Return to Sport after Anterior Cruciate Ligament Reconstruction: A Literature Review

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Introduction

For any individual sustaining an ACL injury there is the choice for a surgical reconstruction with rehabilitation and a conservative option with physiotherapy. e main indication foran individual to undergo ACL surgical reconstruction is the functional instability of the knee [5,6]. Many authors have proposed the Copers and Non-Copers theory presenting those who can be treated a er an ACL injury without surgical reconstruction (Copers) and those who have to go through a surgical procedure (Non Copers). Hurd et al. [7], showed with their study that in the short term 72% of their potential copers returned successfully back to their preinjury activities. Frobell et al. [8] showed not only that there was no signi cant di erence in KOOS4 (function during sport) scores between those who followed a surgical reconstruction and rehabilitation and those who followed rehabilitation and optional delayed reconstruction, but they also reported that 61% of those of the second group avoided surgery.

Whether athletes undergo an ACL surgery or not; their goal is the same: to return to sport. Return to sport is a very unclear de nition

possibilities to get reinjured than patients of an older age. Athletes having de cits on their strength and proprioception, have limited abilities to regain their sports skills and that can lead to an increased risk of re injury [32,33,45,46]. Although, authors have shown that the gra type is not a risk factor for return to sport [42,47] and a recent study a er comparing bone patella tendon bone gra (BPTB) with hamstring autogra showed no di erence between the two gra s on return to sport [48-50], Bochers et al. [51] showed that the use of allogra is a high risk factor for ACL gra failure when these patients attempted to return to high level sports activities.

Taking into consideration all the above described risk factors and examining the rates of return to sports activities, literature presents many di erent outcomes. Some studies show rates of return to some kind of sport participation as high as 75% while others present the rate of return to competitive sports a er ACL reconstruction as 64% [52,53]. Later studies by giving a more speci c de nition of returning to sport, reported only 33% rate of returning to competitive sports at same pre injury level [9]. A recent review has shown that generally 82% of their patients returned to some kind of activity, 63% took part in their pre injury activity and only 44% participated in competitive sports [54]. All the above rates look to decrease even more with time. Brophy et al. [3] reported that 72% of their athletes resumed to play a er ACL reconstruction and at 7 years follow up only 36% of those athletes were still playing soccer. Another study examining an even longer follow-up showed that the rate of participation in competitive pivoting sports went down from 65% at 2 years a er ACL surgery to only 19% at 13.5 years follow-up [55]. What comes up by reviewing the literature is that return to sport a er an ACL injury at the same preinjury level is much less common than it should be expected and that short term success does not really guarantee the long term participation in the same competitive level [56]. Dunn and Spindler [57] suggested that when an athlete has a high pre injury activity level then it is more likely that this individual will return to sport at least at 2 years post ACL reconstruction.

What are the other factors that can make a rehabilitation program successful and reassure a successful return of the patients to the activities that they are willing to practice? Clinicians should keep in their mind that successful return to sport is multi factorial and in uenced by many di erent factors. Today it is generally believed that muscle strength [52] neuromuscular control [58,59], fear of re injury [9,52] and perceived level of knee function [60-62] are probably the most important factors a ecting a successful return to sport a er ACL reconstruction.

Muscle Strength

It is well supported in the literature that quadriceps strength is highly correlated with good outcome post ACL reconstruction [63-66] and de cits in quadriceps strength are associated with low self-reported function and performance measures [67]. De cits on quadriceps strength have been shown to predict performance based functions better than other factors, like gra type, knee pain or asymptomatic knee [67]. e same authors concluded that quadriceps strength de cits of more than 15% are negatively correlated with function and performance a er ACL reconstruction. Although hamstrings are considered very important for the stability of the knee, there is no impact of hamstrings strength de cit on the performance of functional tests [68]. Yet, hamstrings are very important not only for exing the knee but also for reducing the ACL strain [69-71] and their strengthening should be of high importance.

e acceptable de cit on muscle strength before returning to sport as described by di erent authors varies from study to study but rates between 10% to 35% [41,68,72-75]. Ekstrand [71] suggested that the athlete before return to team training should have regained at least 90% of the muscle strength. Hartigan et al. [76] required 90% or more of quadriceps strength before return to sport. Van Grinsven et al. [77] accepted a de cit on hamstrings to quadriceps ratio of 15% or less for their patients before allowing them to return to sports activities. Literature reports that these de cits continue to exist even a er individuals return to sports [67,78-80] and it is even more prolonged for those individuals who had a BPTB gra for their reconstruction since the de cits in quadriceps strength is higher compared to those who had a hamstring gra [81].

Hamstring to Quadriceps ratio is also an important parameter discussed frequently in literature. ere are two types of suggested ratios. Conventional and functional ratios [82]. Conventional ratio (concentric hamstring peak torque/concentric quadriceps peak torque) has been criticized for lacking in functional relation. For this reason the functional ratio (eccentric hamstring peak torque/concentric quadriceps peak torque) [82] has been suggested. A functional ratio of less than 0.6 has been connected with increased risk of hamstring injuries [83], a 1:1 ratio is accepted as the reference value [84] and any value between 0.7 to 1 is accepted since it presents enough dynamic stability [85,86].

Neuromuscular Control/Functional Readiness

Good neuromuscular control is also considered as imperative following ACL reconstruction and can determine a successful return

LSI is one of the most frequently used criteria and an LSI greater than 85% is an acceptable value before a patient can return to sports activities [9,77,99,100]. e results of the hop tests are not only a good way to examine the readiness of an athlete before returning to sport, but it has been shown to be a good predictor of osteoarthritis development at 1 year post surgery [29].

Psychological Readiness

e psychological status of an athlete experiencing an ACL injury is of great importance in order to manage a successful return to his preinjury level. Langford et al. [52] suggested that the fear of getting injured again was a signi cant factor for not returning to their preinjury level of activity. Ardern et al. [54] reported that individuals who manage to go back to their preinjury level sport had a much lower fear of reinjury compared to those who did not manage to go back to this level. ere are also other psychological factors that can a ect the decision of an athlete to return or not, like concerns about the inability to perform at the same level, feeling of isolation from the team mates, lack of athletic identity and may be lack of social or family support [77]. From all the above factors, fear of reinjury has been stated to be the most common reason for retiring from sports, choosing another sport or going back to a lower level of participation [54]. Clinicians should take their patients through every stage of rehabilitation on a very progressive way. Progression from one phase to the other or from a simple set of exercises to more advances should take place only if patients are fully con dent and psychologically prepared [101].

Di erent psychological questionnaires focusing on knee injuries and even more speci c to ACL injuries can be a great tool to every clinician. Questionnaires can evaluate the psychological status of the patients and if needed, further assistance can be provided to the patients. ere are many questionnaires available, but the two most commonly used are KOOS and ACL-RSI. KOOS (knee injury and osteoarthritis outcome score) examines the subjective knee function by using 5 di erent subscales (symptoms, pain, function in daily life, function during sport or recreational activities and knee related quality of life) and a score from 0 to 100 comes out from each subscale where 100 means that the knee is fully functional [102]. Another

Only then they are allowed to return back to their sporting activities, suspecting they are well prepared for this and the chances for re-injury or secondary injury will be minimal.

ere is no one speci c criterion that can reassure a safe return to sport, but a holistic approach is suggested. All di erent factors a ecting recovery a er an ACL injury must be taken into consideration and lead the athlete to a safe return to the same pre injury level of participation.

is eld is open to future studies, to develop an ideal rehabilitation protocol which will allow athletes to return to sport on the best possible way.

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