

A retrospective analysis of return to sports after 9 months in athletes in cases of anterior cruciate ligament reconstruction.

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Abstract

Background: The anterior cruciate ligament (ACL) is responsible for maintaining stability of the knee joint, particularly in activities involving pivoting or kicking. The knee loses its stability if the ACL is ruptured and the joint may become more damaged over time. ACL reconstruction is the surgical treatment of choice. Aim of this study is to analyze the rate of return to sports after 9 months in cases of anterior cruciate ligament reconstruction.

Material & Methods: All cases operated for ACL reconstruction between the year 2017- 2020 were studied .This group included 80 patients with traumatic twisting, pivoting injury while playing sports, diagnosed with ACL tear, with instability at the knee joint .Exclusion criteria included avulsion injuries, meniscus involvement, posterior collateral ligament involvement, collateral involvement and any fracture of either femur or tibia involvement. The Scoring system used is ACL RSI (anterior cruciate ligament return to sport and injury scale).

Results: Total eighty athletes were included in this study. There was no association of symmetrical muscle function or quadriceps strength .The patients with a lower ACL RSI (anterior cruciate ligament -return to sport and injury scale) score had a lower rate of return to sports after 9 months post ACL reconstruction as well as a higher rate of secondary ACL injury.

Conclusion: Athletes operated for ACL reconstruction showed a low rate of return to their sports after 9 months. One of the potential concerns was with returning to sports the re-injury rate to the reconstructed ACL or to the other structures (cartilage, menisci or other ligaments) (1-3). Approximately 1 in 4 patients who are 25 years of age or younger and return to high-risk sport after primary anterior cruciate ligament (ACL) reconstruction sustain a second ACL injury (4).

Keywords: Anterior cruciate ligament reconstruction, return to sport activity.

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Introduction

The ACL is extra synovial collagenous structure which is intra-articular with limited healing capacity that originates at the posteromedial aspect of the lateral femoral condyle and crosses anteromedially to insert anterior to the intercondylar eminence of tibial articular surface. It is constituted by two functional bundles: the anteromedial (tight in flexion, 60-90°) and the posterolateral (tight

in full extension) (5, 6). It receives innervation from the posterior articular nerve, a branch of the tibial nerve, which supplies mechanoreceptors that play a vital role in proprioception. Hence, an ACL injury causes partial deafferentation and alters spinal and supraspinal motor control, thus affecting proprioception (7, 8).

The anterior cruciate ligament (ACL) injuries are amongst the most common and significant

knee ligament injuries occurring in athletes and evaluated by sports medicine practitioners. One of the most common mechanisms that affects females is called "position of no return," in which the athlete lands with an extended hip and knee, knee in valgus, internally rotated tibia, and a pronated foot (9, 10).

Women who participate in athletics are two to eight times more likely to sustain ACL injury than male counterparts in the same landing and pivoting sports (11, 12). Anterior cruciate ligament tear can occur due to both noncontact and contact mechanisms. Approximately 70% to 80% of the ACL tears occur due to noncontact mechanisms associated to landing from a jump, changing direction, or sudden deceleration.

Acute management after ACL tear consists of ligament reconstruction predominantly in young high-level athletes participating in high-demand sports and those with persistent functional knee instability(13,14). The primary function of the ACL is to prevent the excessive anterior tibial translation .This function is carried out mainly by the anteromedial fibers of the ACL .The other important function includes limiting the varus / valgus stress when the knee is in full extension and the rotatory movements which is the function of the posterolateral fibers (15). Significant stress upon the ACL is observed in the last 30 degrees of extension and hyperextension, along with valgus and internal rotation forces (16, 17).

Although not clearly established in many studies (18), several factors need to be evaluated when determining if the patient should return to play (return to sports) after injury or anterior cruciate ligament reconstruction (ACLR).

The first and most important question that the athlete will want answered is "When can I return to the sport?" after an ACL injury. Recently published literature has established that return to sports could be slower than was previously reported, and that better results are obtained after 9 months after reconstruction surgery (19,20).

The objective of this article is to analyze and evaluate the rate of return to sports by athletes after 9 months of ACL reconstruction surgery.

Materials and method

All cases admitted to tertiary care center with a diagnosis of post traumatic ACL tear and above were studied.

Exclusion criteria included ACL avulsion injuries, meniscus involvement, posterior collateral ligament involvement, collateral involvement and any fracture of either femur or tibia involvement.

Analysis of the number of athletes who returned to sports after their ACL reconstruction surgery was done. All procedures were performed by surgeons with a similar level of training.

The study done after following guidelines laid down by the department of orthopedics and all required consents were taken as per the criteria set forth by the declaration of good clinical practice by Helsinki.Pre-operative data such as age, sex, weight, pre-operative deformity, pre-operative knee function (pre injury level of activity/sport) and quadriceps strength and the absence of effusion was collected.

TABLE 1: Profile of patients included (n=50)

Age (yrs.)	Statistic	
Median	30	
Mean	28.56	
SD	7.38	
95% C.I. for mean	26.46 to 30.66	
Min.	18	
Max.	47	
	No.	%
Gender		
• Male	38	76.0%
• Female	12	24.0%
Side		
• Left	20	40.0%
• Right	30	60.0%

Pre-operative intervention:- Goals of pre-operative rehabilitation program included reducing the pain, inflammation, swelling, normal range of motion and gait. All patients in the study received prehabilitation with a good pre-operative protocol which included immobilization/stabilizing the knee joint post

knee injury with long knee brace, pain management with IV/oral analgesics and chymotrypsin/trypsin to reduce the swelling. After the pain and swelling subsided the focus of prehabilitation was shifted to regaining full range of movement at knee joint. Quadriceps strength was also given due importance pre-operatively. A 20% deficit in quadriceps strength before surgery, can predict a significant strength deficiency 2 years after surgery (21, 22).

	Median	Mean	SD	95% CI	Min.	Max.
Emotions						
1. Are you afraid of accidentally injuring your knee by playing your sport	50	49.80	17.90	44.71 to 54.89	10	90
2. Are you confident about your ability to perform well at your sport	50	49.40	19.21	43.94 to 54.86	10	100
3. Are you confident about your knee holding up under pressure	50	51.80	20.97	45.84 to 57.76	10	100
4. Are you confident that you can perform at your previous level of sport participation	50	48.80	17.80	43.74 to 53.86	10	100
5. Are you confident that you could play your sport without concern for your knee	40	47.80	17.65	42.79 to 52.82	20	90
Confidence in performance						
6. Are you confident that your knee will not give way by playing your sport	50	51.00	21.78	44.81 to 57.19	20	100
7. Are you fearful of reinjuring your knee by playing your sport	50	51.40	20.70	45.52 to 57.28	20	100
8. Are you nervous about playing your sport	50	50.60	21.80	44.41 to 56.80	10	100
9. Do thoughts of having to go through surgery and rehabilitation again prevent you from playing your sport	50	51.80	18.37	46.58 to 57.02	10	100
10. Do you feel relaxed about playing your sport	50	50.80	20.19	45.06 to 56.54	20	100
Risk appraisal						
11. Do you find it frustrating to have to consider your knee with respect to your sport	50	50.20	18.46	44.95 to 55.45	20	90
12. Do you think you are likely to re injure your knee by participating in your sport	50	46.00	22.32	39.66 to 52.34	10	90

TABLE 3:- ACL-RSI sub-domain scores and total scores

	Median	Mean	SD	95% CI	Min.	Max.
Emotions	45	48.84	17.77	43.79 to 53.89	20	88
Confidence in performance	46	51.00	16.65	46.27 to 55.73	22	80
Risk appraisal	45	50.10	18.36	44.88 to 55.32	15	100
ACL-RSI total score	46.67	49.95	16.75	45.19 to 54.71	25	85.83

Operative management:-The factors that influenced the outcome of ACL reconstruction surgery were anatomical position, tensioning,

tunnel position and graft choice (23,24,25). Two grafts are commonly used for such a procedure either an auto-graft or an allograft. Less failure rates have been reported in auto-grafts as compared to all-grafts in young athletes. Among the most commonly used auto-grafts are the bone-patellar tendon-bone (BTB) and hamstring tendon (HT) (26). BTB auto-graft allows for bone-to-bone healing, while achieving better graft strength and stable positioning relative to screw fixation (27). Recent literature suggests that the tunnel placement preferred by surgeons is the 11 o'clock position on the frontal view of the knee. Biomechanical studies have suggested that this femoral tunnel placement could not satisfactorily achieve the needed rotatory knee stability, whereas a more lateral placement towards the footprint of the PL bundle, i.e., the 10 o'clock position yielded better results (28). All tunnel placement in the athletes operated were at the 10 o'clock position. Still, it has been shown that there is no single position that could produce the rotatory knee stability close to that of the intact knee (28).

Post-operative factors:-The factors that play an important role in successful rehabilitation after ACL reconstruction surgery are a participation in a good rehabilitation program, psychological readiness and time from surgery. Progressively, emphasis was given on strengthening programs including closed and open kinetic chain (OKC) exercises, neuromuscular control, balance/proprioceptive exercises, and subsequent sport-specific training (29, 30, 31, 32).

Physiotherapy:-

Goals post-operatively:-

1. Control pain and swellings
2. Care for the knee and dressing
3. Early range of motion exercises
4. Achieve and maintain full passive extension
5. Prevent shutdown of the quadriceps muscles
6. Gait training

Weight bearing status- This applies to all ACL reconstruction unless otherwise specified.

1. Day 1-7 = 50% body weight (2 crutches).

2. Day 8-14 = 50-75% body weight (1 crutch).
3. End of week 2 = full weight bearing.

After 2 weeks postoperatively after 2 weeks:-

Goals:-

1. Maintain full extension
2. Achieve 100 - 120 degrees of flexion
3. Develop enough muscular control to wean off knee immobilizer
4. Control swelling in the knee

After 4-6 weeks of surgery:-

Goals:

1. 125 degrees of flexion pushing toward full flexion
2. Continued strength building

Complication: Amongst our limited study group we found 2 cases of post-operative stiffness which presented as lack of full ROM in extension within 2 weeks, one of the reasons for such a complication may have been placement of femoral and tibial tunnel or tensioning of graft at near terminal extension. These patients were advised aggressive post-operative rehabilitation which showed good results and the athletes regained full extension. Such complications can also be managed by drop out casting or in severe cases arthroscopic adhesiolysis specifically in refractory cases. In cases where full flexion isn't achieved manipulation under anesthesia may help to regain lost flexion (33).

Statistical analysis-The return to sports was calculated based on a follow up kept over a time of 9 months to analyze the number of athletes who return to their sports after 9 months .A total of 80 athletes were considered for this study, out of which based on the exclusion criteria 25 patients were eliminated due other associated injuries along with ACL injury, from the 55 athletes included 5 were lost during follow up .The final analysis group included 50 patients. Scoring system used is ACL RSI (anterior cruciate ligament return to sport and injury scale).

The ACL-RSI comprises 12 questions where patients grade their answers on a Likert scale ranging from zero to 100 with ten-point increments (34). Higher scores indicate

greater psychological readiness towards RTS (35).

Results

Eighty athletes were considered in this study, from which fifty athletes completed the study. The main reason for exclusion was other ligament and/or meniscus involvement. The athletes had an average age (mean age =28.56) . Only 55% athletes returned to strenuous sports between a time of 6 to 12 months. After returning to sports and answering the questionnaire, time ranged from 5 days to 2 months.

The study also suggested that athletes who returned to sports at 9 months showed a lower rate of re-injury as compared to those who returned earlier. Based on the results of the questionnaire, it can be suggested that athletes who scored low on the questionnaire were higher in number as compared to those who scored higher.

The study also showed a direct correlation between a low ACL-RSI score and a low rate of return to sports by athletes. These findings can be attributed to various reasons such as decreased level of confidence, fear of re-injury, increased level of frustration having to consider the knee while playing, fear of having to under-go rehabilitation again, increased level of nervousness while playing the sport, worry about the knee holding up under pressure while playing and lastly fear of suffering through similar pain which occurred after the first injury.

Discussion

The most important finding of the present study was Psychological and physical readiness to RTS does not necessarily coincide. Studies based on evaluating the physiological readiness are hence both warranted as well as necessary. This assessment with the ACL-RTI was performed approximately 9 months after surgery with help of a valid and easy to answer questionnaire.

Various studies demonstrate that patients who receive prehabilitation are able to recover full ROM, have lower risk of developing knee

stiffness and arthrofibrosis after surgery, improve quadriceps activation, and reduce muscle atrophy caused by loss of neuromuscular control (36, 37). It was also noted that loss of ROM, particularly knee extension pre-operatively, leads to unfavorable results after ACLR (38).

Laboratory studies have found that an initial graft tension of 88 N resulted in an overly constrained knee, while a lower initial graft tension of 44 N would be more suitable (39). On the contrary, an in vivo study on goats found no significant differences in knee kinematics and in situ forces, between high (35 N) and low (5 N) initial tension groups at 6 weeks after surgery (40). Thus, the literature is confusing and definitive answers on initial graft tension remain unknown (41). There are advocates of early and aggressive postoperative rehabilitation as well as neuromuscular training to help athletes return to sports as early as possible (42). On the other hand some studies suggest that RTP is more dependent on the postoperative rehabilitation program than the graft selection and tensioning (43, 44).

As traditional single bundle ACL reconstruction could not fully restore rotatory knee stability, investigators have explored anatomic double bundle ACL reconstruction for ACL replacement (45, 46, 47, 48). Biomechanical studies have revealed that an anatomic double bundle ACL reconstruction has clear advantages in terms of achieving kinematics at the level of the intact knee with concomitant improvement of the in situ forces in the ACL graft closer to those of the intact ACL, even when the knee is subjected to rotatory loads (49).

Many rehabilitation protocols have been described such as the accelerated program that was initially described by Shelbourne and Nitz (50). A subsequent study demonstrated no difference in subjective or objective outcomes after ACLR between accelerated and traditional rehabilitation programs (19 vs 32 wk) in patients with BTB autografts (51).

In addition to physical readiness, fear of re-injury due to the physiological state of the patient also plays an important role in

returning to sports participation. Although not routinely used, there are several scoring systems available to address the psychological state after ACLR (52). For example, the Tampa Scale for Kinesiophobia (53) and ACL Return to Sport after Injury Scale (54). There are multiple causative factors for symptom recurrence, including but not limited to repeat trauma, infections, technical errors, lack of biologic healing or fixation, or some combination of these causes (55, 56). The percentage of graft failures and contralateral tears has been reported to occur in between 4% and 27% of reconstructed patients, with a higher percentage occurring in the first year (57, 58). A young athlete returning to sport within 1 year of surgery is 15 times more likely to suffer a second ACL tear when compared with a healthy athlete (59). Among the technical factors that can influence and increase the amount of recurrent injuries, tunnel malposition should be highlighted, with the femoral insertion being the primary cause (60). Ideally, proper tension should avoid the laxity caused by the insufficient ligament; without causing overt constriction that may lead to increased joint contact pressures and resultant collagen myxoid degeneration and intra-substance graft necrosis (61). Various studies have shown that using allografts in patients under 25 years of age have a higher likelihood of failing, particularly those allografts that have been irradiated (62, 63). When comparing auto-grafts, multiple systematic reviews have been published with mixed results, leading some surgeons to select the harvest site depending on surgeon comfort or based on anatomy and sport-specific demand (64, 65). The MARS group reported that 7% of failures may be attributed to biologic causes (66).

Conclusion

The study results support the clinical observation that the patients who score poorly on the ACL-RSI score system performed poorly and also showed a lower rate of return to their sport. Hence for the current athletes as well as young and active population it is acceptable to infer that the ability of a post ACL reconstruction patient to active life style or their sport is closely related to the ACL-RSI score. In the above study out of a total of 38

male athletes and 12 female athletes (table-1) the ones who returned to pre-injury activity scored significantly higher on ACL-RSI score as compared to those who scored low on the ACL-RSI score. Based on the questionnaire (table-2) it was noted that (mean=48.80) athletes only had the confidence that they would be able perform at their pre-injury level in their sport. It was also taken into account that (mean= 51.50) athletes had a fear of re-injury. A mean of the total ACL-RSI score of this study was only 49.95 (table-3), which also indicates a low rate of return to sports after 9 month of ACL reconstruction amongst athletes. These findings are in coherence with growing evidence that suggests the validity of

the ACL-RSI score and also implies that surgeons need to use both physiological and physical tests in their evaluation of the readiness to return to sports after ACL reconstruction surgery in athletes.

Abbreviations

- ACL- anterior cruciate ligament.
- ACL RSI - anterior cruciate ligament return to sport and injury scale.
- ACLR - anterior cruciate ligament reconstruction.
- BTB - bone-patellar tendon-bone.
- HT-hamstring tendon.
- OKC - open kinetic chain.

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