11 THE RETURN-TO-SPORT DECISION AS A COMPLEX BIOPSYCHOSOCIAL PROBLEM

Agnieszka Jankowicz-Szymańska, Eliza Smoła, Anna Stefanowicz-Kocoł

11.1 Sports injury - definition

A sports injury is most often defined as an unfortunate event during sporting activity (amateur or professional), which results in immediate pain, discomfort, and reduction or loss of function. However, it should be remembered that repeated training loads are often the cause of overload syndromes, the symptoms of which do not have a specific, strictly defined time onset. Pain and functional limitation increase gradually as the athlete continues to train and compete. However, in both cases (sudden and delayed cause), the impairment of body functions in a sports injury is caused by specific forces acting on the body during sports activities.

According to Timpek et al. (2014), a sports injury can be considered on three levels. Firstly, as a trauma experienced by the athlete at the time of pain, discomfort, and/or loss of function, secondly as a sports injury, i.e. structural damage or dysfunction of the body assessed by a physician on the basis of objective examinations, and thirdly as an impairment, and inability to practice sports stated by an authorized sports medicine body based on a medical examination.

11.2 Causes of injuries in sport

The causes of sports injuries can be divided into physical, environmental, sociocultural, and psychological causes.

- Among the physical causes, the most common are age and biological sex, intensity and type of training, player's mistakes, for example improperly conducted or omission of warm-up, but also previous injuries and diseases, overloading, and current level of fatigue.
- Environmental reasons include practiced sports discipline, poor technical condition of the stadium, gymnasium, sports equipment, etc., but also bad weather conditions.
- Sociocultural causes of sports injuries can be non-compliance with current regulations, ignoring lower-intensity pain or minor injuries for fear that seeking help for them will be seen as a sign of weakness and negatively affect the athlete's position on the team, pressure from teammates, coaches, family or supporters, pressure from the schedule of important

sporting events and an opportunity that 'may not happen again', the opinion of those closest to the athlete that pain in sport is the norm and taking a painkiller is enough.

- Psychological causes of sports injuries can include disturbed self-esteem, excessive optimism or pessimism, low psychological resilience, excessive perfectionism, high levels of anxiety, impulsivity, misplaced sense of control, and excessive desire to compete and win (Blecharz, 2008).

Regardless of what was the cause of the injury, it has a negative impact on the physical functioning of the athlete, and often has a negative impact on his mental state. From the moment an injury occurs and is diagnosed, an athlete needs support from the medical team, sports psychologist, coach, and teammates, family, and friends. The basic tasks of the medical team include explaining to the athlete what the injury was and how the treatment and rehabilitation will proceed, as well as motivating the athlete to actively participate in the therapy. It is also very important to maintain a positive relationship with the athlete and maintain respect for his sports goals but also to protect against returning to the game too quickly, for example under pressure from the coach or other people. The responsibility of the medical team is expressed in professionalism, high competence, empathy, and openness as well as the ability to create optimal conditions for recovery (sometimes it is calming down the player, using mental training techniques and sometimes ensuring the possibility of being close to the team, e.g. therapy conducting at the same time and place as training colleagues).

11.2.1 Football injuries

Researchers believe that a greater understanding of the etiology of injuries will allow for more effective injury prevention. Hence, there is a growing body of research on risk factors and exposure in terms of the timing of exposure and intensity of the stimulus and the occurrence of injuries in sports. Sports medicine physicians, physiotherapists, coaches and statisticians, specialists in data analysis, collaborate in these studies (Nielsen et al., 2016).

Studies show that in football players, injuries most commonly affect the knee joint, ankle and knee joint, thigh muscles and groin area. In the 2021/2022 season, as many as 88.4% of injuries in football players were acute injuries. Almost the same number of injuries occurred during training (49.6%) as during a match (50.4%). One in five injuries (21.5%) were severe injuries, almost half (46.3%) were moderately severe injuries and about one-third of injuries (32.2%) were light in nature. Most injuries (54.5%) involved muscles, but only slightly fewer injuries (42.1%) involved joints and ligaments. Among muscle injuries, the main diagnoses were tears (44.6% of all injuries) and ruptures (6.6% of all injuries). Ligament and meniscus injuries accounted for one in three (30.6%) of all injuries diagnosed during the season and tendon damage was found in one in 15 players (6.7%) (Maestro et al., 2022).

Knee joint injuries

The most common injury to the knee joint in football is damage to the cruciate ligaments. Most injuries to the knee joint occur without contact with another player, as a result of dynamic

movement combined with a change of pace and direction, landing on the lower limb when the knee joint is in extension or rotation of the knee joint when the foot is firmly stabilised on the ground. In the situations described, forces act simultaneously on the knee joint in the frontal plane (valgus or varus), transverse plane (external or internal rotation) and sagittal plane (translation, as in drawer tests). The risk of injury is increased by generalised joint hypermobility and also by certain anatomical features of the knee joint, such as a small and narrow intercondylar notch or a thin and weak anterior cruciate ligament. Additional risk factors are sex hormones in women and core instability and abnormal posture in both sexes (Alentorn-Geli et al., 2009).

Injuries to the ankle and knee joint

The high incidence of injuries to the ankle and knee joint in football is related to the fact that the joint absorbs significant mechanical loads as a result of the foot reacting with the ground. One of the most common injuries to the ankle and knee joint is a sprain, which damages the collateral (fibular) ligaments and reduces the stability of the foot (Kolokotsios et al., 2021). Due to overload and trauma, the risk of osteoarthritis of the ankle and knee joint (as well as the knee joint) is higher in football players than in the general population (Kuijt et al., 2012). Ankle and knee joint injuries cannot be easily linked to isolated risk factors such as strength or joint range of motion. Rather, it seems that these injuries are the result of multiple factors acting simultaneously, among which the athlete's mental state, his or her BMI, or the level of coordination and balance as measured, for example, by the Y Balance Test (YBT) should be calculated (Manoel et al., 2020).

Muscle injuries of the thigh

The muscles most frequently injured are the ischiofemoral muscles and ruptures and tears of these muscles more often affect the kicking lower limb than the supporting limb. The injury usually occurs during running and, more specifically, at the end of the swing phase, when the ischiofemoral muscles, while still being dynamically stretched at high speed, begin to decelerate and contract eccentrically. The injury usually involves the proximal part of the biceps femoris or semitendinosus muscle (Cabello et al., 2015). Risk factors for ischiofemoral muscle injury include gender, age, previous injuries, lack of muscle flexibility and muscle strength balance, poor motor control and incorrect running technique, lack of trunk stability, fatigue and poor external conditions (weather, pavement, etc.) (Van Beijsterveldt et al, 2013.The most serious risk factor, more than doubling the likelihood of a sciatic-shin muscle tear, appears to be a past injury (Engebretsen et al., 2010).

Groin injuries

Acute groin injuries are diagnosed in 5-15% of footballers each season. The most common cause of these injuries is muscle and tendon rupture and accompanying haematoma, much less common are complications of an inguinal hernia or avulsion fractures in the pelvis. Acute groin pain is more common in football players than in runners or swimmers. (Paajanen et al., 2011). Chronic groin pain in football players, on the other hand, is most often a symptom of hip dysfunction, adductor muscles, rectus abdominis muscle or so-called inguinal pubalgia

sometimes referred to as sports hernia (intractable groin pain resulting from strain or tear of the muscle, ligaments or tendons attaching to the pubic bone or damage to the posterior wall of the inguinal canal) (Candela et al., 2019). So far, the specific risk factors responsible for groin injuries in football players have not been clearly defined, although they have been linked to the repeated repetition of dynamic, even violent rotational movements combined with sudden stops and/or changes in pace and direction of movement.

11.3 Reaction to injury

It is difficult to predict what an athlete's reaction to an injury will be. It depends on many factors: related to the injury itself (its type and severity), the situation in which the injury occurred (e.g. injury shortly after winning the gold medal in the world championships or just before the Olympic Games, at the beginning or end of the season, etc.), temperament and personality of the athlete (tendency to anxiety, depression and catastrophizing the situation or a positive attitude and assessment of the injury as a challenge that needs to be overcome), family and financial situation, internal pressure (strong need to compete and win) and external pressure (fear of losing position in team, being forced to return to the game quickly) (Blecharz, 2008).

The reaction to injury is a dynamic process. It can range from shock, disbelief, denial, anger, and disapproval *("Why me?", "How could this have happened?"*), depression and self-blame *("If only I had prepared better...", " If only I hadn't neglected the warm-up..."*), blaming others (for a poorly prepared stadium, defective equipment, imposed too burdensome training plan, insufficient care of a physiotherapist) usually to acceptance. Of course, this pattern is not permanent, and each athlete experiences his injury differently.

Depending on the coexistence of internal and external factors, the trauma may ultimately be perceived only negatively, it may be a contribution to reflection and the search for positive sides, or it may be underestimated.

Negative emotions related to the trauma may manifest themselves in the evaluation of the trauma as:

- a misfortune and unnecessary suffering,
- an enemy and an obstacle to achieving a goal,
- an irreversible obstacle to achieving one's dreamed success,
- a cause of isolation and loneliness,
- a source of anxiety and low mood,
- loss of motivation to act,

- sources of anger and jealousy towards other athletes who can train and improve their performance,
- a source of family problems, including financial ones,
- a sign of weakness,
- an invitation to manipulate the environment.

Among the positive emotions associated with the injury, the following can be noted:

- reflection and looking for positive sides (e.g., more time to spend with family),
- revaluation of one's life plans and goals (e.g., finding an alternative hobby, or activities),
- building work motivation,
- training humility and patience,
- strengthening mental resistance,
- overcoming an unexpected challenge and strengthening self-confidence,
- greater empathy for other athletes struggling with injuries.

The downplaying attitude is characterized by the perception of an injury as:

- an accidental event that will happen to every athlete someday,
- a normal event in sport that will soon be forgotten,
- events that are not of major importance for health and sports career,
- an excuse to rest from sport and carefree laziness,
- excuses from all duties.

Of course, the best prognosis is cooperation with an athlete whose attitude can be described as a reflective optimist. One of the tasks of the therapeutic team is to support the athlete in achieving such an attitude towards the injury.

Ways to deal with injury-related stress

In order to reduce the stress associated with the injury, it is important for the athlete to understand his own condition (the nature and consequences of the injury, the purpose and course of therapy), accept it, regain a sense of control, and take responsibility for their actions. It seems crucial to focus attention on positive emotions, which can be achieved using the athlete's internal resources (self-efficacy, internal locus of control, positive self-esteem, independence, consistency in action reinforced by relaxation techniques, prayer, meditation) or external resources (support from the environment). The athlete should actively cooperate with the therapeutic team, communicate their concerns (e.g., ask about disturbing symptoms), talk about difficulties, and not hesitate to ask for help.

The basic recommendations for an athlete after an injury are:

- use pharmacological treatment and perform follow-up examinations as prescribed by the doctor,
- work systematically with a physiotherapist,
- perform the recommended exercises between appointments with the physiotherapist,
- apply recommendations for modification of daily physical activity, diet, sleep, and rest.
- cooperate with a sports psychologist.

Factors interfering with rehabilitation

The main factor interfering with the rehabilitation process and constituting the greatest obstacle to its effectiveness is pain. Thus, one of the most important tasks of medical personnel is to help relieve pain.

Other difficulties interfering with the course of rehabilitation can be divided into:

Emotional problems

Examples: negative emotions, emotional suppression, depressiveness, sleep problems, and in extreme cases suicidal thoughts

Support that can be provided: presence, showing interest and concern, talking, listening, creating opportunities to express concerns and release negative feelings

Consequences of lack of support: deterioration of well-being and increasing tension associated with suppressing emotions

Cognitive problems

Examples: a distorted or incomplete understanding of the nature of the injury, the purpose and course of treatment, misconceptions about the consequences of the injury, the time needed for recovery and fitness, misconceptions about the prognosis, incorrect implementation of the doctor's and physiotherapist's recommendations

Support that can be given: giving information in a clear and comprehensible way, giving the opportunity to talk to someone who has had similar experiences, making a note of how to take medication when appointments and check-ups are scheduled, detailed instruction on how to do exercises (e.g. making short videos with a mobile phone)

Consequences of lack of support: Anxiety and pessimistic attitude to therapy or belittling of the problem, lack of motivation to actively participate in the rehabilitation process, lack of progress in rehabilitation, discouragement.

Material problems

Examples: financial problems related to the lack of earning opportunities, lack of access to specialist treatment

Support that can be provided: assistance in obtaining financial support, assistance in obtaining access to specialist treatment

Consequences of lack of support: lack of therapy progress, permanent loss of health and fitness, emotional and family problems (Blecharz, 2008).

11.4 Kinesiophobia and fear of re-injury

One common reaction to an injury is fear of movement and re-injury. In the initial phase after the injury, this fear is justified and is a protective factor. As the athlete recovers and returns to fitness, the fear of movement should decrease. It happens, however, that despite effective treatment and the lack of medical contraindications to physical activity, the fear of movement and re-injury remains high. This situation is very unfavorable and is regarded as a factor increasing the risk of re-injury. Even if, from the point of view of medical and fitness assessment, the athlete is ready to return to sport, but still has a fear of movement, the return to sport should be postponed and the athlete should be provided with support, e.g., a session with a sports psychologist.

Tampa scale

One of the most commonly used tools to assess fear of movement is the Tampa Scale of Kinesiophobia (Miller et al., 1991). This scale consists of 17 statements, examples of which are: *"I am afraid that I may hurt myself if I exercise", "Pain always means that I have damaged my body", "No one should exercise when in pain"*. Statements are scored on a Likert scale from 1 to 4: 1 - strongly disagree / 2 - disagree / 3 - agree / 4 - strongly agree (higher scores indicate greater severity of kinesiophobia). The respondent can receive from 17 to 68 points, with a score of 37 or more indicating kinesiophobia. Free access to the electronic scale

calculator in English can be found at: https://www.physiotutors.com/questionnaires/tampa-scale-kinesiophobia/ (access: 10/04/2024)

The scales described below can also be useful in assessing an athlete's psychophysical well-being:

KSC - Kinesiophobia Causes Scale

This tool is used to diagnose the causes of physical activity limitation related to phobic behaviour in the biological and psychological domains. Both domains/subscales contain four factors. The biological subscale assesses morphological parameters, individual need for physical activity, energy resources and biological drives, while the psychological subscale assesses self-acceptance, self-assessment of predisposition to sport, well-being and vulnerability to social influences. A score can be calculated for each subscale separately or for the scale as a whole. The score is given as a percentage. The higher the score, the stronger the fear of movement (Knapik et al., 2011).

SCAT - Sports Competitive Anxiety Scale (Sports Competitive Anxiety Test)

The SCAT scale was developed in 1977 by R. Martens et al. Martens et al. This tool consists of 15 statements to which the respondent answers: rarely - 1 point; sometimes - 2 points; often - 3 points. Five of the 15 statements are items that are not taken into account in the calculation of the score; their introduction into the scale was intended to conceal its essential elements. The remaining 10 statements describe somatic symptoms of stress (8 statements) and cognitive symptoms of stress (athlete's fear of failure) (2 statements). The scoring of two statements should be reversed so that a higher score consistently indicates a high and a lower score consistently indicates a low level of competitive anxiety.

Example statements of the SCAT scale: "Before the game I am anxious", "Before the game I fear I will perform badly:", "Before the game I feel nauseous in my stomach".

SAS - Sport Anxiety Scale (SAS)

The SAS scale, developed in 1990, consists of 21 statements that assess individual differences in somatic anxiety (9 statements, e.g. "I feel my body is tense"), cognitive anxiety in terms of anxiety (7 statements, e.g. "I doubt myself") and cognitive anxiety in terms of concentration (5 statements, e.g. "During competition, I often don't pay attention to what is going on"). The respondent answers using a 4-point Likert scale (1 - not at all; 2 - somewhat; 3 - moderately; 4 - very often). In 2006, a modified and shortened to 15 statements SAS-2 scale was published, which was adapted for children but can also be used with adults (Smith et al., 2006). The SAS scale has been translated and validated into various languages, including Polish (Tomczak et al., 2022).

In addition to those described above, the following can be used in working with athletes:

- Physical Activity and Sport Anxiety Scale - PASAS (Physical Activity and Sport Anxiety Scale) (Norton et al., 2004);
- Competitive Sport Anxiety Inventory - CSAI-2 (Competitive Sport Anxiety Inventory-2) (Lane et al., 1999);
- Perfectionism in Sport Scale - PSS (Perfectionism in Sport Scale) (Hill et al., 2016);
- Sport Motivation Scale - SMS (Sport Motivation Scale) (Pelletier et al., 2013; Wlaczak and Tomczak, 2019).

11.5 The process of making decisions about returning to sport

Thanks to the development of neuroscience, we are learning more and more about the mechanisms of the mind. Research shows that the feelings a person has about their body are made up of the body's physical state, mood, and emotional state to a similar extent. Therefore, when considering the best post-traumatic rehabilitation plan, it is necessary to consider not only the clinical examination result and the pattern of physical symptoms, but also the patient's cognitive, emotional, and behavioral responses (Craig, 2009).

The decision to return to sport after an injury should take into account the patient's clinical condition, mental state, and short- and long-term sports goals. When making such a decision, you always try to find a balance between the athlete's health and his effectiveness in the field. Unfortunately, this is always fraught with risk. Returning too early may have negative consequences for the athlete's health (e.g. re-injury), being too cautious and delaying the decision to return can eliminate the athlete from important competitions and cause them to lose their position in the team (Mayer et al., 2020). The decision to return to sport is usually supported by the opinions of several people. An important voice belongs to a medical doctor and a physiotherapist, but the opinion of a psychologist, trainer, and the closest environment of the athlete is also important. However, it is the athlete himself who makes the final decision. At this point, education about the nature of the injury and its consequences is very important, because research shows that athletes often neglect long-term health prognosis and decide to return to the game as soon as possible for short-term sporting success (Schnell et al., 2014). It is usually easy for athletes to make the decision to return to play too early when a risk-reducing factor is available to them. This may be a cue to wear a stabilizer for the duration of the activity, or to be active at less than 100%, possibly playing until it hurts, *"you can get off the field at any time, someone will replace you"* (Huber et al., 2009). Considering the athlete's well-being, it is desirable that the decision to return to sport is made more consciously, based on a thorough health and risk analysis. Normative tools such as StaRRT can help in this.

The Strategic Assessment of Risk and Risk Tolerance (StARRT) strategy was created to facilitate the decision to return to sport after a musculoskeletal injury (Shrier, 2015). The starting point for the creation of StaRRT was the return-to-sport decision-making model published in 2010 by Creighton et al. In this model, the decision process was based on the analysis of three groups of factors: medical factors, sports factors that may modify the risk associated with returning to sports, and factors modifying the decision to return to sports. In the StaRRT, the way of looking at the problem has changed a bit. The StaRRT assessment assumes that the decision to return to sport should be based on an assessment of the risk associated with this return and comparing it with risk tolerance. If the risk assessment is higher than the risk tolerance, a decision should be made to postpone the return to sport. In the first stage of the assessment according to the StaRRT model, it is estimated from the available information what load can be applied to the athlete's body before it is damaged. The tissue damaged in a sports injury should have optimal conditions for healing. Any stress on the tissue can interfere with the healing process. Therefore, the next step in the StaRRT model is to assess how the stresses of the planned sports activity may affect the risk of re-injury. The psychological readiness of the athlete is also considered at this stage of the return to sport decision process. In the last, third step of deciding to return to sport, the threshold of acceptable risk should be determined. This is not an easy task, because the risk acceptance threshold is highly subjective and largely depends on the athlete's personality traits and the values that guide the community that surrounds the athlete. For example, from a medical point of view, it can be determined that returning to sport is beneficial if the risk of re-injury is no more than 10%. But if an athlete has a vision of not competing in the Olympics and is at risk of depression because of it, the acceptable risk of re-injury can be raised to 15 or even 20%. The structure of the risk assessment and risk tolerance strategy is shown in Figure 1 below.

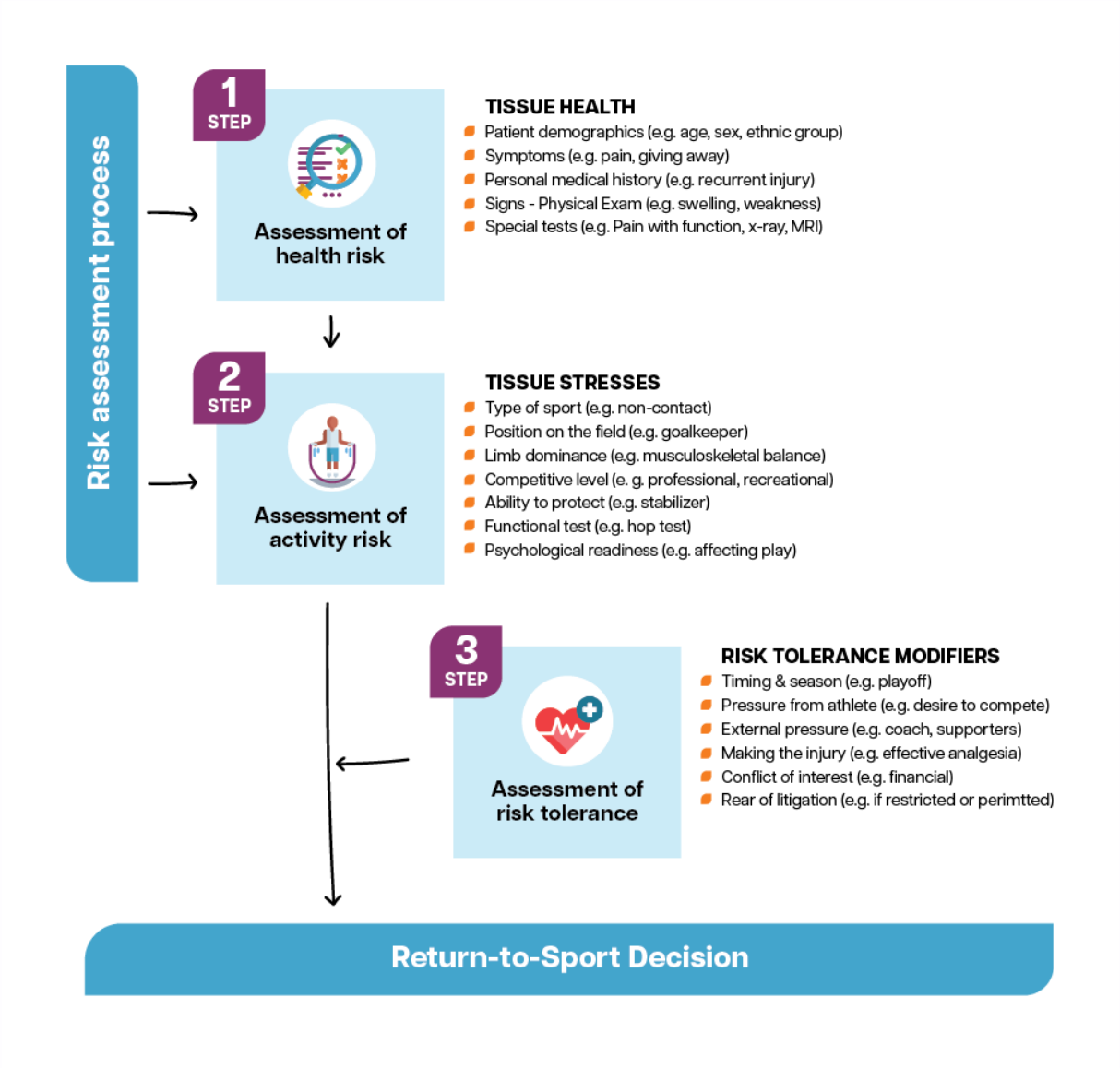

Figure 1 Strategic Assessment of Risk and Risk Tolerance framework, reproduced from Shrier, I. (2015). Strategic Assessment of Risk and Risk Tolerance (StARRT) framework for return-to-play decision-making. British journal of sports medicine, 49(20), 1311-1315.

11.5.1 The decision-making process for returning to sport

The decision-making process for returning to sport will be shown using the example of the athlete after ACL reconstruction, so a brief reminder is given below about the structure of the knee joint and the basic clinical tests that examine this joint (especially ligament and meniscus tests, as these are the structures that are most often damaged in sports injuries).

Structure of the knee joint

The knee joint is the largest and most commonly injured joint. Basic information on the structure of this joint and the ligaments that stabilise it is included in the table below.

Table 19. Characteristics of the knee joint (own elaboration based on Bochenek and Reicher, 2002)

Knee joint		
Joint surfaces	Convex surface	Condyles of the femur
	Concave surface	Tibial condyles
Mobility	Flexion - Upright	Maximum flexion is about 130 º of active flexion and about 160 º of passive flexion until the heel touches the buttock. At full extension, the shank and thigh are in alignment
	External rotation - Internal rotation	The range of outward rotation is greater than the range of inward rotation and varies with the degree of flexion of the knee joint. Rotation of the knee joint is not possible at full extension
Denervation	Nerve branches from the femoral, tibial, common fibula and obturator nerve	
Meniscus	Medial malleolus	Longer, wider, less curved, more firmly attached and less mobile, therefore much more frequently damaged.
	Lateral meniscus	Shorter, more strongly curved, more annular.
Ligaments	Patellar ligament	Extension of the tendon of the quadriceps muscle of the thigh, running to the tibial tuberosity
	Tibial collateral	From the medial epicondyle of the femur to the proximal end of the tibia on the medial side, inhibits the knee valgus movement
	Sagittal collateral	From the lateral epicondyle of the femur to the lateral surface of the head of the fibula, it inhibits the knee's rotation movement
	Front cross	From the posterior edge of the lateral condyle of the femur to the anterior intercondylar field of the tibia, does not allow the shin to extend forward relative to the thigh
	Rear cross	From medial femoral condyle to posterior tibial intercondylar field, shorter, stronger, steeper than anterior cruciate, does not allow posterior movement of tibia relative to thigh

	Oblique popliteal	From the lateral condyle of the femur to the posterior aspect of the joint capsule, fascia of the popliteus muscle and tendon of the semitendinosus muscle, inhibits over-extension and rotational movements
	Arcuate popliteal	From the lateral condyle of the femur to the posterior aspect of the joint capsule under the popliteal ligament, strengthens the posterior wall of the joint capsule
	Transverse ligament	Connects the anterior horns of the meniscus, tightens with outward rotation of the lower leg

Diagnostic tests

The most commonly used and considered to be the most accurate and reliable clinical tests of the knee joint are described below. The tests should be performed on the injured limb and the healthy limb and the results compared.

Anterior cruciate ligament assessment

Anterior drawer test

The examinee lies on his or her back and the therapist sits on the edge of the recliner on the side of the limb being tested, which is bent at the knee joint to a 90 º angle with the shin rotated outwards and the foot stabilised by the patient's thigh. The test subject tries to relax the muscles as much as possible. The therapist embraces the lower leg of the test limb just below the knee joint with both hands and pulls it forward trying to move it in relation to the thigh. More than 5 mm of forward extension of the lower leg indicates moderate and more than 10 mm indicates severe anterior cruciate ligament damage. Note that the test may be falsified if the posterior cruciate ligament is damaged at the same time.

Figure 2 Anterior drawer test

Lachmann test

The subject lies on their back and the therapist stands next to the recliner on the side of the lower limb being tested. The therapist stabilises the thigh from the ventral side with one hand, stabilises the lower leg from the dorsal side with the other hand and bends the test knee to an angle of approx. 15-30 °. The therapist then attempts to extend the shin forward relative to the thigh. Damage to the anterior cruciate ligament is indicated by forward extension of the shin by more than 5 mm and soft end resistance. The subject should relax the muscles as much as possible during the test.

Figure 3 Lachmann test

Pivot-shift test

The test subject lies on their back and the therapist stands next to the recliner on the side of the lower limb being tested. The therapist places one hand on the dorsal side of the knee joint palpating the anterior edge of the tibia, while the other hand embraces the subject's foot. The therapist then internally rotates and slightly valgus the lower leg of the test limb then, maintaining this position, straightens and flexes the knee. Anterior cruciate ligament damage is evidenced by anterior displacement of the shin in the knee extension position. When the knee is flexed, the patellofemoral band pulls the tibia back to its original position.

Figure 4 Pivot-shift test

Evaluation of the posterior cruciate ligament

Gravity drop test

The subject lies on their back and the therapist stands next to the recliner on the side of the lower limb being tested. The therapist flexes the test limb to a 90o angle at the hip and knee with one hand supporting the foot, the other hand holding the lower leg just below the knee joint. The therapist then takes the hand away from the knee area and observes if the tibia drops and the contour of the knee joint changes. This reaction is indicative of damage to the posterior cruciate ligament.

Figure 4 Gravity drop test

Back drop test

The client lies on their back and the therapist stands next to the couch on the side of the lower limb which is bent at the hip and knee with the foot resting on the surface of the couch. The test person tries to relax the muscles as much as possible. In the case of a posterior cruciate ligament injury, the proximal end of the lower leg drops under the influence of gravity and a posterior drawer sign is seen.

Figure 5 Back drop test

Evaluation of knee joint stability

External rotation and hyperextension test

The client lies on their back and the therapist stands next to the couch at the client's feet. The test person tries to relax the muscles as much as possible. Hold the forefoot and lift both feet slightly above the surface of the couch. Knee flexion with simultaneous external rotation of the shin in response to foot elevation is indicative of posterolateral instability and may be due to failure of the knee capsule in this area, damage to the anterior or posterior cruciate ligament, failure of the popliteal ligament, fibular collateral ligament, damage to the tendon of the biceps femoris muscle or the iliotibial band.

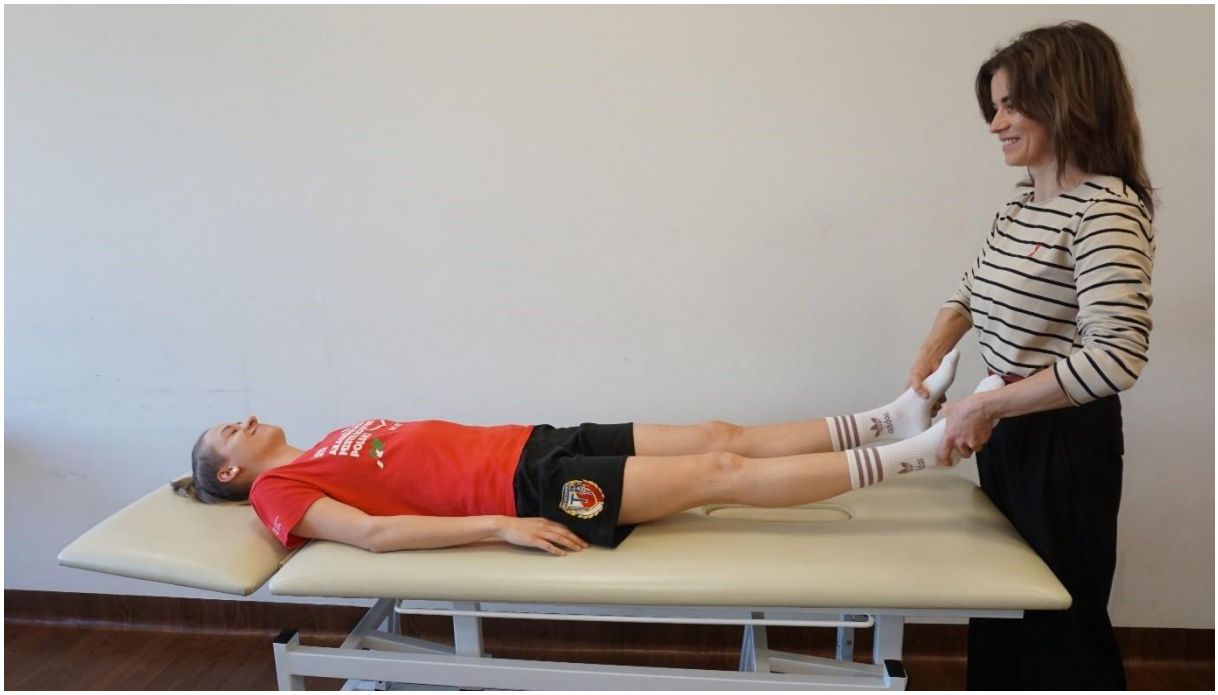

Figure 6 External rotation and hyperextension test

Valgus stress test and varus test

The test subject lies on their back and the therapist stands next to the recliner on the side of the lower limb being tested. Placing one hand on the proximal and the other on the distal part of the lower leg, the therapist tries to position the test limb first in valgus and then in talus of the knee joint. A positive valgus sign indicates damage to the tibial collateral ligament and medial instability of the knee joint, while a positive patellar sign indicates damage to the fibular collateral ligament and lateral instability.

Figure 7 Valgus stress test

Figure 8 Varus test

Meniscus evaluation

Bragard test

The subject lies on their back and the therapist stands next to the couch on the side of the lower limb being tested. The therapist bends the test limb to a 90o angle at the hip and knee joint with one hand supporting the foot, placing the other hand on the knee joint so that the thumb and index finger can feel the lateral and medial part of the joint crevice. The therapist then straightens the knee under examination with the shin in external rotation, to then repeat the same manoeuvre with the shin in internal rotation. Pain over the medial aspect of the knee joint talus that occurs when the knee is straightened with the shin in external rotation indicates

a medial meniscus injury. Pain over the lateral aspect of the knee joint talus that occurs when straightening the knee with the lower leg in internal rotation is indicative of a lateral meniscus injury.

Figure 27 Bragard test for the medial meniscus

Figure 10. Bragard test for the lateral meniscus

McMurray test

The test subject lies on their back and the therapist stands next to the recliner on the side of the lower limb being tested. The therapist supports the foot with one hand, places the other hand on the knee joint and flexes the test limb as far as possible at the hip and knee joint. The therapist then rotates the shin outwards and straightens the knee to a 90o angle, bends the knee again, rotates the shin inwards and straightens again to a 90o angle. If the posterior horn of the medial meniscus is damaged, pain occurs during straightening with external rotation of the shin. If the posterior horn of the lateral meniscus is damaged, pain occurs during straightening with internal rotation of the shin.

Figure 11 McMurray test for the medial meniscus

Figure 12 McMurray test for the lateral meniscus

Childress symptom

The examinee stands, the therapist stands next to him and observes his reactions. The examinee tries to perform a full squat and take several steps in each direction in this position. If the posterior horns of the meniscus are damaged, the examinee cannot assume a full squat position and/or take squat steps due to pain. Pain during the performance of this test may also result from increased osteoarthritis of the knee joint.

Figure 13 Childress symptom

Payra's sign

The subject sits in a cross-legged position. The therapist places his hands on the inner surface of the subject's knee joints and presses towards the ground. The examinee feels pain if the posterior horns of the medial meniscus, which are compressed in the cross-legged sitting position due to knee joint flexion and external rotation of the lower extremities, are damaged.

Figure 14 Parya's sign

Knee joint tenderness test

The client lies on their back and the therapist sits on the edge of the couch on the side of the lower limb being tested. The test limb is bent at the hip and knee and the foot is supported on the surface of the couch. The therapist holds the knee with one hand, stabilising the thumb and index finger on the medial and lateral malleolus, and the other hand grips the subject's foot. When examining the medial meniscus, the therapist rotates the shin outwards and tries to gently push the finger into the medial side of the knee joint crevice. When examining the lateral meniscus, the therapist rotates the shin inwards and tries to gently push the finger into the knee joint crevice on the lateral side.

Figure 15 Knee joint talar tenderness test for the medial meniscus

Figure 16 Knee joint tenderness test for the lateral meniscus

Lower limb dynamic tests

The tests presented below are designed to check whether an athlete after an injury and ACL reconstruction is ready to return to sport. To ensure the athlete's safety, you need to know that he is not in pain, has no signs of inflammation, no feeling of knee instability, or any visible compensation. The therapist should be sure that the athlete is prepared to perform the

exercises that are part of the tests, has adequate muscle strength and range of motion, has performed agility, running and plyometric exercises with you, and tolerates them well.

10 Single Leg Squats Test

The athlete's task is to perform 10 squats on one leg. The bending angle of the knee must be a minimum of 60°. The task is passed if the athlete efficiently performs 10 squats without any problem, loss of balance, or pain. It is required that the knee moves in alignment and does not deviate into valgus or varus. The athlete performs the test for both lower limbs.

Figure 17 Single Leg Squats Test

Single Leg Forward Hop Test

The athlete stands on the marked line and, starting from a single-legged position, performs a long jump as far as possible, landing on the same foot. After landing, the athlete should maintain balance. The test is performed on both legs. The task is passed if the distance of the jump landed on the involved leg is at least 90% of the result for the uninvolved leg.

Figure 18 Single Leg Forward Hop Test

Single Leg Triple Hop Test

The athlete stands on the marked line and, starting from a single-legged position, performs three long jumps in direct succession, as far as possible, and lands on the same foot each time. After landing, the athlete should maintain balance. The test is performed on both legs. The task is passed if the distance of the jump landed on the involved leg is at least 90% of the result for the uninvolved leg.

Figure 19 Single Leg Triple Hop Test

Timed 6-meter Single Leg Hop Test

The athlete stands on one foot on the marked line and jumps as fast as possible landing on the same foot to the line 6 meters away. The athlete should maintain balance during the test. The task is passed if the time taken to cover 6 meters while jumping on the involved and uninvolved leg differs by no more than 10%.

Figure 20 Timed 6-meter Single Leg Hop Test

Single Leg Triple Crossover Hop Test

The athlete stands on one leg on a marked line and performs three jumps forward and diagonally medially at a 45° angle as far as possible, landing on the same foot each time. After landing, the athlete should maintain balance. The task is passed if the distance of the jump landed on the involved leg is at least 90% of the result for the uninvolved leg.

Figure 21 Single Leg Triple Crossover Hop Test

Single Leg Lateral Hop Test

The athlete stands with one foot on the marked line and jumps to the side as far as possible landing on the same leg. After landing, the athlete should maintain balance. The task is passed if the distance of the jump landed on the involved leg is at least 90% of the result for the uninvolved leg.

Figure 22 Single Leg Lateral Hop Test

Single Leg Medial Hop Test

The athlete stands with one foot on the marked line and jumps medially as far as possible landing on the same leg. After landing, the athlete should maintain balance. The task is passed if the distance of the jump landed on the involved limb is at least 90% of the result for the uninvolved limb.

Figure 23 Single Leg Medial Hop Test

Single Leg Lateral Rotating Hop Test

The athlete stands on the marked line on one foot, jumps up, while rotating sideways in the air, and lands on the same leg. After landing, the athlete should maintain balance. The task is passed if the athlete is able to perform at least 90% of the rotation obtained on the uninvolved leg while jumping on the involved leg.

Figure 24 Single Leg Lateral Rotating Hop Test

Single Leg Medial Rotating Hop Test

The athlete stands on the marked line on one foot, jumps up while rotating medially in the air, and lands on the same leg. After landing, the athlete should maintain balance. The task is passed if the athlete is able to perform at least 90% of the rotation obtained on the uninvolved leg while jumping on the involved leg.

Figure 25 Single Leg Medial Rotating Hop Test

Single Leg Vertical Hop Test

The athlete stands on one foot and, raising his hand on the same side of the body, jumps up trying to reach as high as possible. The result is the height the athlete reached with his fingertips. The task is passed if the jump height on the involved leg is at least 90% of the jump height on the uninvolved leg.

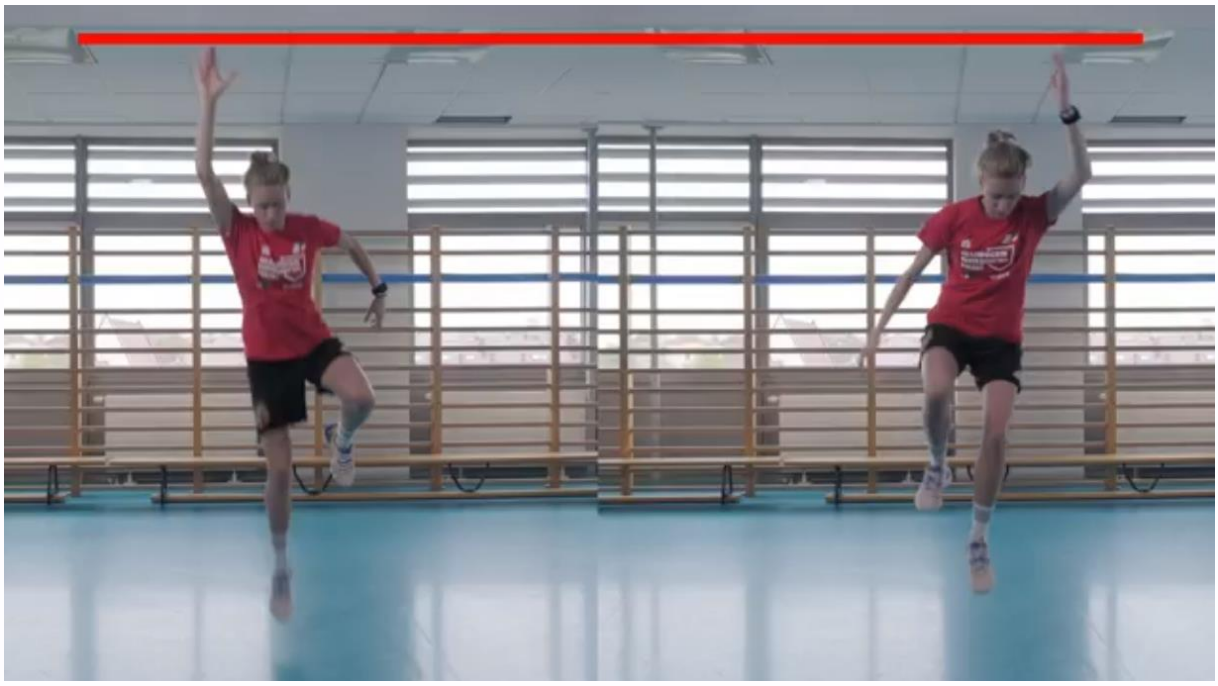

Figure 26 Single Leg Vertical Hop Test

Edgren Side-Step Test (ESST)

Five parallel lines should be stuck on the ground, spaced 1 meter apart, so that the distance between the extreme lines is 4 meters. The athlete stands on the outside of the left-most stuck line and, on the signal, begins to walk towards the right-most line, crosses it with both feet, and changes the direction of movement. The athlete tries to cover as much distance as possible in 10 seconds. The result is the number of 1-meter sections covered. The task is failed if the athlete does not cross the extreme line with the inside foot, crosses the legs or moves forward instead of to the side.

Figure 27 Edgren Side-Step Test

To sum up, it should not be forgotten how important is to ascertain the athlete's readiness to return to play before testing is carried out. According to the attending physician, can the athlete be tested if the muscle strength and range of motion are correct, the athlete does not feel pain at rest and during movement, there is no swelling and other disturbing symptoms, and the gait and run are normal, i.e., without pain, feeling of instability, compensation. It has not been clearly defined how many tests should be carried out, but it is important that they are not just tests consisting of forward jumps. Tests involving jumps to the side, medial, and with rotations may turn out to be crucial. The psychological readiness of the athlete is also important. It must not be forgotten that returning to sport is not the same as returning to competition. The competition requires tolerating full training sessions with opponents and contact (if the discipline requires it, e.g, judo).

In the Table below you can see what to look out for in the decision-making process regarding an athlete's return to play after injury.

Table 10 Criteria for making decisions about returning to sport after an injury (own elaboration based on the example: https://www.evolutionphysicaltherapy.com/post/acl-return-to-sport-testing-what-your-pt-should-look-at-before -clearing-you-to-return-to-sport/)

What should you measure	Why it's worth knowing	What result do you expect	How can you measure it
time since injury	you need to make sure that the tissues have had enough time to recover	depending on the type of injury, e.g. min. 9 months after ACL reconstruction	analysis of the athlete's medical history

symmetry of muscle strength of the right and left sides of the body	muscle strength asymmetry is strongly correlated with secondary injuries, symmetrical muscle strength is essential for proper movement technique / correct movement patterns	>90% symmetry	manual assessment of muscle strength, dynamometer, Biodex device or similar
muscle endurance	essential in running and many sports with repetitive movement patterns	satisfactory muscular endurance and >90% symmetry	adequate functional tests (e.g. toe raises for calf muscles), dynamometer, Biodex devices
range of motion	the correct range of motion reduces the risk of injury, allows to perform the correct movement without compensation, and generate maximum force	100% of the norm	goniometr
symmetry in dynamic tests, e.g., hop tests	using these tests you will assess explosive strength power, dynamic balance and landing mechanism, the asymmetry of these elements in the involved and uninvolved limb is strongly correlated with secondary injury	>90% symmetry	adequate tests e.g. those contained in the e-manual
athlete's readiness to return to the game	strongly correlated with the risk of secondary injury	interpretation consistent with the recommendations for a specific scale or questionnaire	validated scales and questionnaires, you can use those proposed in the lesson or in the e-manual

In the process of assessing an athlete's readiness to return to sport after an ACL injury, you can use the gptpw examination protocol available at: https://www.melbourneaclguide.com/docs/ACL_Guide.pdf (access date: 21.04.2024)

It should be remembered that the primary task of the physiotherapist and the entire medical care team, the coach and the athlete himself is to prevent injury, to prevent the injury that has occurred from worsening and/or the appearance of another injury as a consequence of the primary injury (Meeuwisse et al., 2007).

Klügl et al. (2010) list three sports injury prevention strategies, which are related to:

- training, which should include full professional preparation, including attention to muscle strength, endurance and flexibility, level of coordination and balance, as well as discipline-specific technical skills;

- equipment and the organization of the athlete's environment, i.e. attention to the quality and fit of the athlete's footwear and clothing (including protective elements of sportswear), sports equipment, but also the proper preparation of the ground and the environment in which training and competitions take place;

- regulations, which should adequately govern the rules (including ethical rules) for the discipline.

Rehabilitation on the playing field

It should be remembered that one of the key elements of post-injury rehabilitation, which should by no means be overlooked, is rehabilitation on the field. This is the stage that combines rehabilitation in the gym or physiotherapy office with a full return to training and competition. Buckthrope et al (2019) described four pillars underlying this stage of rehabilitation. These include restoration of movement quality, improvement of physical fitness, re-education of movement patterns specific to the sport, and gradual introduction of full training load.

Rehabilitation after ACL reconstruction usually takes about 6 months, during which the athlete significantly improves muscle strength, joint range of motion, balance and coordination. Gym exercises, however, do not allow, for obvious reasons, to reproduce the conditions specific to a football player's normal training and match load. During the 90 minutes of a match, a soccer player covers up to 13 km running at varying speeds, often makes dynamic turns and stops, and quickly and often automatically decides on the next move while reacting to situations and the behavior of other players (Bangsbo, 1994). Lack of preparation for this load may partly explain the fact that 7% of football players experience a re-torn ACL less than 3 months after returning to play (Waldén et al., 2016).

Rehabilitation on the field should include individual training of technical skills, training with the ball in small groups and finally playing with the whole team. It is important to overtrain the technical elements of the game under the "pressure" of the real situation (unpredictable situations, real speed, interaction). New activities should be introduced gradually, giving the player as much time as he needs.

Figure 28 Stages of rehabilitation on the field (own elaboration based on Buckthrope et al., 2019):

The athlete should remember that spending the rehabilitation period in the gym or on the playing field is not a failure, but a result of reason and is intended to make the athlete safer and less likely to re-injure himself. In managing the pace of rehabilitation and motivating the player to persevere in the rehabilitation process, a well-trained physiotherapist, familiar with the specifics of soccer, who accompanies the player also during rehabilitation on the field, plays a huge role.

Intercultural communication recommendations

- Physiotherapists should educate themselves about the patient's cultural background, particularly regarding attitudes towards sports, achievement, and teamwork. Understanding these cultural nuances can help tailor the communication approach appropriately.
- Take the time to build a trusting relationship with the patient. Acknowledge their dedication to sports and their team, showing empathy for the impact the injury has on their identity and aspirations.

- Practice active listening to understand the patient's emotional state, concerns, and goals related to their sports involvement. Allow them to express their feelings without judgment or interruption.

- Validate the patient's emotions and the significance of sports in their life. Acknowledge their feelings of loss, frustration, or disappointment due to the injury's impact on their ability to play professionally.

- While maintaining empathy, provide realistic expectations about the recovery process and the possibility of returning to professional basketball. Help the patient understand the importance of prioritizing their health and well-being over immediate sports participation.

- Explore alternative avenues for the patient to remain involved in sports or contribute to their team in different capacities, such as coaching, mentoring, or sports administration. Emphasize the value of their experience and expertise beyond playing on the court.

- Suggest the option of seeking psychological support or counselling to cope with the emotional impact of the injury and transition away from professional sports.

- Emphasize the importance of physiotherapy and rehabilitation in achieving the best possible recovery outcomes. Provide personalized treatment plans tailored to the patient's needs and goals, considering their cultural attitudes towards health and wellness.

- Involve the patient in the decision-making process regarding their treatment plan and rehabilitation goals. Encourage them to take an active role in their recovery journey, empowering them to make informed choices about their health.

Recommendations typical for Polish culture

- In Poland family is extremely important. Every important event in a young person’s life is usually widely discussed by family members. The final decision regarding the event or issue, while taken by the young person, is expected to comply with the advice received from parents.

- In the Polish context of healthcare the doctor and/or the therapist advise the patient, showing various options, but it is the patient who must make the decision which option/treatment he/she will undergo. It may happen (as it is shown in the video) that he opinions of the members of the therapeutic team differ significantly.

- Sportspeople are considered to be both physically and emotionally strong, which puts pressure on an individual sportsperson who wants to live up to the expectations. They are likely to take decisions to benefit the team, even if their health may suffer because of them.

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