Original Article

Psychology of sport injury rehabilitation: a review of models and interventions

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ABSTRACT

Santi, G. & Pietrantoni, L. (2013) Psychology of sport injury rehabilitation: a review of models and interventions. *J. Hum. Sport Exerc., 8*(4), pp. 1029-1044. The aim of this review is to provide the state of the art about the psychology of sport injury rehabilitation by analyzing the most recent literature and research on this field. In the first part, we presented theoretical models contextualizing the sport injury, the motivational process underlying the recovery, and the influence of social and contextual factors. The second part focuses on the possible psychological interventions and their effect on the rehabilitation process. In conclusion, some gaps in the current literature have been highlighted and directions for future research have been provided. **Key words**: SPORT, INJURY, PSYCHOLOGY, MOTIVATION, RECOVERY, REHABILITATION, INTERVENTION.

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INTRODUCTION

Sport injuries threaten athletes' career and success (O'Connor et al., 2005). Some injuries are little and do not have any impact, instead others can end a career and have consequences on athletes' quality of life. Moreover, injuries determine rehabilitation costs, which concern athletes and/or sport organizations, in terms of monetary costs or lost time.

Over their careers professional athletes spend thousands of hours in training. Despite this, or because of, they have a risk of injury higher than normal exercisers (Brewer, 2009). For example, in windsurfing there is a probability of 0.22 injuries every 1000 hours of practice among amateur performers, but these data rise till 13 injuries every 1000 hours among professional performers (Perez-Turpin et al., 2012a). Vitali (2011) provides the example of gymnastics and football: the 70/80% of professional female gymnasts occur in an injury every season and the 75% of professional football players (both men and women) have injuries every season.

Research on recreational sports (Van der Sman et al., 2003; Perez-Turpin et al., 2012a) shows that differences may be found between different sports. For example in skiing and snowboarding there are 2-4 injuries every thousand days of practice, in indoor climbing there are 1-3 injuries/1000 days, while non-competitive windsurfing is relatively safe with a mean of 1 injury every thousand days of practice.

There are also gender differences. According to US data about recreational sports men are generally more liable to occur in an injury if compared with women (NEISS, 2010). For example, injured men in baseball are twice than injured women, and in basketball injured men are four times than women. However, there are some exceptions: in horse riding injured women are more than men. Unfortunately, these data do not consider the number of participants and do not provide any information regarding professional sports. Research on elite performers is limited and the most of studiesregards single sports. For example, Perez-Turpin and colleagues (Perez-Turpin, Cortell-Tormo, Suarez-Llorca, Chinchilla-Mira & Carreres-Ponsoda, 2012) have examined the context of windsurfing evidencing how female athletes are generally more liable to suffer injuries, with an exception: during competition men occur in injuries more frequently than women.

The incompleteness of these data is due to the difficulty to uniform data from different countries, and collected in different ways (Van der Sman et al., 2003). Moreover, there is a lack in the literature about epidemiology of sport injuries among professional athletes, and therefore it is not possible to determine the gap between professional and recreational sport, and the incidence of different risk factors on sport injury (Giustini & Cedri, 2002). Probably because of this shortage of data, there are few psychological studies on sport injury prevention; instead there is a consistent research on rehabilitation process. That is why we chose to review the literature on psychology of sport injury rehabilitation.

An injury does not affect exclusively physical capabilities, but also contextual and psychological aspects. In fact, in some situations, injuries can deprive athletes of their compensation increasing life-stress, and determine fear to reinjury, sensation of loss, negative emotions, and other mood disturbances (Sparkes, 2000; Vergeer, 2006; Naoi & Ostrow, 2008). The negative impact of injury depends only in part on how much time athletes have spent in sport: high performers, who have a stronger athletic identity, experience major feeling of loss and mood disturbance. However, they also have a better reaction to the injury, probably because they have more psychological resources to cope the situation (Rees, Mitchell, Evans & Hardy, 2010). For these reasons, during the rehabilitation process athletes may benefit of the support from relevant social agents and of the intervention of a psychologist.

PSYCHOLOGICAL MODELS FOR SPORT INJURY REHABILITATION

Through the years, several psychological models have been proposed in order to contextualize the rehabilitation process following sport injury. For example, the biopsychosocial model (Brewer, 2009; Brewer, 2007) considers the factors influencing the rehabilitation process, and the intermediate and final outcomes of the rehabilitation. Secondly, cognitive appraisal models explain how cognitive appraisal is related to other psychological and contextual factors. Finally, stage models explain the stages of the athlete's psychological reaction to the injury, and how they are related to the phases of physical rehabilitation.

Biopsychosocial model

The biopsychosocial model (Figure 1) is composed by seven dimensions: injury characteristics, socio-demographic factors, biological factors, psychological factors, social and contextual factors, intermediate biopsychological outcomes, and sport injury rehabilitation outcomes.

The sport injury rehabilitation process starts with the occurrence of the injury. The location of the physical damage in the body, the type, cause and severity of the injury, and the history of the athlete and his/her previous injuries are factors that affect biological, psychological, and also social-contextual dimensions. Similarly, socio-demographic factors, such as athlete's age, gender, ethnicity, or socio-economic status, have an effect on biological, psychological, and social-contextual dimensions. Subsequently, these three factors affect the intermediate outcomes, as such as the range of motion, the strength and the endurance of a muscle, the joint laxity, the perception of pain, and the duration of the recovery. Finally, the intermediate outcomes influence the outcomes of the rehabilitation, such as functional performance, quality of life after injury, satisfaction of the treatment, and readiness and desire to return to sport. A central role in this model is played by psychological factors; in fact they have a reciprocal relationship with biological and socio-contextual factors, and with intermediate and final outcomes.

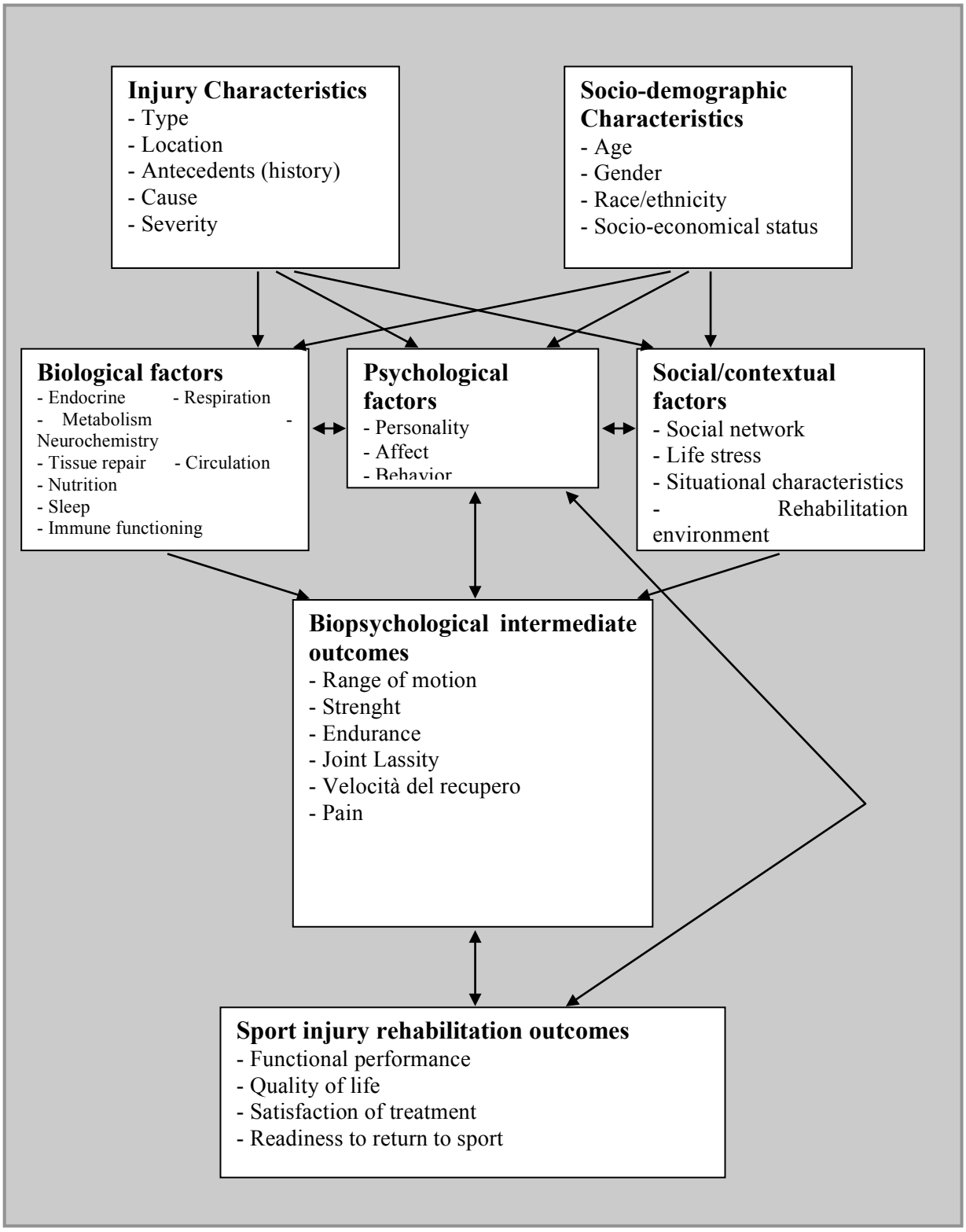

Figure 1. *The biopsychosocial model (Brewer, 2007, 2009)*

Cognitive appraisal models

The previous model provides a holistic framework useful in order to explain the whole sport injury rehabilitation process. However, an explanation of the relationships between different psychological factors is not provided. Previously, cognitive appraisal models investigated in-depth these relationships and underlined how cognition plays a central role in determining individual reactions to sport injury. Brewer (1994) proposed the "cognitive appraisal model of psychological adjustment from athletic injury". According to this model, personal factors and situational factors influence cognitive appraisal of individuals. The cognitive appraisal determines the emotional response, for example fear to reinjury, anger, and depression. Finally, these emotions affect the athlete's behavior, such as the adherence to the program.

More recently, Weise-Bjornstal and colleagues (1998) have revised and integrated this model. In their "integrated model of psychological response to the sport injury and rehabilitation process" (Figure 2), Weise-Bjornstal and colleagues have added personality as a personal factor and they assume that psychological factors affect and are affected by intermediate and final rehabilitation outcomes.

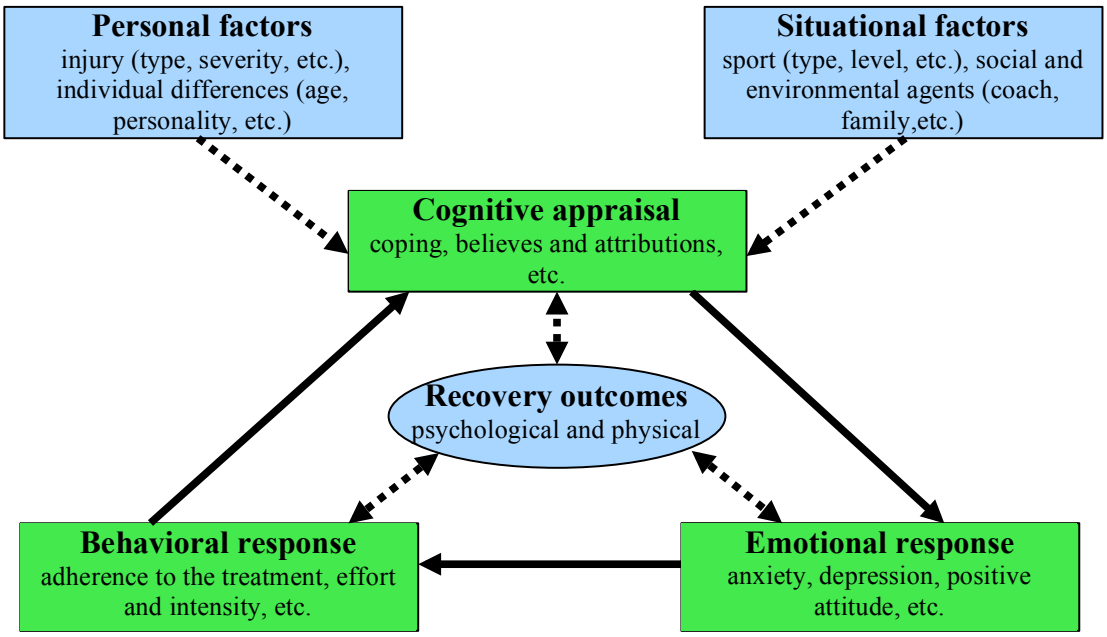

Figure 2. *Integrated model of psychological response to the sport injury and rehabilitation process (adapted from Weise-Bjornstal et al., 1998).*

Stage of the return to sport models

In order to explain the psychological stages of the rehabilitation, stage models provide a succession of emotions and attitudes occurring following sport injury. One of the first stage models in clinical contexts was proposed by Kubler-Ross (1969). In this model stages are: denial, anger, bargaining, depression, and acceptance. However, research in sport injury rehabilitation contexts has not found correspondence between this model and the actual reaction of athletes. In fact, individual characteristics seem to strongly affect the psychological phases of the rehabilitation. For example, athletes have different reactions if they are at the first or at the second injury, or they can be more or less motivated in the program based on the social support they receive (Brewer, 2007).

More recently, O'Connor et al. (2005) have proposed the "affective cycle of injury". This model proposes three different responses to the injury: denial, distress and determined coping.

We talk of denial if the athlete refuses and negates the consequences of the injury. Athletes may exhibit denial about severity of injury, about its consequences on sport career or on quality of life. It is possible to identify denial not only by what athletes say, but also by how they contradict other information about the injury. In fact, it is necessary to distinguish between a positive thought and denial. If the athlete says "I will recover in only 8 months" and the physiotherapist has predicted 12 months, this may be functional. That is because the athlete is aware, but excludes negative thoughts, and may be more motivated in following the rehabilitation program. It is different if the athlete negates the severity of the injury, shows a lack of self-confidence and resistances to collaborate with medical staff. Denial typically occurs in the early stages of rehabilitation, immediately after the injury, but generally it is not necessary to intervene at this time because this denial is adaptive to the injury. If denial persists during the following stages and interferes with the treatment, the psychological intervention is required (O'Connor et al., 2005).

Distress is given by negative emotions derived from injury, such as anxiety, depression, anger, fear, feeling of loss and disruption of self-concept. Also distress is more present in the early stages of rehabilitation, but it is more adaptive to the injury: in fact in this phase it is possible to establish a relationship based on trust between the injured athlete and the medical staff. However, it is possible that the athlete experiences distress also in other phases, for example during the latter stages of rehabilitation the desire to return to sport may make the final steps of recovery boring and frustrating.

Determined coping is when an athlete has overcome a passive attitude and starts to cope the new situation. This includes: evaluating resources, setting realistic goals, and maintaining commitment, focus on the program and cooperation with the staff. Determined coping occurs generally in the latter stages of the rehabilitation, when the athlete has overcome denial and has become able to manage distress. This attitude is the most functional to get success in the rehabilitation.

The "affective cycle of injury" maintains the concept of different emotional phases, but it is more flexible, because it does not provide a predetermined sequence. Emotions may change during a month, a week and also in the course of the day. It is helpful to consider this model in relation to the stages of the physical rehabilitation. For example, we have a prevalence of denial and distress in the early stages and determined coping in the latter stages. Moreover, different attitudes emerge as consequences of particular events. For example, if a rugby player knows that the substitute in the team has played a very good match and has scored several points, this may cause distress.

Motivation-based models

The motivation underlying the rehabilitation program is an important factor in determining the adherence to the program (Chan et al., 2011). Below, two types of motivational models are presented: self-determination theory, which explains motivation underlying athletes' behaviors, and trans-contextual model, which is based on the assumption that motivation is transferable from a context to another one.

Self-determination theory has been proposed by Ryan & Deci (2000). In their theory, they assert human actions and behaviors are not only energized by intrinsic motivation, but there is a continuum from demotivation to intrinsic motivation (see Table 1). When self-determination is at the lowest level we talk of demotivation. Demotivation is characterized by non-regulatory behaviors reflecting the lack of intention to act. Between demotivation and intrinsic motivation there are different extrinsically motivated behaviors:

external regulation, introjected regulation, identified regulation and integrated regulation. External regulation is characterized by external rewards or punishments, for example an athlete who returns to the competition because the coach threatens to replace him/her with another player. Introjected regulation involves behaviors performed in order to avoid guilt or to achieve rewards, for example an athlete who returns to the competition only to not disappoint teammates. Identified regulation is a free choice, but it is still determined by external factors: the person does not perform an action for the satisfaction derived, but in order to achieve an ego oriented-goal, such as athletes who want to return to sport because they want to maintain a good shape, or because they want absolutely to win a competition. Integrated regulation is still an extrinsically motivated behaviour: the behaviour is integrated with other needs or values which are part of the personal identity, in this case athletes return to sport in order to demonstrate their athletic capabilities. Finally, the highest level of self-determination is characterized by intrinsic motivation; in this case athletes have internally regulated behaviors. This level is characterized by intrinsic satisfaction and enjoyment in performing the action. An example of this kind of motivation is given by athletes who want to return to sport because they really like it.

Table 1. *Self-determination theory (adapted from Pietrantoni & Prati, 2012)*

Low self-determination ◄——————————————————————► High self-determination

Controlled motivations ◄——————————► Autonomous motivations ◄——————————►

Motivation	**Demotivation**	**Extrinsic Motivation**				**Intrinsic Motivation**
Regulation Style	Non-regulatory behaviors	External regulation	Introjected regulation	Identified regulation	Integrated regulation	Internal regulation
Characteristic	No-control, incapacity, no-intentions	External reinforcement and punishment, playing up someone	Reinforcement and punishment are introjected	More importance for personal objectives and values	Congruence with self-imagine and achievement of an identity	Intrinsic satisfaction, fun and enjoyment
Example	*"I don't understand why I should do training"*	*"I should return, because the coach threats to replace me"*	*"I should return, because I don't want to disappoint my teammates"*	*"I want to return, because I want to maintain a good shape"*	*"I want to return, because sport is part of my life-style"*	*"I enjoy when I do sport"*

When regulation is determined by external factors (rewards or punishments, team influences, possibility to win a trophy, etc.) we talk of controlled motivations. Instead behaviors driven by needs, values, enjoyment or satisfaction, characterize autonomous motivations (Pietrantoni & Prati, 2012). Research on self-determination theory supports the idea that the autonomous motivation of a person is driven by the individual needs for competence, autonomy and relatedness. Competence is the sense of efficacy in doing something: athletes may desire to recover a high level of ability in their sport, and this may determine high intrinsic motivation in the rehabilitation. Autonomy is characterized by the desire to keep the control of events: athletes think that recovery outcomes are the result of their behavior, and they are more determined in following the program. Relatedness is the degree of integration with the social environment:

injured athletes may often feel a sense of isolation from their friends, teammates and fellow competitors, and then they can be intrinsically motivated to return to the competition.

Trans-contextual model (Hagger et al., 2005) explains how motivation is transferable from a context to another one. According to this model we may explain the relationship between sport motivation and injury rehabilitation motivation. Trans-contextual model derives from the "hierarchical model of motivation" proposed by Vallerand (2000). According to Vallerand, there are three different levels of transferability: specific, contextual and global.

At the specific level, the autonomous motivation of athletes can become autonomous motivation in adhering to the treatment. If athletes enjoy to do a training session, and they like to do correctly warm-up, strength training, and recovery, at the same way they may enjoy in executing warm-up, strength training and recovery in a rehabilitation exercise, because this is the path to return to sport.

At the contextual level, social agents influence the behavior of athletes. If the coach provides to the athletes autonomy support, this may influence positively autonomous motivation of the athletes in the sport context. At the same way, if injured athletes perceive autonomy support from the physiotherapist in the rehabilitation context, they may increase their autonomous motivation in following the treatment.

At the global level, the causality orientation of athletes determines their type of motivation. In particular an internal locus of control determines an autonomous motivation in athletes and their perception of autonomy support from coach or physiotherapist, while an external locus of control determines individual controlled motivation and perception of controlled support from others.

Previous research (Chan et al., 2011) has found that autonomous support and autonomous motivation are strongly linked with treatment adherence. This is true for several contexts, such as smoking cessation programs, addiction, or weight management. In sport injury context, it has found that when patients perceive the physiotherapist as autonomy supportive they are autonomously motivated.

Type of motivation determines different reaction to the treatment: for example enhancement in autonomous motivation increases commitment, persistence and satisfaction. Research on sport contexts highlights how social support enhances self-regulation and intrinsic motivation (Podlog & Eklund, 2007a; Chan et al., 2011).

PSYCHOLOGICAL INTERVENTIONS

A variety of psychological interventions may be useful during the rehabilitation and in the re-entry period. Below, the following types of interventions are described: educational interventions, goal setting, imagery, self-talk based interventions, biofeedback, and social support based interventions. According to the models previously presented, we can intervene on cognitive appraisal of athletes through self-talk, but also providing them biological information and feedback about their recovery. Emotions can be managed through education and imagery. Finally, athletes' motivation may be enhanced by intervening directly on the athlete through goal setting or with the provision of social support.

Educational interventions

Education can make athletes aware of their situation. Research has shown how the athletes do not have a clear vision of the rehabilitation process immediately after the injury and this can determine negative

emotions and demotivation. Moreover, athletes think a better knowledge of the rehabilitation process permits to see realistically the situation and reduce anxiety (Francis et al., 2000). That is why it is important to intervene in the early stages of the rehabilitation (O'Connor et al., 2005).

In this phase it is important that medical staff provides an anatomical description of the injury and a timetable of the recovery. Afterwards, it is necessary that athletes know how the recovery process involves muscle soreness and stasis. They even should be aware that not only injury produces pain, but also the rehabilitation. Athletes should learn to not use excessive painkillers and recognize injury pains, which are negative symptoms, and rehabilitation pains, which are positive symptoms (Taylor & Taylor, 1998).

Athletes should be prepared also about their oncoming emotions, such as frustration, anger, or mood swings. It is also necessary that they are conscious of their role in the rehabilitation program, and the importance of their compliance with the medical staff.

Education restrains emotions and attitudes typical of denial and distress phases, such as anxiety, depression, resistances, and loss of self-confidence. Consequently, their duration reduces, anticipating a determined coping attitude (O'Connor et al., 2005).

Goal setting interventions

Setting goals determines an enhancement in motivation and commitment, and provides a direction in order to optimize the recovery. A point of strength of this intervention is the favour that it meets among sport and medical professionals: in fact it results one of the most required interventions by athletes and coaches (Filby et al., 1999), and it is considered one the most important by physiotherapists (Arvinen-Barrow et al., 2010). Furthermore, it has been shown how athletes utilising goal setting strategies have a better return to the competition (Vitali, 2011; Hamson-Utley & Vazquez, 2008).

A goal setting intervention follows some criteria: objectives are specific, measurable, realistic, stimulating, and time-based (Weinberg, 2009). Setting clear and realistic goals induces in the athlete a sense of control of the rehabilitation process, while stimulating goals determine the activation of the athlete. The combination of both short-term and long-term goals maintains an high motivation over time.

Goal setting interventions may be conduct by a psychologist, but also by physiotherapists and coaches trained by the psychologist. For an effective goal setting intervention physiotherapists and coaches are taught to write-down objectives and progress, and also athletes are taught to self-monitor their recovery (Evans & Hardy, 2002b). A goal setting training satisfies the need for athletes, coaches and other sport professionals, to manage the return to sport, avoiding unrealistic goals and over-expectations (Podlog & Eklund, 2007b; 2009). Physiotherapist and coach take part at different times in the goal setting intervention: the role of the physiotherapist is predominant during the physical rehabilitation, therefore there is a handover and, when athletes return to play and compete, the role of the coach is more important.

An effective goal setting reduces athletes' anxiety, and improves their self-confidence (Taylor & Taylor, 1997; Evans & Hardy, 2002a; Carson & Polman, 2012). As a result of the intervention the athlete is more adherent to the program and perceives the treatment as more effective (Evans & Hardy, 2002a).

Imagery

Imagery is one of the most investigated techniques in psychological evaluation studies (Olmedilla et al., 2011). Imagery may be classified in several ways: it is possible, for example, to differentiate according to

theperspective (external vs. internal) or according to the type of sensations (visual, auditory, kinesthetic, etc.). When athletes visualize themselves performing an action from an external perspective they are like spectators watching a film. Instead, if they adopt an internal perspective, they visualize what they see from their eyes when performing the movement. Visual and auditory imagery refers to visual information and sounds: an athlete may imagine the return to the competition, the view of the stadium and the noise of the public. In kinesthetic imagery the athlete recalls proprioceptive feedbacks, heart rate, etc. (Hale et al., 2005). In this debate we adopt a distinction between imagery for performance and imagery for rehabilitation, based on the possible applications.

Performance imagery refers to mentally visualize movements, to reproduce proprioceptive feedbacks, or to mentally reproduce tactical situations. It is useful for improving sport skills in order to enhance performance, and its effectiveness in training and competition is widely demonstrated (Weinberg & Gould, 2011; Mellalieu et al., 2009; Vealey & Greenleaf, 2001). During training or competition it is frequent that athletes use autonomously motor imagery, but they lose this habit during rehabilitation. However, research has shown how athletes adopting this technique during the rehabilitation have a better return to the competition (Vitali, 2011; Cupal & Brewer, 2001). In fact when athletes are far from practice because of injury, performance imagery may help them to maintain their individual skills and their tactical sharpness. Moreover imagining to perform an action determines muscular activation, increasing blood circulation in an area that is inactive after the injury. Finally, visualizing positive images of the return to the competition and imagining the related sensations can be useful to increase self-confidence in those athletes who return to play after long time.

Imagery for rehabilitation is based on the anticipation of pain sensations or anxiogenic situations in associations with relaxation strategies (e.g. view of quiet places, breathing exercises, etc.). It is important that athletes become confident with relaxation strategies before to imagine negative situations (Hale et al., 2005). Before a surgery intervention athletes may experience anxiety and have concerns regarding the oncoming pain. The adoption of this technique can be helpful to obtain a muscle relaxation and have a physiological effect in reducing stress hormones, determining considerable benefits in recovery (McKinney et al., 1997a; 1997b). Moreover, when athletes return to the competition, visualizing a scene of a new injury can reproduce anxiety and negative emotions in athletes and the ability to use relaxation increases their capacity to cope with pain and control anxiety.

Self-talk based interventions

This intervention includes cognitive restructuring, positive thinking and self-monitoring. Self-talk based interventions help athletes to recognize and change negative thoughts (Podlog et al., 2011). Naoi & Ostrow (2008) propose a protocol for the implementation of these cognitive interventions following sport injury:

1. expressing feelings and thoughts - athletes express sensations and thoughts about their lives (health, athletic conditions, academic situation, social environment); in this phase the psychologist uses techniques such as active listening, reflection, clarification;
2. identifying negative thoughts – athletes are asked to write-down or talk about their thoughts and identify those thoughts which could have a negative impact on the recovery;
3. looking in a positive light – athletes try to find positive aspects of the injury, and the psychologist help them providing examples (recovery progress, social support, increased resilience and coping skills, etc.) and changing negative thoughts in positive ones;
4. selecting statement – athletes identify three positive thoughts and write them on a paper; for example “I’m getting healthier and stronger every day”, “I can do it!”, “I can recover sooner than normal”, etc.;

5. reading statements – athletes read the three positive thoughts to the researcher, and after this they practice self-talk repeating to them-selves these three statements;
6. maintaining – participants keep the paper and should read and repeat to them-selves at least once a day the statements; they should also monitor their work and, during the following sessions, the psychologist monitors them by asking how many times every day they have read the statements..

Some authors consider this intervention helpful in reducing concerns (Podlog et al., 2011). However the effectiveness of these strategies in restraining anxiety and depression should be better investigated (Naoi & Ostrow, 2008).

Biofeedback

Biofeedback interventions are based on the use of computerized equipment, which provides immediate feedbacks. According to the biopsychosocial model, giving feedback is important because it provides the athletes with information regarding their intermediate outcomes.

In a biofeedback intervention sensors are applied on the person and send signals to a computer. The computer receives and processes signals; then it records data and gives information to the athlete about his/her physiological functions, such as electromyographic activity (EMG), heart rate, skin conductance, or blood pressure. Alternatively, an operator, such as the psychologist, the physiotherapist, or the coach, may mediate the information provided by the computer and help the athlete in the interpretation. This can be particularly helpful in those athletes who need for psychological support. Moreover, athlete's reactions and responses are collected and analyzed in relation with recorded data (Peper et al., 2009).

Making athletes aware of their own physiological state may change their interpretation of symptoms. A similar change in cognitive appraisal affects emotional and behavioral responses, and may improve athletes' health and performance (Thompson & Thompson, 2003). Changes in athletes remain also after the intervention, this because athletes acquire the ability to interpret body signals and consequently improve their self-regulation (Peper et al., 2009).

In the specific context of sport injury rehabilitation biofeedback is helpful, because it gives information about the recovery. Providing athletes with information regarding their improvements can make them more self-confident and reduce their anxiety and negative thoughts about the return (Brewer, 2009). On the contrary, uncertain results have been found regarding the effectiveness of this type of intervention in increasing muscle strength (Mendo, 2011; Leploy et al., 2012).

Social support based interventions

Support interventions are based on the assumption that an increased support reduces the perception of negative psychological or physical symptoms through the enhancement of coping strategies. According with hierarchical model of motivation (Hagger et al., 2005; Vallerand, 2000), motivation derived from social context influences the motivation of injured athletes. Although few studies have evaluated the effectiveness of this type of interventions in enhancing sport injury recovery, social support has recently been receiving increasing attention in the specific context of rehabilitation (Rees et al., 2010).

According to the existent literature, we can distinguish four types of support: emotional, instrumental (tangible aid), informational (providing information), appraisal (evaluating the situation) (Hogan et al., 2002). Moreover there are several sources of social support during sport rehabilitation, such as family and friends,

coach and teammates, medical staff and other people who had previous similar injuries (Arvinen-Barrow et al., 2010).

Support by professionals. It is necessary that the psychologist makes coach and physiotherapist aware of their important role in supporting the athlete. In fact, they have the possibility to support directly the athlete, but also to involve teammates and other injured athletes in the social support-based intervention. Particularly physiotherapists, who are close to the athletes during the rehabilitation, provide significant emotional and informational support (Ford & Gordon, 1993; Gordon et al., 1998). That is why they should be trained to be more supportive and give feedback. Moreover, they should know more about basic psychological interventions, because frequently they do not have a clear vision of techniques such as goal setting, imagery, self-talk (Arvinen-Barrow et al., 2010). The importance of coach or physiotherapist during the phases of the rehabilitation changes depending on athlete's individual differences (Handegard et al., 2006).

Support through family or friends. Emotional and instrumental support are mainly provided by family and friends. They may be more supportive if the psychologist trains them on active listening and positive thinking, and their involvement in the intervention has a relevant effect on athletes' mood (Hogan et al., 2002).

Peers support. In order to enhance peers support it is possible to organize meetings among athletes who are injured at the same time, or with athletes who had previously experienced similar situations (similar injury, similar career, etc.). During these meetings athletes may discuss about their feelings, concerns and ways to cope the stress. Involving other injured athletes in the rehabilitation process may increase athletes' satisfaction for the treatment and their coping strategies. Hogan et al. (2002) assert that reciprocal support, for example among athletes who are currently injured, seems to be more effective than interventions in which the athlete only receives support. This is because, in the first case, the athlete develops the ability to resolve problems and cope the situation.

Social support based interventions have different effects depending on the source and type of support. For example, emotional support provided by family, physiotherapist and others, has an effect in reducing depression, instead informational support reduces anxiety and increases self-confidence. Finally, appraisal support provided by other injured athletes determines an enhancement in coping strategies, treatment motivation and satisfaction, and a reduced fear to reinjury (Rees et al., 2010; Handegard et al., 2006; Hogan et al., 2002).

CONCLUSION

In order to fill up a lack in literature, this review has presented an overview of the literature on psychology of sport injury rehabilitation and summarized the main psychological interventions and their effectiveness. Psychological interventions can provide a considerable aid in the rehabilitation process. Knowledge about the individual reactions to the injury, the motivation underlying the recovery and the effects of other factors, is important in order to predict athletes' recovery and implement supportive interventions. As a consequence of injury, athletes experience negative emotions, mood disturbance, feeling of loss and isolation. Psychological interventions can help them to overcome and manage a negative situation. Focusing on increasing motivation and self-confidence may facilitate the recovery. Finally may be helpful to intervene in order to reduce anxiety and fear to reinjury when athletes return to the competition.

The psychological models presented in the first part of this paper provide a framework for the implementation of psychological interventions. Motivational models provide implications for social support based interventions, while stage models may be helpful to provide information about athletes' emotions during the rehabilitation process. The byopsychosocial and cognitive models explain how some factors influence each other and how is possible to intervene, for example giving feedback about physiological information or changing negative thoughts in positive ones. In Table 2 it is shown a summary scheme of the effectiveness of educational, goal setting, imagery, self-talk, biofeedback, and social support-based interventions. Major and minor strengths of these types of interventions are reported.

Table 2. *Type of psychological intervention in sport injury rehabilitation and effect on athletes*

Type of psychological intervention	**Effect on athletes**
Educational intervention	- - resistance to collaborate - anxiety - depression + self-confidence
Goal setting	+ + treatment motivation and satisfaction + + self-confidence - anxiety
Imagery for performance	+ + self-confidence + + sport skills + + muscular activation (circulation)
Imagery for rehabilitation	- - anxiety + + coping strategies - - stress - - muscular tension
Self talk based intervention	- - negative cognitions - depression - anxiety
Biofeedback	+ + self-confidence - - negative cognitions - - anxiety + muscular strength
Social support based intervention	+ + coping strategies + + self-confidence + + treatment motivation and satisfaction - - depression - - anxiety

++ indicates a strong increase
+ indicates a minor increase
- indicates a minor reduction
-- indicates a strong reduction

Psychology may complete the knowledge about sport injury rehabilitation and psychological interventions can provide a comprehensive service to athletes. In literature there is richness of specific studies about sport injury rehabilitation, and the effectiveness of described interventions is widely demonstrated. However, research on social support could be developed: social support is a wide field and it is possible to intervene through different sources of support. It would be interesting to evaluate the effectiveness of specific types of social support based interventions in sport injury rehabilitation context.

Finally, it is important to consider that the absence of reliable data on injuries in professional sports represents a limit for the research on sport injury prevention. It would be, therefore, important that future surveys investigate epidemiology of sport injury in order to provide data for the evaluation of risk factors. This would permit to fill a further lack in the psychological literature.

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