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A COMPUTERISED PROGRAMME FOR MONITORING ATHLETES' EMOTIONAL STRESS AND PAIN PERCEPTION

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ABSTRACT

Until the 1990s, rehabilitation interventions primarily addressed the physiological dimensions of sports injury. Although some athletes adapt psychologically to injury quite effectively, there appear to be many individuals who experience negative emotional responses after sustaining a sport-related injury. In the past, physiotherapy management focused on helping rehabilitating athletes' return to their prior level of functioning by treating their overt physical problems. Recently, however, the sports medicine community has come to realise the integral role that psychosocial factors play in injury occurrence and the recovery processes. Because of their close involvement with injured athletes during rehabilitation, physiotherapists might be best suited to provide some form of psychological assistance to rehabilitating athletes. The objective of this study was to provide physiotherapists with a practical psychological instrument for the treatment of injured athletes. A computer programme to assist physiotherapists in identifying, referring or treating athletes who experience negative emotional responses was developed and evaluated.

Key words: Psychological assistance; Injured athletes; Rehabilitation; Physiotherapists; Treatment.

OVERVIEW OF CURRENT RESEARCH

Injury is, without a doubt, one of the most significant obstacles to successful sports performance (Heil, 1993). No athlete, regardless of experience and ability, is immune to injury and most physically active individuals find it difficult to avoid injury (Durso-Cupal, 1998). Sports injury is a serious and expensive health problem that has not abated, in spite of improvements in equipment and physical conditioning techniques (Bergandi, 1985). The elite athlete invests a great deal of time and energy to attain optimal performance in sport, hence any significant injury is likely to be perceived as a traumatic life event with physical and psychological ramifications. For some athletes a promising career may even be prematurely terminated because of serious injury (Quinn & Fallon, 1999). The ability to resist injury and to rehabilitate well when injury does occur is fundamental to longevity in sport and to the full realisation of sports potential.

Athletes react differently to injury, both physically and psychologically. Some seem to recover from injury quite easily, while others may experience negative emotions such as

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frustration, depression, anger, irritability and tension after sustaining a sports-related injury (Pearson & Jones, 1992). These responses can also be affected by the severity of the injury, with those athletes suffering from more serious injuries displaying significantly greater levels of frustration, depression and anger than athletes with less severe injuries (Smith *et al*., 1990b). The emotional responses experienced by injured athletes can also impact on the rehabilitation process itself. According to Smith *et al*. (1990a) and Fisher (1990), athletes who experience negative emotional responses to injury, often suffer prolonged or problematic rehabilitation.

Until the 1990s, rehabilitation interventions primarily addressed the physiological dimensions of sports injury with the exclusion of the psychological dimensions (Petitpas & Danish, 1995). Injuries were mostly viewed from a structural, anatomical, or physical environmental point of view with little regard for affective, perceptual/cognitive and personological factors (Pargman, 1993). Interventions that facilitate injury prevention or coping with the threat to self-concept, beliefs, commitments and values were omitted in treatment (Danish, 1986; Steadman, 1993).

Scrutiny of the sports psychology literature reveals that much of the early research in the domain of injury rehabilitation, focused on the prediction and prevention of sports injury. Considerably less attention was given to rehabilitative considerations. Andersen and Williams (1988) were of the first researchers to address this issue. They developed a multi-component theoretical model of stress and injury. This model proposes that athletes with a history of many stressors, personality characteristics that exacerbate the stress response and few coping resources will, when placed in a stressful situation, be more likely to appraise the situation as stressful and will exhibit greater psychological activation and attentional disruptions. The severity of the resulting stress response is instrumental in determining the risk of injury. The model also proposes certain interventions for reducing the risk of injury (Williams & Andersen, 1998).

Some authors (Rotella, 1985; Gordon, 1986; Gieck, 1990; Silva & Hardy, 1991) suggest that injured athletes progress through a grief cycle similar to that experienced by the terminally ill. In the treatment of injured athletes, they have therefore advocated the use of a stage model such as the one originally proposed by Kübler-Ross (1969). This approach does not, however, account for individual differences. Research to date has also not supported the major claims of stage models, and the notion of a stereotypical pattern of distinct emotional responses to loss has not stood up to empirical scrutiny (Brewer, 1994).

Cognitive appraisal models, in contrast to stage models, have been developed to account for individual differences in responses to sports injuries (Brewer, 1994). Some examples of cognitive appraisal models, which have relevance to psychological responses to injury, include: the transactional model of stress (Lazarus & Folkman, 1984); the psycho-physiological stress model (Weiss & Troxel, 1986) and the cognitive-emotional-behavioural model (Wiese-Bjornstal & Smith, 1993). In each of these models responses to injury are analysed in the context of the stress process. It is proposed that the way the athlete appraises his/her injury determines the emotional response which, in turn, is thought to affect the behavioural outcome. There are, however, little or no experimental or empirical data available to support the applicability of these models to the recovery process (Quinn & Fallon, 1999).
Until recently, only four empirical psychological prevention and thirteen empirical psychological rehabilitation intervention studies have been conducted (Durso-Cupal, 1998).

Consequently there is only a preliminary understanding of the complex interplay of psychological and physiological variables that contribute to prevention and rehabilitation of sports injuries. Current sports injury interventions, according to Durso-Cupal (1998), appear to be conceptually and theoretically primarily based on an amalgam of models advanced by Moos and Tsu (1977), Lazarus and Folkman (1984), Cohen and Wills (1985), Weiss and Troxel (1986) as well as Andersen and Williams (1988). Wiese-Bjornstal and Smith (1993) have probably made the most significant contribution to the theoretical foundation for psychological interventions with their integration of the Andersen and Williams (1988) pre-injury psychosocial model with the Wiese and Weiss (1987) stress model of injury.

According to Heil (1999), most of these theoretical models remain just that - theoretical. There are very few, if any, that provide a practical instrument for therapeutic use. Heil (1993) contends that medical treatment and rehabilitation interventions have a very important psychological impact on the athlete. Physicians and sports medicine specialists as such have unique roles to play in the rehabilitation process that incorporates psychological principles. Kolt (2000) shares this view. Most theoretical psychological rehabilitation intervention models, however, disregard the importance of physicians and sports medicine specialists. Heil (1993) suggests that injury is most effectively managed within a team approach, consisting of physicians, sports medicine specialists and psychologists, and which provide better continuity of care as well as better quality of care.

By nature of their training sport psychologists are probably the best suited members of the sports medicine team to address an athlete's post-injury emotional responses (Pearson & Jones, 1992; Brewer, *et al.*, 1994; Crossman, 1997). However, access to sport psychologists is often limited or unavailable, and many athletes may be reluctant to accept formal psychological assistance. On the other hand, through their close involvement with injured athletes, physiotherapists might be very well suited to provide some form of psychological assistance (Gordon *et al*., 1991; Pearson & Jones, 1992; Kolt, 2000). In the past, the principal focus of physiotherapy management has been to help rehabilitating athletes return to their prior level of functioning by treating their overt physical problems. Recently, however, the sports medicine community in general has come to realise the integral role that psychosocial factors play in injury occurrence and the recovery processes (Brewer *et al.*, 1994). Some researchers (Pearson & Jones, 1992; Ninedek & Kolt, 2000) have realised the importance of preparing physiotherapists to deal with athletes experiencing psychological problems during treatment. A large paradigm shift to this way of thinking still has to be made.

FOCUS OF THIS STUDY

The objective of this paper is to contribute to the shifting of this paradigm by informing physiotherapists (in particular sport physiotherapists), of a practical psychological instrument that could be used in the treatment of injured athletes. This study focused on developing such an instrument that could assist physiotherapists in the identification, referral or treatment of injured athletes experiencing psychological problems. Certain criteria and the following aims were set. Firstly, the instrument had to be easy for physiotherapists to use without receiving any formal training. Secondly, the face value of the instrument had to be accepted by the individuals using it. Thirdly, it had to involve a minimum of additional work, above and beyond the normal tasks involved in treating patients. Lastly, it had to be effective in assisting athletes' rehabilitation from their injuries.

SELECTED ASSESSMENT INSTRUMENTS

According to Heil (1999), the level of emotional distress and the experience of pain are good indicators of how well rehabilitation is progressing. Therefore, in the development of an instrument, special attention needed to be paid to these two factors. For instance, the more extreme the emotional response relative to the injury and the more limited the athlete's coping resources, the greater the likelihood of treatment complications. Alternatively, pain as an immediate response to injury, reflects not only the severity of tissue damage, but also anxiety and expectations regarding the impact of injury on performance. Pain that appears to be out of proportion to the magnitude of the injury may signify a breakdown of coping mechanisms (Heil, 1993). Existing instruments were used such as the *Incredibly Short POMS*, (Dean *et al*., 1990) the Affective subscale of the *McGill Pain Questionnaire* (MPQ), (Melzack, 1975) the *Emotional Responses of Athletes to Injury Questionnaire* (ERAIQ) (Smith *et al*., 1990a) and others for assessing emotional distress as well as the experience of pain. Rather than use pen-and-paper response methods, current computer technology was employed.

Assessing emotional distress

One of the best ways to assess emotional distress is through the use of psychological tests. The purpose of psychological testing in injury is to help gather information about the athlete's personality style and coping skills. It also helps to determine how injury or other circumstances have affected these personality styles and skills. Psychological testing provides a relatively concise, time efficient and objective measure of an athlete's functioning (Heil, 1993).

For the purpose of this study, the *Incredibly Short POMS* (ISP) (Dean *et al*., 1990) was used. The ISP was derived from the *Profile of Mood States* (POMS), originally developed by McNair *et al*. (1971). The POMS is an effective measure of mood states in athletes. Since Morgan (1980) popularised the use of the POMS in sports research, studies using the POMS have ranged from those done with individuals involved with fitness activity such as aerobics to Olympic athletes. A brief alternative to the POMS (that could be administered in less than 1 minute) was devised and is called the *Incredibly Short POMS* (ISP) (Dean *et al*., 1990). The ISP accurately gauges anxiety, depression, confusion, anger, energy levels and the validity does not differ much from that of the full version of the POMS (Meyers, 1999). Further research is being done on this instrument and it is now called the *Brief Assessment of Mood* (BAM), but nothing in this regard has yet been published.

Assessing the experience of pain

The tolerance of pain, in one form or another, is a routine aspect of sport performance for most athletes. However, even for athletes who show a remarkably good tolerance for performance pain, the pain of injury can be quite distressing (Heil, 1993). Pain and suffering, according to Jensen and Karoly (1992), are private, internal events that cannot be directly observed by clinicians or assessed via bioassays. Assessment of the pain experience is, therefore, frequently built upon the use of patient-selfreport. For the purpose of assessing pain, researchers have been forced to decontextualise the pain experience by separately addressing an individual's awareness of pain ("my arm hurts"), emotional reactivity ("the pain in my arm is killing me") and behavioural responses (the tendency to use the left arm when the right one hurts). Most researchers agree that at least three distinct dimensions of the pain

experience can be assessed in nearly all pain patient populations, namely, pain location, pain intensity and pain affect (Jensen & Karoly, 1992).

The instrument most frequently used to **assess pain location** is that of pain drawing. Pain drawing is a relatively simple diagnostic tool that allows pain sufferers to give a graphic representation of their pain. It provides information not readily evident in other forms of self-report and is especially useful for its clear portrayal of pain distribution through the body (Heil, 1993).

One of the most commonly used methods to **assess pain intensity** is a *Visual Analogue Scale (VAS)*. This scale consists of a line, usually 10 cm long, whose ends are labelled as the extremes of pain (*no pain* to *pain as bad as it could be*). Patients are asked to indicate which point along the line best represents their pain intensity. The measured distance from the *no pain* end to the mark made by the patient, is that patient's pain intensity score (Jensen & Karoly, 1992).

Assessing pain affect appears to be more complex than both pain location and pain intensity. Pain affect can be defined as the degree of activation, or changes in action readiness, caused by the sensory experience of pain (Jensen & Karoly, 1992). This arousal is often felt as distressing or frightening and can lead to interference in daily activities and habitual modes of response. Measures of pain affect do not appear to be as homogeneous as measures of pain intensity. They are less likely than measures of pain intensity to be strongly related to one another, suggesting that the affective component of pain may consist of a variety of emotive reactions (Morley, 1989).

One of the most widely used measures of pain affect by far, is the "Affective" sub-scale of the *McGill Pain Questionnaire (MPQ)* developed by Melzack (1975). The MPQ recognises that pain consist of different dimensions. Responses to the questionnaire indicate both the sensory and emotional aspects of pain, which vary in different people at different times. Pain sufferers use words that show how much emotional distress is associated with their problem. In describing their pain, people can use words such as "it's horrible", or "it's wearing, depressing, or frustrating". This would give an insight as to how much pain has started to dominate the patient's life in terms of psychological distress.

CONSTRUCTION OF THE SPORTS INJURY MANAGEMENT (SIM) COMPUTER PROGRAMME

The aim of the SIM programme is twofold. Firstly, it creates a database for keeping a record of patients' biographical data. Secondly, it processes patient data from the different psychological tests in order to give a profile of the mood states and pain experiences of those patients. Comparison of subsequent profiles can then be used to assess whether an injured athlete has made any progress from one therapy session to the next.

Starting the programme

When starting the programme, an introductory screen is displayed. After five seconds this screen automatically defaults to the next "SIM Main Menu" screen. The therapist administering the programme then has the option of either selecting a new patient data file or

retrieving existing patient data. When the option "New Patient" is selected, the programme allows the therapist to create a new file for that patient.

For new patients, the patient's first name, surname and initials can be entered into the database. Based on this information, the programme creates a file for that specific patient. Additional information that can be entered, include current address, date of birth, height, weight and home and business telephone numbers.

Psychological profile

A psychological profile is compiled by using the following instruments: the *Emotional Responses of Athletes' to Injury Questionnaire* (ERAIQ), the *Incredibly Short POMS* (ISP), a Pain Drawing instrument, a Visual Analogue Scale (VAS) and the Affective subscale of the *McGill Pain Questionnaire* (MPQ).

The ERAIQ (Smith *et al*., 1990a) forms the basis of the first twenty questions of the computer programme. The original questionnaire has been adapted for the purposes of this programme. Questions one and two of this instrument offer the therapist an opportunity to gain insight into the athlete's values and priorities. The athlete can share sports-related, as well as academic or non-sport career goals. Athletes, who are tired, burned out, or alternatively burning with ambition, can often be identified through these two questions already. Question three permits the therapist a glimpse into the athlete's motivation for sport or exercise and heightens the therapist's appreciation of what is lost to the athlete when injury occurs. The questions on perceived goals, athleticism, patients' perception of the nature of the injury, pressures to participate in sport and to perform to the expectations of others, stress and social support are mostly self-explanatory (Wiese-Bjornstal & Smith, 1993).

It is important to note that sometimes information omitted from the athlete's responses can be significant. For example, athletes suffering from an eating disorder or exercise addiction may frequently rank weight and stress management lowest on their list of motivators, perhaps in a conscious or unconscious effort to draw attention away from some major concerns and areas of discomfort (Wiese-Bjornstal & Smith, 1993).

For the purpose of **assessing pain location**, the scoring template for pain drawing developed by Margolis *et al*. (1986) was used. The instrument was adapted for use on the computer by allowing the patient to use the mouse to click on the areas affected. This will give an indication of where on or in the body the patient experiences pain. The *Visual Analogue Scale* (VAS) was chosen to give an indication of pain intensity, as it is easy to administer with a computer programme. Unlike a number on a scale that could be easily remembered, using the VAS would make it very difficult for a patient to remember the exact position on the line where he/she previously indicated his/her pain. This would contribute to obtaining an honest rating of the pain experienced, eliminating efforts to please the therapist. The Affective subscale of the *McGill Pain Questionnaire* was adapted for use in the programme. Patients can give an indication of the emotional pain experienced by selecting certain adjectives from lists of words.

Existing patients

As previously stated, the programme allows data of new patients, as well as of existing patients to be entered. This choice can be made on the "SIM Main Menu" input screen. As soon as the "Existing Patient" option has been selected on this particular screen, the "Existing Patient Menu" screen is opened. By executing the "Load Patient Data" option on that screen, the therapist can select the file of any previous patient for further therapy sessions. If any of the selected patients' biographical data have changed, the option "Change/View Patient Biographical Data" can be selected and the data altered. If no alterations need to be made, the therapist can proceed directly to the "Next Test" option on that screen. The test data from previous sessions for that particular patient will be displayed on the same screens and any of this data can be changed at this point. After the completion of each therapy session, the therapist can either display the patient's psychological profile on the computer monitor, or print the profile.

Scripts

Provision was made for scripts, or handouts, that can be given to the patient after each treatment session. These scripts might vary from general information on the role of the sport psychologist in the management of injuries, to more specific information on for instance mental imagery, goal setting, rehabilitation adherence, keeping of a homework log, or any information relevant to the rehabilitation of the specific athlete. After the completion of each session, the therapist may either select a particular script thought appropriate for the patient at that time, or scripts may be generated by default. This is done on the "Scripts" screen of the programme.

FEEDBACK ON PROGRAMME (SIM)

Injured athletes may choose to rehabilitate on their own, but usually within the rehabilitation setting there are at least two parties involved, namely the party receiving treatment and the party administering the treatment. Although the aim of rehabilitation is complete recovery, it would probably be safe to say that the perspectives of the two parties involved in reaching that objective may differ slightly. To make provisions for these differences in perspectives, the effectiveness of the programme was evaluated firstly from the therapists' and secondly from the injured athletes' points of view. For this purpose two very simple questionnaires were developed.

In the development of the questionnaires, the following questions were asked: (1) How easy/difficult was the SIM computer programme to use? (2) How useful was the SIM computer programme in helping you/your patient rehabilitate from injury? (3) Would you recommend the use of the SIM computer programme to other athletes/other therapists? (4) What aspects of the SIM computer programme did you like? (5) What aspects of the SIM computer programme did you dislike? Lastly, both patients and therapists had the opportunity to make any other comments or suggestions.

RESPONSE TO FIRST THREE QUESTIONS

Question	Response options	Patients (N=17)	Therapists (N=9)
How easy/difficult was the SIM computer programme to use?	Very easy	65%	67%
	Easy	24%	22%
	Moderately difficult	11%	11%
How useful was the SIM computer programme in helping you/your patient rehabilitate from the injury?	Very useful	41%	67%
	Useful	35%	11%
	Moderately useful	24%	22%
Would you recommend the use of the SIM computer programme to other athletes/therapists?	Very definitely	42%	100%
	Strongly inclined	29%	
	Moderately inclined	29%	

Patient feedback

It is important to receive feedback from patients using the SIM programme, because the success of the programme largely depends on whether patients perceive it as helpful in their rehabilitation, or whether they perceive it as a hindrance. The extent to which they see it as helpful, will determine how quickly it is accepted as an integral part of their rehabilitation process. Seventeen athletes took part in this study and the following feedback was received from them.

On the first question, 65% of the injured athletes indicated that they found the programme very easy to use, 24% indicated that it was easy to use and the remaining 11% found it moderately difficult to use. On the second question, 41% injured athletes found the programme very useful in their rehabilitation, a further 35% found the programme useful in helping them rehabilitate from their injury and the remaining 24% found the programme moderately useful. In answering the third question, 41% very definitely felt they would recommend the programme to other rehabilitating athletes, 29% injured athletes felt moderately inclined to recommend the programme to other athletes and the remaining 29% felt a bit stronger about recommending the programme. Feedback on the fourth question ranged from statements to the effect that in using the programme the athletes had become more aware of their injuries, it made them more aware of their rehabilitation and the progress they were making to statements that it helped keep them positive about the whole process. On the fifth question, patients' feedback included that they thought some of the questions were too personal and that it was difficult to use the programme where more than one injury was present.

Patients also had the opportunity to make other comments and suggestions regarding the programme. Some thought that it would be better if the therapist was involved with the entering of the data, while others had comments on the structure of the programme and how they would like to have it altered to suit their needs.

Therapist feedback

As with feedback from patients, it is equally (if not more) important to receive feedback from the therapists using the programme. The programme was developed with physiotherapists in mind, so it stands to reason that if the feedback received was largely negative, the goal of the programme had not been achieved. Nine therapists took part in the programme and the following feedback was received: On the first question, 66% of the therapists found the programme either very easy or easy to use, while only 11% found it moderately difficult to use. Feedback received on the second question revealed that 66% therapists found the SIM programme moderately helpful in helping their patients rehabilitate from injury, while 22% therapists found it very useful. When asked whether they would recommend the use of the programme to other therapists, all the therapists indicated that they would either moderately or strongly recommend the programme. Answers to the fourth question ranged from comments that the programme would help reinforce the positive effects of each treatment session, that the graphic representation was useful in gauging progress to the fact that the programme gives injured athletes the opportunity to quantify their pain experience.

The main concerns of the therapists in giving feedback on the fifth question, was that the administration of the programme might impede the time available for physical rehabilitation. This also led them to recommend in their answers to the sixth question, that the programme should be further condensed, or that provision be made to administer the programme through pencil and paper tests. In general it would seem that both injured athletes and physical therapists alike who participated in this study received the SIM programme favourably. When taking into consideration that the programme was to a very large extent only a prototype, the feedback indicates that the SIM programme definitely has huge potential to be of value in the rehabilitation of injured athletes. Recommendations made by both the athletes and the therapists will be incorporated in a subsequent version of the programme.

COMMENTS

Criticism that can be levelled against most of the models for the psychological rehabilitation of sports injuries would be that they remain mostly theoretical models. Very few, if any, of these models seem to provide a physical therapist interested in using psychological principles in injury rehabilitation a ready-made instrument for that purpose. An attempt was made in the development of this instrument to rectify this impasse by creating an instrument that might be used even after minimal training.

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