familiar with using imagery.

There are two main applied implications that emerged from this study. Firstly, the results indicated that the imagery intervention had a beneficial effect on certain aspects of patient's confidence. Psychologists or physiotherapists working with patients recovering from hip/knee replacements in future, could use a similar imagery intervention in order to enhance patient's confidence in their bodies and ability to perform upon re-entry into normal physical activities, increase confidence in their new hip/knee and decrease fear of re-injury. Previous research (e.g., Draper & Ladd, 1993) has considered fear of re-injury as a barrier to recovery from orthopaedic surgery.

Secondly, Orbell et al., (1998) found that the number of hours of formal and informal support received by patients following hip/knee replacement increased over a 9-month follow-up period. Participants in the intervention group in this study had less stiffness and difficulty performing daily activities than the control group, indicating that a possible way to reduce the amount of support needed following hip/knee replacement, could be to employ an imagery programme similar to the one utilised in this study, in order to facilitate resumption of normal daily activities. Future research could examine this suggestion in more detail.

In conclusion, the results of this study provide support for the efficacy of an imagery intervention to enhance the confidence and progress of patients rehabilitating from hip and knee replacement surgery. Replication of the current findings is recommended, and future research should investigate the efficacy of imagery interventions to enhance confidence and progress of patients rehabilitating from other injuries. Additional research is also needed to begin to examine the underlying mechanisms by which imagery may influence confidence and progress in the context of rehabilitation.

Chapter 6

General Discussion

Summary

The overall aim of this research project was to begin to investigate the role of confidence in injury and rehabilitation. Previous researchers had highlighted and acknowledged confidence as an important factor in the recovery process, however, very little was known regarding the precise role of confidence. The majority of the early research focused on facets of confidence that had been identified as important in healthy athletes, rather than identifying aspects of confidence that might be uniquely important in the context of injury and rehabilitation. A review of the literature regarding confidence and rehabilitation indicated that it was not sufficient to focus exclusively on self- or sport-confidence, rather research should investigate more diverse aspects of confidence. The conceptualisation of confidence employed throughout this research project was the subjective probability of an outcome occurring. Defined in this way confidence was expressed with respect to the injury experience. Importantly, throughout the research project, we were not only concerned with self-confidence, but also with a number of other situations in which people's belief about the likelihood of events occurring might have an impact upon their behaviour and feelings. Based on this definition of confidence, this thesis highlighted a number of facets of confidence that were important during the injury and recovery period that had not been accounted for in previous research.

The first study was designed to investigate the importance of confidence with respect to different facets of the entire injury and recovery process. A review of the literature exposed a lack of descriptive data pertaining to the precise role of confidence in the injury and rehabilitation context. Consequently, it was important to

initially establish a descriptive foundation of knowledge concerning this. In depth interviews were conducted with five seriously injured high-level athletes and three physiotherapists with extensive experience of working with elite injured athletes. Content analysis identified 6 first-order categories directly related to confidence including: confidence in the injured body part (IBP), confidence in own body, confidence in the rehabilitation team, fear of re-injury at the point of re-entry into sport, confidence about ability to perform on re-entry into sport, and loss of self-esteem. Four other first-order categories emerged that were not directly related to confidence but appeared to be important, these were adherence motivation, looking for improvement in the IBP, actively seeking skills to develop whilst injured, and change of approach to sport. One of the important findings from this study was the identification of a number of facets of confidence specific to the rehabilitation context that had not been investigated in pervious research. The range of facets of confidence highlighted in this initial study supported the suggestion that research should investigate diverse aspects of confidence specific to the injury context, rather than focusing solely on specific aspects of self-confidence or sport-confidence as had been the focus of much of the earlier research.

Research focusing on athletic injury and rehabilitation has been criticised for lacking in empirical rigor (e.g., Evans & Hardy, 1999; Brewer, 2001), and a reliance on non-population specific measures (e.g., Evans & Hardy, 1999; Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998). Study 2 attempted to address these limitations by utilising the results of the first study, to develop the Self Evaluation Inventory, a population specific instrument to measure confidence throughout the entire athletic injury experience. Each raw data theme was used to generate an item for the inventory and each first-order category formed a subscale. Each item was based on a

statement, which reflected a response by the athletes and/or physiotherapists during the interviews. As a result of confirmatory factor analysis using the sequential model testing approach (Jöreskog, 1993), the six factor 42 item model was reduced to an six factor 27 item model which demonstrated acceptable model fit. The six subscales included: confidence in the injured body part (IBP), confidence in own body, confidence in the rehabilitation team, fear of re-injury at the point of re-entry into sport, confidence about ability to perform on re-entry into sport, and loss of self-esteem. There were several strengths to this study, including the number of participants (over 400) involved and the magnitude of the participant's injuries. Participants were precluded from training or competition for a minimum of two weeks (mean 32.70 weeks), whereas, previous research had often reported on trivial injuries (Evans & Hardy, 1999). Further, participants were sampled from early to late in the rehabilitation period. Researchers (e.g. Evans & Hardy, 1999; Weise-Bjornstal et al., 1998) have called for the need to account for temporal features of psychological factors in sports injury research.

Flint (1998) argued that although it is often complicated and difficult to achieve, psychological and physiological reactions to sport injury and outcome variables must be considered concurrently. However, the majority of psychology of injury research has operated independent of any physiological considerations. Study 3 attempted to address this limitation through the inclusion of both psychological and physiological outcome variables, in a study investigating the nature of the relationship between different facets of confidence and athletic injury rehabilitation. The Self Evaluation Inventory (SEI) developed in the second study was employed to examine whether certain facets of confidence early in the rehabilitation period could predict physical recovery later on. The participants in the third study were 30 athletes

undergoing anterior cruciate ligament (ACL) reconstruction. It was hypothesised that confidence in the injured body part (IBP), confidence in own body, fear of re-injury at the point of re-entry into sport, confidence about ability to perform on re-entry into sport and, loss of self-esteem would have a quadratic relationship with physical outcome variables. Whereas it was hypothesised that confidence in the rehabilitation team would have a linear relationship with the physical outcome variables. The results demonstrated some support for the hypothesis. In particular support was found for those relationships where a quadratic relationship had been hypothesised and the neuromuscular indices of recovery and participant perceived rates of recovery. Inspection of the scatterplots with the quadratic line of best fit indicated that the quadratic relationships were all plateau effects not inverted 'U' effects. No significant relationships were found for the strength or laxity data, or the subscale confidence in the rehabilitation team. The results of this study provided support for previous research (e.g. Waldrop et al., (2001) suggesting that certain facets of confidence can significantly predict variance in outcome following orthopaedic surgery. A major strength of this study was inclusion of both psychological and physiological outcome variables. The findings of this third study indicated that certain facets of confidence might be beneficial in enhancing certain aspects of the recovery process.

The fourth and final study of this thesis drew on results from the previous three studies in order to design an intervention study to try to augment the confidence of patients in rehabilitation. With the intention of providing an additional dimension to the thesis, it was decided to recruit participants rehabilitating from hip and knee replacements, rather than athletes as had been utilised in the previous three studies. No previous research had examined the efficacy of an imagery intervention to

enhance the confidence of patients in rehabilitation. Additionally, no imagery intervention research had been conducted previously with patients rehabilitating from hip/knee replacement surgery. An imagery intervention was developed which included basic imagery training, healing imagery and mastery imagery based on participant's responses on the SEI. This study addressed the need for well-controlled research, which examines specific intervention strategies on individual's rehabilitation (Cupal, 1998). The study attempted to control for relaxation effects and social support by employing a control group, which received the same amount of relaxation training and social support as the intervention group. The results demonstrated support for the hypotheses that participants in the imagery intervention group would have higher levels of confidence following the imagery intervention and would rehabilitate more quickly than participants in the control group. Specifically, the results showed the intervention enhanced participant's confidence in their bodies, confidence in their ability to perform at re-entry into normal activities, confidence in the IBP and fear of re-injury. In addition, participants in the intervention group had less stiffness and difficulty performing daily activities. The participants also perceived the intervention to have enhanced their confidence a great deal, helped them to overcome difficulties in their rehabilitation and been generally helpful to their rehabilitation.

Theoretical Implications

The four research studies in this thesis highlight a number of theoretical implications. Firstly, previous research that had begun to empirically examine confidence in relation to sport injury rehabilitation (e.g. LaMott, 1994; Magyar & Duda, 2000; Quinn & Fallon, 1999) had employed the SSCI (Vealey, 1986) as a measure of sport-confidence. The SSCI was not developed for specific application to

injury, rather as a measure of confidence for current sporting performance. Research utilising the SSCI in the context of injury rehabilitation may provide a good insight into how sports-confidence is affected by injury. However, the results of this thesis indicate that certain facets of confidence become uniquely important during injury rehabilitation and would not be taken into account by research employing a non-population specific measure, such as the SSCI. Indeed, only one of the six subscales in the SEI (confidence in ability to perform upon re-entry into sport) would measure a similar construct to the SSCI. The remaining five subscales of the SEI would not be addressed at all.

The results from this thesis identified and examined a number of facets of confidence in injury rehabilitation that had not been empirically investigated in previous research. For example, confidence in the injured body part had been identified in earlier qualitative studies (e.g., Evans et al., 2000; Johnston & Carroll, 1998), as had fear of re-injury at point of re-entry into sport (e.g., Bianco, Malo & Orlick, 1999; Evans et al., 2001; Gould et al., 1997a; Ievleva & Orlick, 1991; Johnston & Carroll, 1998; Udry, Gould, Bridges & Beck, 1997), however, neither facet of confidence had previously been empirically investigated. To the best of the authors' knowledge, confidence in own body had not been identified in any previous research.

The initial qualitative study identified an important connection between loss of confidence and loss of self-esteem. Bandura (1997) argued that self-efficacy (i.e., situation specific self-confidence) and self-esteem are not directly related. Bandura (1997) purports that an individual may be entirely inefficacious in a certain activity without losing any self-esteem whatsoever, because they do not invest their self-worth into that activity. Hardy and Moriarty (2005) found that domains of value have a

bigger impact on self-esteem. There is every reason to believe that athletes would believe competence in sport to be of great importance. Prior to commencing the study the authors had not considered loss of self-esteem and its relationship to confidence during injury. As a result none of the questions in the interview guide asked about loss of self-esteem during the different facets of injury rehabilitation. Nevertheless, loss of self-esteem kept emerging when participants were discussing the role of confidence during injury rehabilitation. Loss of self-esteem remained a significant factor in the confirmatory factor analysis of the model tested in Study 2. Further, in the third and fourth studies, the Cronbach's alphas for loss of self-esteem were the highest of all six subscales. Whilst Bandura's (1997) argument for the lack of a connection between confidence and self-esteem may be true in certain situations, the findings from this thesis together with Hardy and Moriarty's findings question Bandura's (1997) argument in the context of athletic injury and rehabilitation.

Throughout this thesis it appears that injury and rehabilitation have an impact on an individual's confidence, suggesting an aspect of fragility of confidence in the context of the recovery process. The quadratic relationships found in Chapter 4 between certain facets of confidence and physical recovery were plateau effects rather than inverted 'U' effects, which suggests that during rehabilitation an athlete cannot have too much confidence. Specifically, there were no negative effects associated with high levels of confidence. This is an interesting point as some research has suggested that high-level athletes demonstrate a resilience of confidence. Research by Jones, Hanton, and Connaughton (2002), investigating mental toughness in World Champion performers identified an "unshakable" sense of self-belief as being crucial and fundamental to mental toughness. Further more, Jones et al., (2002) suggest that an important aspect to World Champion athletes' mental toughness is the ability to

use setbacks as a source of increased determination to "bounce back". Similarly, in a study investigating the psychological characteristics of Olympic medallists, Gould, Dieffenbach and Moffett (2002) found that the most common characteristics of mental toughness identified by participants in their study were resilience, perseverance and the ability to successfully deal with adversity. This resilience of self-confidence was backed up by Olympic gold medallist in downhill skiing, Kerrin Lee-Gartner when describing her recovery from a serious knee injury. Lee- Gartner (Orlick & Lee-Gartner 1993) argued that the only way she got through her injury was:

> to always believe in myself and to look at the reasons why I was going through these struggles, to look at the end result really…I stayed focused through every single bad thing, stayed focused, stayed focused, stayed focused. I think that's the only way through it, to go gradually and continue believing in yourself the whole way. That's the key to everything when you're down" (Orlick & Lee-Gartner, 1993; pp. 113-114).

The participants involved throughout this research project were a combination of recreational and high-level athletes. The athletes involved in Study 1 were high-level but not Olympic athletes. The physiotherapists, however, were experienced in working with Olympic athletes and reported that based on their experience, injury had an impact on these athlete's confidence. Studies 2 and 3 of this thesis contained some international and Olympic athletes, however, the majority of participants competed at county, club and recreational levels. It would be interesting for future research to examine the effects of injury on the confidence of Olympic and elite athletes to establish whether or not their "unshakable" sense of self-belief remains in tact even in the face of serious injury.

This thesis contains a diverse range of populations from high-level athletes to 85 year-old patients rehabilitating from hip and knee replacement surgery. Interestingly, the pattern of findings were generally consistent across the very different populations, highlighting that confidence appears to be important from high-level athletes to 85 year-old retirees.

Previous researcher has found confounding results with regard to changes in confidence during the injury rehabilitation period (e.g., Evans et al., 2000; La Mott, 1994; Quinn & Fallon , 1999). A possible reason for this could be due to different methodologies employed and non-population specific measures in rehabilitation. The data collection procedures in this thesis were designed to account for the temporal features of confidence during the entire injury period. The qualitative interviews conducted in Study 1 questioned participants on their perception of the role of confidence from injury onset to re-entry into sport. In Study 2 participants were sampled from early to late in the rehabilitation period. Studies 3 and 4 followed participants from pre-surgery to six months post-surgery, following ACL reconstruction and hip/knee replacement surgery respectively. The SEI demonstrated an ability to measure confidence throughout the entire injury recovery experience.

Applied Implications

There are four main applied implications worthy of consideration. Firstly, it would seem that injury does have an impact on athlete's confidence, highlighting a potential vulnerability of confidence during the injury and recovery experience. Although athletes may appear to have resilient confidence prior to injury, it is possible that their confidence may become vulnerable and fragile during the injury period. Consequently, medical teams, coaches and sport psychologists working with injured

athletes need to ensure that athletes are well supported and treated with sensitivity during the entire injury experience.

Secondly, although the SEI is still in the developmental stages and further validity research needs to be conducted, the confirmatory factor analysis conducted in Study 2 (Chapter 3) did provide support for the use of the SEI to measure confidence during sports injury rehabilitation. Sport psychologists working with injured athletes could employ the SEI to monitor athlete's confidence during the injury process and work on augmenting those facets of confidence where athletes demonstrate low confidence. Additionally, the SEI now provides researchers with a population specific measure of confidence during injury rehabilitation. Brewer (2001) argues that population specific measures enable researchers not only to employ standardised instruments across research studies, but also permits researchers to ask more fine-grained research questions.

Thirdly, results from Study 3 indicate that sport psychologists working with athletes rehabilitating from ACL reconstruction might do well to enhance athletes' confidence in their body and ability to perform at re-entry into sport, confidence in their injured body part, decrease fear of re-injury, and try to limit losses of self-esteem. High confidence in these facets of confidence early in rehabilitation, were found to be associated with better EMD, RFD and patient perception of recovery later on in the rehabilitation process.

Finally, the results of Study 4 demonstrated the effectiveness of an imagery intervention to augment certain facets of patient's confidence during rehabilitation from major orthopaedic surgery and to be associated with less stiffness and difficulty performing daily activities. Psychologists or physiotherapists working with patients rehabilitating from hip/knee replacements might include basic imagery training,

healing imagery and mastery imagery into patient's rehabilitation programs following hip/knee replacement surgery.

Research Strengths

One of the key strengths of this thesis is the range of methodologies and statistical analysis employed and. Throughout the thesis qualitative and quantitative methodologies were utilised together with statistical analysis that included confirmatory factor analysis, quadratic and linear regression analysis and multivariate analysis of variance. A major strength of the thesis was the third study, which employed a multidisciplinary approach. Few studies have been conducted that have included both psychological and physical outcome variables. A third strength of this thesis is that it expands our knowledge of the role of confidence in injury rehabilitation. Prior to this thesis very little was known concerning the precise role of confidence in the injury rehabilitation experience. Although there is still a long way to go to further our understanding of the relationship between confidence and rehabilitation, this thesis has provided a valuable foundation of knowledge for future researchers to build upon.

For some time researchers (e.g., Brewer, 2001; Evans & Hardy, 1999; Wiese-Bjornstal et al., 1998) have argued for the development of measures specific to the athletic injury domain and this research has provided an inventory to measure confidence during injury rehabilitation.

A major strength to the thesis was that the participants were recruited from hospital clinics and were all seriously injured athletes or patients undergoing hip/knee replacement surgery. A limitation to much earlier injury research has been the relatively trivial nature of some of the injuries sustained by participants. As Evans and Hardy (1999) noted injury has often been defined as one days loss of

participation. In Study 1 participants had sustained a serious injury that required surgery and was potentially career ending. Participants in the second tudy had sustained injuries that were expected to preclude them from sport for a minimum of two weeks (mean 32.70 weeks) and participants in Studies 3 and 4 were rehabilitating from major orthopaedic surgery. The need to control for injury severity is vital in order to be able to provide sound and empirically valid research findings.

Participants in Studies 3 and 4 were initially recruited prior to surgery and were then each participant followed for six months following surgery. The frequency and duration of data collection for these two studies demonstrated a methodological rigour that has not often been reported in injury related research. The diverse range of populations was also a major strength from high-level athletes to 85 year-old retirees.

Research Limitations

A number of limitations exist in this thesis. As with any injury related research, sample size has been a limitation of some of the research. As recommended by Evans and Hardy (1999), however, this research project attempted to maintain methodological rigor in controlling for injury type and severity, possibly at the expense of large sample sizes.

One of the limitations to the development of the SEI was that due to time constraints the item pool contained only items that were developed from direct quotes taken from the qualitative study. Exploratory factor analysis using structural equation modelling techniques demonstrated acceptable model fit for the SEI, however, further confirmatory analyses is needed. It would be of value for future researchers to develop more theoretically driven items for those subscales with few items and to conduct further confirmatory analyses on the model. In addition, although Studies 3 and 4 (Chapters 4 & 5) provide some evidence of predictive validity of the SEI, it

would be advantageous to conduct further predictive and discriminant validity analysis.

The current research included all phases of the injury period and participants in Studies 3 and 4 were followed from pre-surgery to six months post-surgery. However, the majority of participants in Study 3 were only just considering re-entry into sport at the six month post-surgery stage. A few participants had begun to train and compete again but the majority were just at the re-entry into sport stage. Some previous research (e.g., Evans et al., 2001; Johnston & Carroll, 1998) had indicated that the period of re-entry into sport is an important period with respect to athlete's confidence. Consequently, it would be advantageous for future research to continue to collect data right through participants' return to competitive sport. However, in the present Study 3 the data collections took place at the hospital and participants were discharged at the six months post-surgery stage, making continued data collection very difficult.

Future Research Directions

This thesis had highlighted a number of areas that are worthy of consideration by future researchers. Firstly, the results of these four studies have identified a number of facets of confidence salient to the rehabilitation context that previous had not considered. Future researchers might investigate the importance of these facets of confidence in rehabilitation in more detail. The SEI offers a population specific measure that can be employed to measure confidence during injury and rehabilitation. Further validation work is needed and to examine the utility of the SEI as a psychometrically valid measure, with which to assess confidence during injury and rehabilitation.

Studies 3 and 4 in this thesis have highlighted the potential role of certain facets of confidence in rehabilitation. Future research needs to begin to examine the underlying mechanisms through which confidence may exert its influence during injury rehabilitation. This research has provided a basic foundation of knowledge regarding the role of confidence and future research is needed to build upon this in order to further our understanding of the precise role of confidence during the entire injury and rehabilitation experience.

The final study of this thesis demonstrated the ability of an older population of patients to make use of relatively sophisticated performance enhancement/ psychological strategies during rehabilitation. Such strategies are little used with an older rehabilitation population. This study also demonstrated the ability of an imagery intervention to both enhance the confidence and recovery of patients rehabilitating from hip/knee replacement surgery. Future research might begin to investigate the efficacy of teaching physiotherapists the imagery intervention and their delivering the imagery intervention to patients rather than the psychologist. If it could be found that the intervention was effective delivered in this way, it could be much more cost effective which would potentially allow it to be more widely used. Our understanding of the effectiveness of imagery interventions to develop appropriate levels of confidence in rehabilitation would be enhanced by future research employing a variety of different populations rehabilitating from different types of injuries. Researchers might also examine the efficacy of different types of intervention strategies (e.g., goal-setting) to enhance confidence during rehabilitation.

Concluding Remarks

In conclusion, this research project has provided a preliminary understanding of the role of confidence in rehabilitation. The research involved in the thesis has identified a number of different facets of confidence that are perceived to be important during injury rehabilitation; provided a potential instrument to measure confidence during the recovery period; demonstrated the relationship between certain facets of confidence and recovery outcome; and, indicated the efficacy of an imagery intervention to enhance confidence and recovery in patients recovering from hip/knee replacement surgery. The combination of results from the four studies provide a much needed insight into the role of confidence in the recovery of motor performance and has provided an initial foundation of knowledge for sport psychologists, medical teams and future researchers to draw upon.

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APPENDIX 1
FULL RAW DATA QUOTES FOR EACH FIRST ORDER THEME

Confidence in the Injured Body Part

"It's hard to describe, it just doesn't feel right."

"I still think there is something wrong, but I don't think there is anything I could do about it."

"I think that maybe there's something there."

"It [IBP] feels pretty good most of the time, occasionally it sort of, I think that maybe there's something there, but how much it is me thinking there's something there and how much there is actually something there I don't know."

"It probably won't ever be 100%."

"I still get tweaks and aches and whatever."

"It was still sensitive, it's still sensitive now, I don't think that will ever go away … even now sometimes it's kind of like a bit painful."

"I think it was about 6 weeks post op it suddenly swelled up and went quite dodgy and I got quite worried about it… I was aware of things that happen, and I went back to see [his surgeon] about that stage and he said I was fine, it's just because it was 6 weeks, that's when the knee starts getting the blood supply back."

"I did a side step and something like crunched inside it. It didn't collapse, but I kind of fell to the ground, probably partly protecting it, and then, I don't know, it didn't really swell up much, but I went to the hospital anyway … And they kind of checked it and they said the knee and the ligaments were all right."

"I was a bit wary… I'm more aware of it because I've injured it before and when I do hit it, it's like 'oo' that maybe affected my confidence a bit."

"I'm always aware that it's [IBP] going to be there."

"I'm a bit wary though when I do play."

"I was a bit like wary."

"I'm a bit wary of it now, thinking perhaps that once you've had one big knock it might go again."

"I did a side step and something like crunched inside it. It didn't collapse, but I kind of fell to the ground, probably partly protecting it"

"Sort of held the leg back." [during first training session]

"I'm one shot away from messing up my elbow again. I'm one day away or one silly incident."

"Worrying that it [IBP] would hold up."

"Would it (IBP) be strong and stable enough for me to not walk but run and do things like that...I think the confidence sort of lacks sort of falls out."

"Knowing that the knee was not going to be ever as strong as it could be."

"Everything [in the IBP] was quite weak because it had been chopped about so much."

"at the early stages I had not idea of how successful it was going to be. I was fairly confidence that it was going to get better, because speaking to [his surgeon] and that he said like loads of people are pretty successful."

"They focus on any little sensation they're getting from it, you know they'll zoom in on it."

"Some people ... even after you've said they are fit to go back, say I've got a slight pain will it be alright?"

Confidence in Own Body

"...generally the confidence was low when you can't trust your body any more and when you get to that stage, I mean that's pretty fundamental to someone who considers themselves a sports person, if you can't trust your body and your body has let you down in pretty much all the endeavours that are important to you then it makes you down."

"Oh, it was just massive, you just lose, the confidence you lose is the confidence in your body."

"The confidence was just proportional to what the body lets you actually do."

"Now the confidence is a reflection of my form or vice versa"

"There are only two things that affect my confidence as a performer and one is how resilient my body is, and the other is simply how good my form is"

"Even in my dreams it was just constant thing of your body can't do this any more"

Confidence in Rehabilitation Team

"I ruptured a couple of discs in my back and it's not known what caused it, the surgeon doesn't know, and unfortunately, it wasn't successfully diagnosed for about 14 months, so it sort of got worse and that was despite seeing a million people, you know, I saw physios by the dozen, I saw chiropractors, chiropodists, acupuncturists ,

doctors, surgeons, you name it. But they all misdiagnosed it except the surgeon at the end who had a lot of cat scan and that showed two discs had completely burst, so I needed had surgery after that"

"Well the back's always bad, that's inevitable because probably about the 14 months use when it was not diagnosed there was injury that just couldn't be fixed y the surgery."

"And then I went back the next day and got a pot, and I had that for a couple of weeks, then I went back and they took the pot off and decided I hadn't fractured my knee-cap at all. So I'd had a pot on for no reason apparently. "

"And they kept going 'oh yes, well do ...' just sort of fadding about, and they gave me an MRI scan, and the guy said at the time sort of 'oh yes you should have something there but we can't see anything'. They seemed to be really long-winded about getting ...."

"I think it was like just being mis-diagnosed loads of times, it was just such appalling, just being told different things all the time and never knowing where you stood."

"I had two or three months of physiotherapy including deep tissue massage and electro pulse thing that they put through, ultrasound, none of which really seemed to make a huge difference."

"before the surgeon I had a go at acupuncture, just - I was prepared to try anything, I even scanned the internet for tennis elbow ideas in case there were any other sort of. .. I would have tried anything really because it was becoming very important, it was interfering with my general life"

"I suppose I wanted someone who was probably the best, and they probably were the best at the hospital I was at. But you want someone who knows your sport, a sports physio rather than a general phsio."

"Perhaps they could have pushed me a bit harder, but it's a quite serious injury so they know best. But again I felt you are given exercises to do at home, I wasn't doing them at home"

"the other thing really is their [the injured athlete's] confidence of knowing, are they going to trust you that you can actually get them back at that stage, sometimes they don't, I think trust you completely"

"I think if you can reason why something hasn't worked you still keep the confidence between yourself and that patient in that they know that you are working for them"

"If you haven't warned them that something will happen then their confidence in you drops"

"One of the overriding things you've got to get early on is their confidence in you as a physio. And if you can do that, their confidence to do what you're telling them to do, and not to do any more or any less, they'll be ok."
"It's the building of rapport early on so that you know they'll [injured athlete] trust you later."

"If they don't fully trust that you know what you are talking about, and that you are the best person to be treating them for this, then they are far less likely to come back."

"Right from the beginning I tend to say a rough period, this is how long it will take"

"You give them an idea of what to expect"

"If you can get the patient to know that for three months you're not allowed to do x, y, and z, and your not allowed to do x, y and z because this would happen and that would happen, so rather than just giving them a rule , they know the reason behind it"

"I think if you're up front with them [the injured athletes] if you say...you're going to have to do this twice a day, each session is going to take 45 mins, and its going to take about 6-8 weeks, and that's going to be the things that's the basis of getting you better"

"I think as long as you communicate with them [the athletes] they're happier than when you just sort of presume that they know"

"We break the skill down into component parts so that they've got the confidence to do each separate bit and then put them together.

""You need them to know how it is going to affect them in their day to day life style, how it's affecting them in their training, if they are still training, and also how important it is for them to get back to full fitness really."

"Obviously if that's your job [professional athlete] and that's your profession you're going to need to get back pretty soon aren't you."

"You've got to find out their [the athlete's] goals and their expectations"

"I think it would be important to know that sport they [the athlete] do and what level of sport they do because that will, I think, have quite a lot of influence."

"Many patients we have, they're not like professional athletes, but the pressure isn't on them as much to return to the sport, they're quite happy to just take it steady"

"I think that gives them a little bit more confidence, the fact that yes you've seen that problem before with somebody else"

"That this is a common problem we see within sports, so I think that can give them confidence to know that, 'OK I'm not the first person, so maybe this can be helped"

Looking for improvement in the IBP

"If they don't see improvement from last week to this week then there's going to be a change in their confidence"

"As soon as you get any hint that you might be able to swing a club again"

"It makes you feel fantastic when you think well my body can do a bit more than I thought it could...just being able to bend and realise that yes I can do that, it makes an enormous impact"

"Just being able to touch my toes and move around and dance around a bit is a delight"

"When you have a new patient with the same kind of surgery, and they'll say 'remember when my knee was like this', and that's nice for them as well because they can see a progress for themselves and think, well I am getting better"

"I was gutted [following a setback]"

""They can get set-backs and they get more pain, or more of the same sort of symptoms and then they end up getting more depressed."

""well it was pretty shattering [the setback]"

"I suppose they can become almost despondent, as in like this isn't working, should I be doing it or whatever"

Fear of Re-injury at Point of Re-Entry

"I wasn't sure how good it was going to be even though like I'd done lots of rehab"

"I was worried if my leg would hold up"

"I was trying to get backing form by a certain data and I was just panicking like whether it would rub and hurt and whether it would just stand up you know"

"I still wasn't overly confident at like running flat out, kind of sideways kind of movements and things like that"

"when they go back to training ...they don't necessarily have the confidence in it [the IBP], but physically they are alright"

"To some extent they are returning to sport they can do it gradually, but there is a point where they've just to go...there is all of a sudden that jump you've got to take"

"I'm always conscious of it and you always have to sort of pull things back, I can't let go a hundred percent, I'm always guarded against it"

"then they don't actually put 100% into the game because they're worried about making it worse"

"don't get injured...that's the thing I probably thought of every minute of every game I played"

"No confidence at all. I was very, I wasn't terribly keen to play because I just assumed that I would be injured."

"For the first few days I wasn't as confident, I was definitely thinking about it because you always think 'God if I have a fall now would it happen again' so it definitely affected me"

"I was crapping myself continually, you know when's it going to go, when's it going to go"

"Obviously they are quite anxious, because they feel that the problem's going to recur again"

"They do worry that the same thing is going to happen at the same time again"

"the only thing he [the injured athlete] hadn't been tackled as you run from behind when he wasn't expecting it , which was how he got injured in the first place...and that was what he was worried about"

"No confidence , not at all. I was very, I wasn't terribly keen to play because I just assumed that I would be injured"

"I kept bottling it out"

"if it came down to tackling, I wouldn't let people tackle me"

""I wasn't confident at all then and I don't think I made any tackles, I just kind of bottled it out of all of them"

"I've seen people go back with a shoulder injury, hesitating, going in with the other shoulder but they weren't quite confident enough in that shoulder and fracturing their cheek or rib"

"confidence wise when I was tackling, and maybe less confident in one way because I'd had extra time off, whereas if I'd gone back into it sooner I might have been more confident"

"when I had the ball I wasn't too bothered about that, because that wasn't how the injury happened"

"I'd kind of be going in and then at the last minute I'd sort of pull out and bottle it because of protecting my knee because obviously I did it in a tackle and I was thinking 'ooo' better not happen again"

"I think that when I was on the ground I was like partly protecting it, I was making sure I didn't get my leg trapped under piles of people and stuff like that"

Confidence about Ability on Re-Entry into Sport

"The night before I remember, I was a bit nervous thinking God, like almost thinking like I don't really want to ride. I don't know why I'm coming here"

"I remember the night before feeling definitely nervous"

"I remember thinking of up to a week before pushing everything trying to get back, and everything revolves around getting back, and then sort of as it nearer and nearer thinking 'I'm not actually fussed about riding again.' Not just riding but apprehensive about getting back."

"Just enormous trepidation, like what if I'm not good, still no good"

"that I wouldn't be able to perform satisfactorily"

"Certainly I ended up doubting my ability."

"When you get really close to when they [injured athletes] are going back, that's when they start thinking about it. More than early on. When all of a sudden, 'oh, I'm supposed to be better now' and I'm going back into that again."

"prior to that first run it was jut hoping like hell that you can do a bit"

"I've avoided competition on the basis that I didn't think I could compete"

"I felt there was no point in my trying to do that [compete], when I can't play the game, and I'm no where near playing the game at my best"

"I've just avoided competition because it would be a waste of time"

"I got offered to play a game for the [team], but I wasn't that confident on it still and I didn't want to play so I turned it down."

"I'd just make an excuse – avoid doing it [compete]"

"when I did run it was so easy and so brilliant, just fantastic it felt great"

Loss of Self-esteem

"Your whole identity is of someone who can do things reasonably well and then all of a sudden you can't do those things, certainly can't do running its got to change your self image."

"My whole life revolves round sport and I couldn't do that then I was, well I mean I had no confidence, as a young person as someone who was pretty athletic and good at sports, that bits taken away from you so obviously in that area my confidence was

probably non-existent or it was shattered ... my whole identity at the time was probably that of an athlete/footballer, take that away and you're undermine your identity so that has a huge impact on your confidence"

"I haven't had anything else to be successful at in life to give me that fillip of confidence that makes me feel good."

"My general level of confidence or self esteem ranges from very high to very low over short periods of time and not having something like golf to perk me up and having success at golf to keep me going, I've had to look for other things"

"Having something that you are really really good at makes a huge difference in life and when things are tough or you're not quite sure where they are going ... you can go and escape to to prop you up and say, look you're still great at this is really helpful ... Taking that away means that I haven't got anything that I would now say that I'm fantastic at."

"I had to be careful crossing roads and stuff"

"simple tasks just like unloading the shopping bags out of the car or whatever, I would go to do them and as I tried to pick something up realise I didn't have the strength and it hurt too much just to pick up a shopping bag. So that was kind of frustrating."

"Just accepting that I couldn't do things that I took for granted"

"I probably felt a bit hopeless"

"actually being treated like an invalid isn't great, you don't want to be waited on hand and foot. Sort of left of the sofa in a heap too much, you know you get up to go and fix something and somebody says 'it's all right, don't worry, don't move yourself, don't trouble yourself' that sort of gets to you a bit."

"I wanted to do rather than get people to run around for me with my little bell or whatever because I couldn't move."

"Once on the settee I didn't move for the day sort of thing, I felt like a slob."

"the general self-esteem that I have always found in my life that my golf gave me kind of mirrors my life at the time, so when I'm playing my best golf, I've generally felt the best about myself."

"There was a reduction in self-esteem if you like, there was a very negative time because the whole thing went together"

"At the time of the injury golf was very important to me as a general thing, then taking it out of my life made me lower in general self confidence about everything else I was doing"

"It got to the stage where every time I dream about playing footie, I was even injured even in my dreams. When I was running in my dreams I was running half pace because I was thinking I can't run like that any more because I'll injure myself"

"Probably seeing friends who have maybe got international honours now, and perhaps thinking that could have been me."

"just seeing friends in general playing and getting stuck in, or watching it on the TV and thinking I'd love to get back into it but knowing that perhaps I can't now, so that's probably the biggest confidence, taking away of confidence."

"they feel very vulnerable with regards to their confidence"

"you definitely start to think 'Will I ever get my job back?' you know what I mean ... certainly for the last two months of my injury I thought, 'no I'm going to struggle to get back'."

"Certainly during those times your confidence was low because well its like being prematurely old, its like being 70 years old when you're 26."

"I had to go to Australia with a walking stick, like an 800 year old man"

"it's the turning up in the club, but not actually being part of the squad. Being a bit of a spare part."

"it was very hard to accept that with some of my mates I could no longer compete with them or just do the things they wanted to do"

Adherence Motivation

"It was good to push myself to do things, and sometimes I did just push myself too much as well."

"I went through a stage of making myself use it [IBP]."

""I wanted to use it [IBP]"

""I did try not to use it [IBP] if I could help it, it never felt all that good."

"they'll [athletes] actually push themselves to do more than they have to do."

"You make yourself. You don't give yourself the option of not doing it [pushing self in rehab]."

"Its jut the determination to say I'm going to make this work even if it hurts and that sometimes is a lack of understanding ...It isn't overconfidence, its more an over willingness to work hard."

"They [injured athletes] can get too confidence and then they can put themselves back."

"the ones you think might be a bit over confident, those are the ones I might be inclined to use a bit of scare tactics with"

"Over confidence then you have to be careful, because they're obviously potentially going to do themselves some damage physically."

"I think it was high expectations, but expectations based on what I was ... I just wanted to get back to where I was."

"they [athletes] respond well to what you say to them. Because they actually want to get better."

""extremely motivated to work [at rehab exercises]"

""they [injured athletes] will not adhere because they try to go ahead and do it that way, it's 'I'm sure I could do that now if I tried' ...and would go against advice and breakdown because they have attempted it too soon."

"I stuck to it reasonably well [rehab programme]"

"I was pretty good at doing stuff while I was at home"

"I tend to have this attitude of just doing a little bit, seeing if it hurts and doing a little bit more and seeing if that's OK."

"So my test of whatever intervention I had done, was if it got back to neutral after about a day then it was OK to repeat that exercise."

"Everything I've done that has hurt has kind of sorted itself out within 24 hours...and I've though OK that's still getting better slowly."

"they're the ones really that will try and do too much, thinking it will get them beter, and I think you have to educate them into realising that rest sometimes is just as important to healing and recovery as is exercise."

"You tell me to do that and I'll do it in half the time."

""They sometimes go out and actually do too much without you knowing."

"in my case that's always been dangerous because I always try to do too much too quickly."

"Within a week of surgery I was in a pool swimming. Within two weeks of surgery I was rowing."

"You think well if that's the best you can do that time I'll make sure I can do better."

""I thought I was capable of riding. Not to – about 80% of what I could before … you could just about get away with it you know."

"When you have injuries you tend to try and get back too soon. It's not something you can wait, other people win on your horses, and that's why you try and get back quicker."

"You might have a patient that is only 80% better and you feel that if they play, that will make them worse again … you know its not going to kill them it's not going to damage them detrimentally in the future … sometimes it might be a case of telling someone to actually compete or play with an injury."

Actively Seeking Skills To Develop Whilst Injured

"all through my life I've been doing 4 or 5 competitive sports a week, … so you go from playing 4 or 5 competitive sports a week to playing absolutely none, and actually the only thing I was allowed to do was swim, That kept me sane."

"that was crucial because it meant that I could still see that my body was progressing. Getting better. So you'd set yourself goals in swimming I would set myself a session and I could do it."

"So when your confidence is so hooked up in what your body can do and you are losing confidence in other areas because you can't do things then having areas where you are actually improving is important."

"Allow the player to actually continue with as much as they can … if you actually stop anybody from doing any sport, there's a definite downward spiral of motivation."

"we've got an injured knee, it's still important to work on your upper body because you're going to get carry over – and it makes them feel better as well, they're not just sat there having treatment they can actually be doing something in the mean time."

"did quite a lot of mental rehearsal in terms of imagining of when I got back to golf, I kept on trying to tell myself that when I did get back to playing golf I was going to be fantastic. So I tried to keep my hopes up on all of that rehearsing what I was going to change about my swing and how it was going to become softer and smoother … So I did a lot of work on all of that and the first time I actually got out and played nine holes of golf after I came back, I did strike the ball beautifully, virtually every shot I struck the ball beautifully and a week later I shot 5 over, which was 2 under my handicap, which is fantastic."

Change of Approach to Sport

"I have to change my mentality a bit from playing champagne golf and trying to be the one who hits the ball the furthest … I have to become a different kind of golfer."

"I suppose I stuffed things up always trying to do too much and pushing my body a bit too hard and knackering my body and subsequent to that when I was accepting that there were going to be restrictions on what you do."

"Sport is still very important, I still put a hell of a lot of effort into sport, but I suppose my general fitness the condition before was all sport related .... whereas now fitness, is more sport and life."

"golf is still a disappointment ... I sort of just accepted that because my elbows no good."

"first team mentality"

"I had to reframe my whole approach to golf and just enjoy it."

"I've taken the importance of playing golf out of my work requirements."

"I'd kind of got used to not playing."

"More of an acceptance."

"because I had accepted a worse case scenario and ultimately that made it all easier ... I found out the role that golf played in my life and accepted that actually I could live a life without that golf. Life would be better if I could play golf, but it wasn't actually total jump off the bridge scenario that it had looked like at the beginning."

APPENDIX 2

SELF EVALUATION INVENTORY
ITEM POOL

Confidence in the Injured Body Part
My injured body part now feels 100% normal
I worry about my injured body part each time I feel any discomfort, pain or swelling.
I am wary of using my injured body part
I try to protect my injured body part.
I worry that my injured body part will break down again
I worry that my injured body part will never be as strong as it was
I am confident that my injured body part will get back to normal.
I focus on every little sensation that I get from my injured body part

Confidence in Own Body
I cannot trust my body any more
I feel that my body has let me down
My confidence is now based on my form in sport, not just on how I feel about my body
I am confident that my body will not let me down
I feel very vulnerable physically

Confidence In Rehabilitation Team
I have confidence in the professional ability of my physiotherapist
My physiotherapist has given me clear and specific expectations for my rehabilitation program
I believe that the medical team fully understand the role sport has in my life
I feel confident that the medical team have rehabilitated people with my injury before

Fear of Re-injury at Point of Re-entry into Sport
I worry that my injured body part will not hold up in a competition
I feel confident that I can put 100% effort into my performance without re-injuring myself
When I am performing, I constantly pull back and never let myself go a hundred percent
I constantly worry about the possibility of re-injury
I avoid the situation in which the injury occurred
Whenever I am in a situation like the one in which the injury occurred, I protect my injured body part

Confidence about Ability to Perform on Re-entry into Sport
Right now, I feel apprehensive about my ability to perform in competition
Facing the moment of truth and competing again makes me feel nervous
I cannot perform at my best, therefore, I avoid competition altogether
Actually competing again feels like a big obstacle in front of me.
I feel confident that I am ready to compete again

Loss of Self-Esteem
I feel that I am never going to be the same person that I was prior to my injury.
I see myself as an athlete through and through.
My whole life is my sport.
The one thing in my life that I am really good at is my sport
Since my injury, I have felt less confident in all areas of my life.
When things in my life are tough, I really miss having my sport to escape to, to make me feel better.
My life has felt empty since my injury.
When I image/dream of myself performing, I worry about re-injury in my dream/imagery
Seeing other people doing well in the things I would like to be doing, reduces my confidence.
My confidence does not feel very stable at the moment
My injury makes me feel prematurely old.
When I image/dream myself performing, I am injured in my imagery/dream
I feel very isolated from my team-mates/ fellow athletes
I feel very isolated socially.

Appendix 3

Fit measures for two-factor models

Scale	χ^2	DF	P(χ^2)	RMSEA	NNFI	CFI	SRMR	GFI
Loss of Self-esteem with Confidence in the IBP	235.27	64	0.00	0.078	0.92	0.94	0.062	0.92
Loss of Self-esteem with Confidence at point or re-entry	145.17	53	0.00	0.064	0.96	0.96	0.055	0.95
Loss of Self-esteem with Confidence in own Body	245.64	64	0.00	0.087	0.94	0.95	0.069	0.91
Loss of Self-esteem with Confidence in Rehab Team	104.90	53	0.00	0.050	0.96	0.97	0.047	0.96
Fear of re-injury with Loss of Self-esteem	231.90	64	0.00	0.083	0.93	0.94	0.066	0.92
Fear of re-injury with Confidence in the IBP	59.31	19	0.00	0.073	0.96	0.97	0.044	0.96
Fear of re-injury with Confidence in Rehab Team	10.32	8	0.01	0.059	0.96	0.98	0.044	0.98
Fear of re-injury with Confidence in own Body	55.03	19	0.00	0.068	0.97	0.98	0.042	0.97
Fear of re-injury with Confidence at point of re-entry	63.00	13	0.00	0.093	0.94	0.96	0.043	0.96
Confidence at point of re-entry with Confidence in own body	43.53	13	0.00	0.078	0.96	0.98	0.045	0.97
Confidence at point of re-entry with Confidence in Rehab Team	13.77	8	0.08	0.041	0.98	0.99	0.026	0.99
Confidence at point of re-entry with Confidence in the IBP	93.86	13	0.00	0.12	0.88	0.93	0.064	0.94
Confidence in the IBP with Confidence in own Body	52.82	19	0.00	0.066	0.97	0.98	0.041	0.97
Confidence in the IBP with Confidence in Rehab Team	33.47	13	0.01	0.062	0.94	0.96	0.050	0.98
Confidence in Rehab Team with Confidence in own Body	24.02	13	0.034	0.045	0.98	0.99	0.032	0.98

Note. n = 402

APPENDIX 4

Summary of the rehabilitation protocol used in the UK after anterior cruciate ligament reconstruction using patella tendon graft procedures

Period	Rehabilitation aims and recommended exercises
Early rehabilitation	
Perioperative period (1-4 days after surgery)	Emphasis on dealing with pain, reducing swelling and increasing range of motion. Active and passive exercises to attain full knee extension and flexion. Patella mobilisations and prone hamstring exercises performed. Injured limb supported (straight leg raises avoided). Positive weight bearing with elbow crutches and cricket splint (if necessary).
Early postoperative period (5-10 days after surgery)	Increase weight bearing and gait re-education. One-legged cycling, patella mobilisations and maintenance of terminal extension encouraged. Bilateral heel raises, minisquats, low step-ups, hamstring exercises (with weights) and active quadriceps (90-45°)are employed.
Protected motion period (2-4 weeks after surgery)	Progression to full weight bearing. Emphasis on active range-of-motion and closed kinetic chain activities; cycling, step-ups (forward, sideways, backwards), ciniband work and rowing machine. Proprioception activities such as trampette, wobble board and 1-legged balance work (eyes open/closed) are emphasised. Swimming using flutter kick is encouraged.
Intermediate rehabilitation Phase (6-12 weeks)	Full range of movement should be achieved. Difficulty of all activities is increased (e.g. height of step, 1-legged dips introduced). Proprioception work is advanced (e.g. jogging and 1-legged balance on trampette). Side stepping, figure-of-eight and backwards walking is introduced. Isokinetic hamstring work is performed.
Preparation for activity phase (12-24 weeks after surgery)	Correction of any existing quadriceps deficits through isokinetic quadriceps work. Running activities are increased. Acceleration and speed are increased. Figure-of-eight circuit and sport-specific drills are used to introduce turning and deceleration components. Functional drills include: hopping, shuttle runs, back-pedalling, single-leg full squats and lunges. Possible return to solo (noncontact) sporting activities.
Return to activity (6-9 months)	Training for specific sports is commenced. Deceleration with pivoting and direction change is introduced. Earliest return to contact sport at 6 months after surgery.

Adapted from: Doyle, J., Gleeson, N.P., and Rees, D. : Sports Medicine, Volume 26(6). December 1998. 379-393

Appendix 5

Research into the Benefits of Rehabilitation following Anterior Cruciate (ACL) Reconstruction Surgery

Researchers: Professor Lew Hardy, Dr Nigel Gleeson, Anna Waters (University of Wales Bangor);
Mr Dai Rees, Mr Simon Roberts
(Orthopaedic Consultants R.J.A.H Orthopaedic Hospital, Gobowen)
Andrea Bailey and Jane Hughes (Senior I Sports Injury Physiotherapists, R.J.A.H Orthopaedic Hospital, Gobowen)

The Research Question:

We want to see how effective our rehabilitation is at improving the stability and protection of your knee joint and returning you to full fitness in your sport following surgery.

What are the benefits of this research?

We aim to find out how to make the rehabilitation following ACL reconstruction surgery most effective for all patients. We are hoping that findings from this research will benefit patients in the future. However, we cannot be sure if the rehabilitation can be improved until people like you are willing to help.

Will you consider helping us in this research?

We are asking people with an ACL injury who have chosen to undergo surgical treatment to help in this research.

What would I have to do?

Alongside the routine clinical assessments, you will be asked to undertake tests of stability and muscle performance in both knees before your operation, and then at 1.5, 3, 6, 9, 12 and 24 months following your operation.

When we assess your progress we will be monitoring:

(1) The strength of your leg muscles and your ability to repeat brief strength tasks accurately. This allows us to check how well the muscles can produce force to protect the joint efficiently.
(2) The strength of your ACL. This allows us to check how well the rehabilitation is strengthening the reconstructed ligament to protect the joint.
(3) Your psychological response to the rehabilitation, especially various aspects of your confidence.

The initial assessment should take approximately 1 ½ hours and the following sessions should take approximately an hour during each visit.

Other useful information

All your results will be confidential and will be seen only by you and the researchers mentioned at the beginning of this leaflet. There are not foreseeable risks or harm associated with taking part in the research.

Your own results will help your clinicians plan a safe progression for your rehabilitation. All assessments will be carried out within the hospital.

Who do I contact if I have any questions or problems?

Anna Waters, University of Wales Bangor, George Building, Bangor, Gwynedd, LL57 2PX. Phone: 01248 383495.

Do I have to take part?

No. You can refuse to take part in this research. You do not have to give a reason. You can also change your mind and withdraw from the research at any stage. Please tell us should you wish to do so. Once again, you do not have to say why you wish o withdraw from the research and your relationship with the physiotherapist, the consultant and the standard of treatment that you receive will not be affected in any way.

Summary of Research Program

Decision to have ACL surgery (Consultant Mr Rees/ Mr Roberts)

⇩

Have knee assessed before operation

⇩

Operation

⇩

Start physiotherapy program

⇩

1.5 months after operation: Assessment of leg muscles and knee joints

⇩

3 month after operation: Assessment of leg muscles and knee joints

⇩

6 months after operation: Assessment of leg muscles and knee joints

⇩

9 months after operation: Assessment of leg muscles and knee joints

Appendix 6

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

The researcher conducting this project subscribes to the ethics conduct of research and to the protection at all times of the interests, comfort, and safety of participants. This form and the information it contains are given to your for your own protection and full understanding of the procedures. Your signature on this form will signify that you have received information, which describes the procedures, possible risks, and benefits of this research project, that you have received an adequate opportunity to consider the information, and that you voluntarily agree to participate in the project.

Having been asked by Anna Waters of the School of Sport, Health and Exercise Sciences at the University of Wales Bangor to participate in a research project, I have received information regarding the procedure.

I understand the procedure to be used in this research and any possible risks to me in taking part.

I understand that I may withdraw my participation in this research at any time.

I also understand that I may register any complaint I might have about this experiment to Professor Roger Eston, Head of the School of Sport, Health and Exercise Sciences, and that I will be offered the opportunity of providing feedback on the experiment using standard report forms.

I may obtain copies of the results of this study, upon its completion, by contacting:
Anna Waters (PhD Student), School of Sport, Health and Exercise Sciences, University of Wales Bangor, George Building, Holyhead Road, Bangor, Gwynedd, LL57 2PX.

I confirm that I have been given adequate opportunity to ask any questions and that these have been answered to my satisfaction.

I have been informed that the research material will be held confidential by the researcher.

I agree to participate in the study.

NAME (Please print legibly)_____

ADDRESS: (Optional) _____

SIGNATURE: _____

DATE: _____

APPENDIX 7 - Self-Evaluation Questionnaire

Every athlete experiences rehabilitation in a different way. The questionnaire you are about to complete measures how you have been feeling over the past week. Please complete the questionnaire as honestly as you can. Sometimes athletes may not want to admit to finding the rehabilitation period difficult and emotionally traumatic, as they believe this is undesirable. However, these feelings are common, and in order for us to understand them fully, we would like you to share your feelings with us truthfully. If you are finding the rehabilitation period difficult, please indicate these feelings accurately on the questionnaire. Equally, if you feel you are progressing well and coping with everything with ease, please indicate these feelings as accurately as you can. Your answers will be treated with confidentiality. We will only be examining group responses.

Name: _____ Date: _____

Sex: Male/ Female

Age: _____

Date of Injury: _____

Type of Injury: _____

How serious was the injury? _____

Anticipated length of time out of sport participation: _____

Level of sport participation: _____

Main Sport: _____

Please read each of the statements below and then circle the appropriate number to the right of the statement to indicate how much you personally agree with the statement. There are no right or wrong answers. Please answer the questions reflecting how you have felt *over the past week.*

	Strongly Disagree		Disagree	Neutral	Agree		Strongly Agree
1. My injured body part now feels 100% normal.	1	2	3	4	5	6	7
2. I feel that I am never going to be the same person that I was prior to my injury.	1	2	3	4	5	6	7
3. I push myself to use my injured body part.	1	2	3	4	5	6	7
4. I cannot trust my body any more.	1	2	3	4	5	6	7
5. I have confidence in the professional ability of my physiotherapist	1	2	3	4	5	6	7
6. The one thing in my life that I am really good at is my sport.	1	2	3	4	5	6	7
7. I have found things in my sport that I can work on whilst I am injured.	1	2	3	4	5	6	7
8. I worry that my injured body part will not hold up in a competition.	1	2	3	4	5	6	7
9. Right now, I feel apprehensive about my ability to perform in competition.	1	2	3	4	5	6	7
10. Since my injury, I have felt less confident in all areas of my life.	1	2	3	4	5	6	7
11. I try to protect my injured body part.	1	2	3	4	5	6	7
12. I do not give myself the option of not completing my rehabilitation exercises.	1	2	3	4	5	6	7
13. I feel that my body has let me down.	1	2	3	4	5	6	7
14. My physiotherapist has given me clear and specific expectations for my rehabilitation program.	1	2	3	4	5	6	7

	Strongly Disagree		Disagree		Neutral		Agree	Strongly Agree
15. When things in my life are tough, I really miss having my sport to escape to, to make me feel better.	1	2	3	4	5	6	7
16. I work on my mental rehearsal whilst I am injured.	1	2	3	4	5	6	7
17. I feel confident that I can put 100% effort into my performance without re-injuring myself.	1	2	3	4	5	6	7
18. Actually competing again feels like a big obstacle in front of me.	1	2	3	4	5	6	7
19. My life has felt empty since my injury.	1	2	3	4	5	6	7
20. I worry that my injured body part will break down again.	1	2	3	4	5	6	7
21. I work as hard as I can at my rehabilitation exercises so that I can return to my previous level of sport participation as quickly as possible.	1	2	3	4	5	6	7
22. I am confident that my body will not let me down.	1	2	3	4	5	6	7
23. Seeing other people doing well in the things I would like to be doing, reduces my confidence.	1	2	3	4	5	6	7
24. I feel confident that the medical team have rehabilitated people with my injury before.	1	2	3	4	5	6	7
25. Rather than do nothing, I work on those areas of my body not affected by my injury.	1	2	3	4	5	6	7
26. I constantly worry about the possibility of re-injury.	1	2	3	4	5	6	7
27. I feel confident that I am ready to compete again.	1	2	3	4	5	6	7
28. My confidence does not feel very stable at the moment.	1	2	3	4	5	6	7
29. I worry that my injured body part will never be as strong as it was.	1	2	3	4	5	6	7
30. I know the optimal work rate for my injured body part and am able to stick to that during my rehabilitation exercises.	1	2	3	4	5	6	7

	Strongly Disagree		Disagree		Neutral		Agree	Strongly Agree
31. I feel very vulnerable physically.	1	2	3	4	5	6	7
32. When I image/dream myself performing, I am injured in my imagery/dream.	1	2	3	4	5	6	7
33. Whenever I am in a situation like the one in which the injury occurred, I protect my injured body part.	1	2	3	4	5	6	7
34. I feel very isolated from my team-mates/ fellow athletes.	1	2	3	4	5	6	7
35. I am determined to stick to my rehabilitation program.	1	2	3	4	5	6	7
36. I am aware of my injured body part almost all the time.	1	2	3	4	5	6	7
37. I am able to communicate easily with my rehabilitation team.	1	2	3	4	5	6	7
38. Psychologically, I am ready to perform in competition again.	1	2	3	4	5	6	7
39. Since my injury, I have changed the way I approach my sport.	1	2	3	4	5	6	7
40. I feel confident about being able to use my injured body part.	1	2	3	4	5	6	7
41. The rehabilitation team gives me sufficient information about my rehabilitation programme.	1	2	3	4	5	6	7
42. Since my injury, I have continued to work towards my goals in sport.	1	2	3	4	5	6	7
43. I feel nervous when I think about competing again.	1	2	3	4	5	6	7
44. Since my injury, I have changed the emphasis I place on sport.	1	2	3	4	5	6	7
45. I trust the rehabilitation team to be able to help me to fully recover my previous level of performance.	1	2	3	4	5	6	7
46. Since my injury, I have continued to work on those aspects of my sport that I can.	1	2	3	4	5	6	7
47. I am physically ready to perform in competition again.	1	2	3	4	5	6	7

	Strongly Disagree		Disagree	Neutral	Agree		Strongly Agree
48. Rather than focusing solely on sport, I have begun to think about developing skills for use outside of sport.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
49. I have accepted that I may never regain my previous level of performance in sport as a result of my injury.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
50. Simply being able to get back into sport will be great even if I cannot perform at the levels I used to perform at.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

APPENDIX 8– Summary Non-Significant Regression Analyses Results for Chapter 4

Summary of non-significant Regression Analysis of Self-evaluation Inventory Subscales on EMD 6 Months Post-operation, Controlling for individual differences and laxity effects

Predictor	R^2 Totals all worse than	R^2 Change all worse than	F change all worse than	Significant F change all worse than	β all worse than	Overall F all worse than
Confidence in Rehabilitation Team	.631	.028	1.98	.171	-.210	14.85

Summary of Non-significant Regression Analysis of Self-evaluation Inventory Subscales on RFD 6 Months Post-operation, Controlling for individual differences and laxity effects

Predictor	R^2 Totals all worse than	R^2 Change all worse than	F change all worse than	Significant F change all worse than	β all worse than	Overall F all worse than
Confidence in Rehabilitation Team	.529	.048	2.68	.113	.329	10.14

Summary Table of Regression Analysis of Self-evaluation Inventory Subscales on Hamstring and Quadriceps Strength 6 Months Post-operation, Controlling for individual differences

Predictor	R^2 Totals all worse than	R^2 Change all worse than	F change all worse than	Significant F change all worse than	β all worse than	Overall F all worse than
Quadratic Loss of Self-Esteem	.718	.039	1.25	.311	-.124	11.46
Quadratic Confidence in the IBP	.735	.074	2.70	.095	.324	13.72
Quadratic Confidence in Own Body	.732	.066	3.07	.064	.264	17.08
Quadratic Fear of Re-injury at Point of Re-entry into Sport	.687	.021	.824	.450	-.0098	13.71
Quadratic Confidence in Ability to Perform at Re-entry into Sport	.714	.048	2.08	.146	.214	15.60
Linear Confidence in Rehabilitation Team	.140	.055	1.72	.201	.318	2.20

Summary Table of Non-significant Regression Analysis of Self-evaluation Inventory Subscales on Laxity 6 Months Post-operation, Controlling for individual differences

Predictor	R^2 Totals all worse than	R^2 Change all worse than	F change all worse than	Significant F change all worse than	β all worse than	Overall F all worse than
Quadratic Loss of Self-Esteem	.350	.008	.335	.568	-.197	4.6
Quadratic Confidence in the IBP	.401	.059	2.57	.121	.556	5.80
Quadratic Confidence in Own Body	.427	.085	1.85	.178	.001	4.65
Quadratic Fear of Re-injury at Point of Re-entry into Sport	.461	.119	2.77	.082	-.351	5.35
Quadratic Confidence in Ability to Perform at Re-entry into Sport	.342	.000	.012	.913	-.0043	4.51
Linear Confidence in Rehabilitation Team	.425	.083	3.76	.064	-.689	6.40

APPENDIX 9
VISUAL AND KINAESTHETIC IMAGERY ABILITY QUESTIONNAIRE

Name:

Date:

The first part of this questionnaire assesses your visual imagery ability. Visual imagery refers to the ability to visualise, that is, the ability to form mental pictures, or to "see in the mind's eye". People all have different levels of imagery ability.

The aim of the first part of the questionnaire is to determine the vividness of your visual imagery. The items on the questionnaire will possibly bring certain images to your mind. You are asked to rate the vividness of each image by reference to the 5-point scale given below. For example, if your image is "vague and dim" then give it a rating of 4. After each item write the appropriate number in the box provided. Before you begin the questionnaire familiarise yourself with the rating scale below. Throughout the test, refer to the rating scale when judging the vividness of each image.

The second part of the questionnaire assesses your movement and kinaesthetic imagery ability. Movement imagery refers to your ability to imagine a movement. Kinaesthetic imagery refers to your ability to feel what performing a movement is like without actually doing the movement. You are asked to rate both the vividness of each movement image and the kinaesthetic sensation of each image by reference to the 5-point scale given below. For example, if your image is "Moderately clear and vivid" visually and the feeling of the movement is "reasonably vivid" then give it a visual rating of 3 and a kinaesthetic rating of 2.

There are no right or wrong answers or some ratings that are better than others.

Visual Rating Scale		Kinaesthetic Rating Scale	
Perfectly clear and vivid as normal vision	.....Rating 1	Perfectly accurate feeling as when actually performing task	……Rating 1
Clear and reasonable vivid	.....Rating 2	Reasonably vivid feeling	……Rating 2
Moderately clear and vivid	.....Rating 3	Moderately vivid feeling	……Rating 3
Vague and dim	.....Rating 4	Vague feeling	……Rating 4
No image at all but you "know" that you are thinking of the skill	.....Rating 5	No feeling at all but you "know" that you are thinking of the skill	……Rating 5

VIVIDNESS OF VISUAL IMAGERY QUESTIONNAIRE

In answering items 1 to 4 think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your minds eye.

Item	Rating
1. The exact contour of face, head shoulders and body	
2. Characteristic poses of head, attitudes of body etc	
3. The precise carriage, length of step, etc. in walking	
4. The different colours worn in some familiar clothes	

Visualise a rising sun. Consider carefully the picture that comes before your mind's eye.

Item	Rating
5. The sun is rising above the horizon into a hazy sky	
6. The sky clears and surrounds the sun with blueness	
7. Clouds. A storm brews up, with flashes of lightening	
8. A rainbow appears	

Rating Scale

The image aroused by an item might be:

Perfectly clear and as vivid as normal vision .....Rating 1

Clear and reasonably vivid .....Rating 2

Moderately clear and vivid .....Rating 3

Vague and dim .....Rating 4

No image at all you only "know" that you are thinking of the object .....Rating 5

Think of the front of a shop, which you often go to. Consider the picture that comes before you mind's eye.

Item	Rating
9. The overall appearance of the shop from the opposite side of the road.	
10. A window display including colours, shapes and details of individual items for sale.	
11. You are near the entrance. The colour, shape and details of the door.	
12. You enter the shop and go to the counter. The counter assistant serves you. Money changes hands.	

Rating Scale

The image aroused by an item might be:

Perfectly clear and as vivid as normal vision .....Rating 1

Clear and reasonably vivid .....Rating 2

Moderately clear and vivid .....Rating 3

Vague and dim .....Rating 4

No image at all you only "know" that you are thinking of the object .....Rating 5

VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE (MODIFIED)

Think of each of the following acts, and classify the images according to the degree of clearness, vividness and kinaesthetic sensation as shown on the rating scale.

Item

1. Standing
2. Walking
3. Running

Visual Rating	Kinaesthetic Rating

Item

4. Reaching for something on tiptoe
5. Drawing a circle on paper
6. Bending to pick up a coin

Visual Rating	Kinaesthetic Rating

Item

7. Walking upstairs
8. Catching a ball with two hands
9. Throwing a stone into water
10. Riding a bike

Visual Rating	Kinaesthetic Rating

Visual Rating Scale		Kinaesthetic Rating Scale	
Perfectly clear and vivid as normal vision	.....Rating 1	Perfectly accurate feeling as when actually performing task	.....Rating 1
Clear and reasonable vivid	.....Rating 2	Reasonably vivid feeling	.....Rating 2
Moderately clear and vivid	.....Rating 3	Moderately vivid feeling	.....Rating 3
Vague and dim	.....Rating 4	Vague feeling	.....Rating 4
No image at all but you "know" that you are thinking of the skill	.....Rating 5	No feeling at all but you "know" that you are thinking of the skill	.....Rating 5

APPENDIX 10
Questions on Imagery Use

Please rate the frequency of your imagery usage.

1. How often do you use visual imagery?

Never			Sometimes			Often
1	2	3	4	5	6	7

2. How often do you use kinaesthetic imagery?

Never			Sometimes			Often
1	2	3	4	5	6	7

3. How often do you use healing imagery?

Never			Sometimes			Often
1	2	3	4	5	6	7

4. How often do you image yourself using you (new) hip or knee?

Never			Sometimes			Often
1	2	3	4	5	6	7

5. How often do you image yourself completing your rehabilitation exercises?

Never			Sometimes			Often
1	2	3	4	5	6	7

6. How often do you image yourself as physically ready to engage in your normal physical activities?

Never			Sometimes			Often
1	2	3	4	5	6	7

7. How often do you image yourself engaging in your normal physical activities?

Never			Sometimes			Often
1	2	3	4	5	6	7

APPENDIX 11

Post Study Questionnaire

1. How often did you manage to practice the imagery in general?
   a. Never Sometimes Often
   b. 1 2 3 4 5 6 7 8 9

2. How often do you use healing imagery?
   a. Never Sometimes Often
   b. 1 2 3 4 5 6 7 8 9

3. How often do you image yourself using you (new) hip or knee?
   a. Never Sometimes Often
   b. 1 2 3 4 5 6 7 8 9

4. How often do you image yourself completing your rehabilitation exercises?
   a. Never Sometimes Often
   b. 1 2 3 4 5 6 7 8 9

5. How often do you image yourself as physically ready to engage in your
   a. normal physical activities?
   b. Never Sometimes Often
   c. 1 2 3 4 5 6 7 8 9

6. How often do you image yourself engaging in your normal physical activities?
   a. Never Sometimes Often
   b. 1 2 3 4 5 6 7 8 9

7. How easy was it to fit into your daily schedule?
   a. Not at all Somewhat easy Easy
   b. 1 2 3 4 5 6 7 8 9

8. To what extent did you manage to develop a routine of using imagery?
   a. No routine Some routine A routine
   b. 1 2 3 4 5 6 7 8 9

9. With regard to your rehabilitation, to what extent did the imagery affect you confidence?
   a. Not at all Somewhat A great deal
   b. 1 2 3 4 5 6 7 8 9

10. To what extent, if any did the imagery motivate you towards engaging in your normal physical activities again?
    a. Not at all Somewhat A great deal
    b. 1 2 3 4 5 6 7 8 9

11. To what extent if any did the imagery help you to overcome any difficulties that came up during your rehabilitation?
    a. Not at all Somewhat A great deal
    b. 1 2 3 4 5 6 7 8 9

12. How useful did you find the imagery during your rehabilitation?

a.	Not at all				Somewhat				A great deal
b.	1	2	3	4	5	6	7	8	9

13. How easy did you find completing the questionnaires?

a.	Not at all				Somewhat easy				Easy
b.	1	2	3	4	5	6	7	8	9

What was the most important thing you got out of participating in this study?

Based on your experience, what would you say are the strengths of this research?

What about weaknesses?

Is there anything else you would like to discuss or comment on?

APPENDIX 12
Patient Information Sheet for All Participants

Researchers: Anna Waters, Professor Lew Hardy,
(University of Wales Bangor);
Dr Jeremy Jones,
(Department of Rheumatology, Ysbyty Gwynedd, Bangor)

Study Title
An examination of two different methods of support with patients recovering from hip or knee replacement surgery.

You are invited to take part in a research study. The names of all patients on waiting lists for hip and knee replacement surgery are being given to Anna Waters, the researchers mentioned at the top of this page, who is a member of staff at Ysbyty Gwynedd. Anna is contacting all patients to give them the opportunity of taking part in the research. It is important for you to understand what the research is about and what it will involve before you decide whether or not to take part. Please take the time to read the following information and discuss it with your friends, relatives and GP if you wish. If you have any questions or anything does not seem clear please do ask. Please take your time to decide whether or not you wish to take part.

Consumers for Ethics in Research (CERES) publish a leaflet entitled 'Medical Research and You'. This leaflet provides more information about medical research and looks at some of the questions you may want to ask. A copy can be obtained from CERES, PO Box 1365, London N16 0BW.

Thank you for taking the time to read this.

What is the purpose of this study?

The purpose of this study is to examine two different methods of providing support to patients following hip and knee replacement surgery. At the moment we do not know which is the better method and this study will help us to find this out. Your involvement in the study would begin prior to your surgery and finish six months post surgery.

Why have I been chosen?

All patients waiting for operations for hip or knee replacement are being asked if they would like to take part in this research.

Do I have to take part?

You do not have to take part, it is up to you to decide whether or not you choose to do so. If you do decide to take part you will be given this information sheet to keep and be asked to sign an informed consent form. If you do decide to take part you are still free to withdraw at any time and without giving a reason. This will in no way affect the standard of care you receive.

What will happen to me if I take part?

Once you have had a chance to read this leaflet and ask any questions about the research, you will be asked if you would like to take part. If you decide to take part then you will be randomly assigned to one of the two methods of support. As we do not know yet which is the best method of support, there are no advantages or disadvantages to being in either group. Neither you nor the researchers have any control over which group you are put into, this is done by a computer, which randomly selects the group that each patient is put into.

One of the researchers Anna Waters, will visit you in your home about two weeks before to your operation and you will be asked to complete three questionnaires. These questionnaires will each take about ten minutes to fill out and the questions will cover how you are getting on, how confident you are feeling and how you feel about your hip or knee. These same questionnaires will be used again following your surgery so that we can see how you think your recovery is progressing.

Following your operation, Anna will visit you fortnightly for three months. These sessions will last approximately an hour and a half and you will be taught a relaxation technique. The technique you are taught will depend on the group that you are in. You will also be asked to fill in the same three questionnaires that you filled out before your operation, to see how your recovery is progressing.

In between these sessions you will be asked to practice the relaxation training. You will also be asked to maintain a rehabilitation diary.

Following the first three months after your operation, Anna will visit you once a month for a further three months. During these sessions you will simply be asked to complete the three questionnaires again.

What are the possible disadvantages and risks of taking part?

There are no foreseeable risks or harm associated with taking part in the research.

What are the possible benefits of taking part?

We hope that the method of support will help you. However, this cannot be guaranteed. The information we get from this study may help us in our rehabilitation of future patients following hip and knee replacements.

What if something goes wrong?

In the extremely unlikely event that you are harmed taking part in this research project, there are no special compensation arrangements. If you are harmed due to somebody's negligence, then you may have grounds for legal action but you may have to pay for it. Regardless of this, if you wish to complain about any aspect of the way you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms may be available to you.

Will my taking part in this study be confidential?

Any information collected about you during the course of the research will be kept confidential and will only be seen by the researchers mentioned at the beginning of this leaflet, Anna Waters, Professor Lew Hardy, and Dr Jeremy Jones.

Any information about you, which leaves the hospital or your home where the questionnaires will be completed, will have your name and address removed so that you cannot be recognised from it. Upon agreement to participate in this research your GP will be notified of your participation in this study.

What will happen to the results of the research study?
It is intended that the results of this study will be published in a scientific journal. Participants will be informed when this happens and advised where they can obtain a copy of the published results. Your results will be treated with confidentiality. We are only interested in group responses.

Who is organising and funding the research?
This research is being conducted as part of Anna Water's PhD at the University of Wales, Bangor under the supervision of Professor Lew Hardy. Anna's PhD is funded by the Economic and Social Research Council (ESRC).

Contact for Further Information
Please feel free to contact Anna Waters if you require any further information or have any questions. School of Sport, Health and Exercise Science, University of Wales, Bangor, George Building, Bangor Gwynedd, LL57 2PX. Phone: 01248 383495

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APPENDIX 13
Healing Imagery Script Focusing on Bone Healing

Allow the relaxation to grow and spread as you focus your attention on your hip/knee ...take an internal view ... become aware of how the inside of your hip looks ... become aware of the muscles ... become aware of how your hip/knee looks ... let yourself see and feel the area... allow yourself to move around and see the structures from different angles...

Imagine the new hip/knee/prosthesis being accepted by your body and becoming one with the surrounding bone ... imagine the blood flowing through your arteries bring nutrients and oxygen to the bones and areas surrounding your hip/knee ... notice the veins taking away any injured cells and new healthy cells taking their place ... imagine the blood revitalising the bone, bringing nutrients and energy to heal the bone ... sense your body healing the area ... knowing where to work effectively and efficiently. Imagine the bone growing and binding strongly to the new joint so it becomes a healthy, strong joint ... imagine your joint smooth, strong and flexible ...

Imagine your joint completely healed ... see and feel the joint smooth, strong and supple ... notice the bone smooth and healthy ...see the colour, texture and shape of the healthy muscles and surrounding tissues. See your joint and the surrounding area strong, healthy and supple. Feel yourself walking and be aware of how strong and comfortable your hip/knee feels as you walk around. Feel the joint and the muscles in your leg strong and smooth as you move around.

Now slowly begin to come back to the present environment...notice any sounds in the room or outside...notice any smells. Notice how comfortable you feel sitting there. When you wish to come back to the here and now, count upwards from one to seven counting on each inhalation, gradually experiencing greater alertness and awareness of the external environment. When you reach seven you should feel fully awake, relaxed and refreshed.

Healing Imagery Script Focusing on Ligaments Healing

Allow the relaxation to grow and spread as you focus your attention on your hip/knee ...take an internal view ... become aware of how the inside of your hip looks ... become aware of the muscles ... become aware of how your hip/knee looks ... let yourself see and feel the area... allow yourself to move around and see the structures from different angles...

Focus on the muscles surrounding your hip/knee ... notice the ligaments and tendons around your hip/knee ...imagine the blood flowing through your arteries bringing nutrients, oxygen and healing energy to the ligaments, tendons, tissues and muscles around your joint ... you can image the ligaments, tendons in general or you may want to focus on specific areas, it doesn't matter, you choose ...see and feel the blood flowing round the ligaments repairing any areas in need of repair ... see the ligaments binding round your joint making it strong and healthy ... notice the ligaments healing and repairing ... sense your body healing the area ... knowing where to work effectively and efficiently ... feel the blood cells repairing any damaged areas cleaning up the ligaments and leaving them looking and feeling strong and healthy ...

Image the ligaments binding around the joint reinforcing it ... making the joint strong and stable ... notice the muscle tendons that cross the joint strong and healthy contributing to the strength and stability of the joint ... Imagine your joint completely healed ...notice the bone smooth and healthy ... the muscles and tissue strong and supple ... the ligaments and tendons around the joint healthy, providing support, strength and stability to the joint.

Feel yourself walking and be aware of how strong and comfortable your hip/knee feels as you walk around. Focus on the strength and stability of the muscles in your leg as you move around. Feel the energy and strength in the muscles in your leg with each step you take.

Now slowly begin to come back to the present environment...notice any sounds in the room or outside...notice any smells. Notice how comfortable you feel sitting there. When you wish to come back to the here and now, count upwards from one to seven counting on each inhalation, gradually experiencing greater alertness and awareness of the external environment. When you reach seven you should feel fully awake, relaxed and refreshed.

Healing Imagery Script Focusing on Muscle Healing

Allow the relaxation to grow and spread as you focus your attention on your hip/knee ...take an internal view ... become aware of how the inside of your hip looks ... become aware of the muscles ... become aware of how your hip/knee looks ... let yourself see and feel the area... allow yourself to move around and see the structures from different angles...

Focus on the muscles surrounding your hip/knee ... become aware of how they look, the colours, texture and shape of the surrounding muscles and tissues ... you can image the muscles in general, or specific muscles around your joint, which ever you prefer ... imagine the blood flowing through your arteries bringing nutrients and oxygen to the area ... imagine the veins taking away any damaged cells and new healthy cells taking their place ... feel the blood flowing to the muscles bringing nutrients and energy to repair the muscles fibres ... making the muscle fibres strong and healthy

See and feel the blood circulating through the muscles and the blood cells repairing the muscle fibres and taking away any damaged cells so the area looks strong and healthy ... sense your body healing the area ... knowing where to work effectively and efficiently ... image the muscles healthy, strong and flexible ... see the surface of the muscles smooth, strong and supple ... imagine your joint completely healed ... see the joint ... notice the bone smooth and healthy and the muscles surrounding it strong, healthy and supple ... Feel yourself walking and be aware of how strong and comfortable your hip/knee feels as you walk around. Focus on the strength and flexibility of the muscles in your leg as you move around. Feel the energy and strength in the muscles in your leg with each step you take.

Now slowly begin to come back to the present environment...notice any sounds in the room or outside...notice any smells. Notice how comfortable you feel sitting there. When you wish to come back to the here and now, count upwards from one to seven counting on each inhalation, gradually experiencing greater alertness and awareness of the external environment. When you research seven you should feel fully awake, relaxed and refreshed.