

Return to Sports After Anterior Cruciate Ligament Reconstruction – A Review of Patients with Minimum 5-year Follow-up

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Abstract

Introduction: It is difficult to counsel the anterior cruciate ligament (ACL) deficient patient considering surgical reconstruction on the likelihood of eventual return to sports as information on this is lacking, especially in the Asian context. We wanted to determine how many of our patients who had ACL surgery returned to their previous levels of sports, 5 years after their surgery. For those that had not returned to their previous levels of sports, we wanted to identify their reasons for not doing so. **Materials and Methods:** Based on our inclusion criteria of a minimum 5-year follow-up after primary ACL reconstruction, 146 patients were identified for assessment. Sixty-four patients were successfully recalled. The mean age of our patients was 24.8 years (range, 18 to 40). The patients completed the Lysholm Knee, Tegner activity and the Subjective International Knee Documentation Committee (IKDC) questionnaires. Clinical examination of the operated knee was performed according to the Objective IKDC evaluation form and with a KT-1000 arthrometer. **Results:** The mean Lysholm score was 85.2 and the mean subjective IKDC score was 79.5. 81.2% of our patients had normal or nearly normal knees (IKDC A or B) with the remaining 18.8% at IKDC grade C. The mean side-side difference for anterior translation using the KT-1000 arthrometer was 1.2 mm. The median pre-injury Tegner activity level was 7 and the median 5-year post-surgery Tegner activity level was 6. Nineteen patients did not return to their pre-injury sports levels because of social reasons and were excluded. From the remaining 45 patients, 28 patients (62.2%) returned to their previous level of sports and 17 patients (28.8%) did not return to their previous level of sports. Of whom, 9 (20%) said that they did not return due to fear of re-injury and the remaining 8 (17.8%) said they had not returned because of knee instability and pain. At 5 years, the subgroup of patients who had returned to sport had the best scores: Lysholm (88.5), subjective IKDC (84.6) and IKDC Grade A&B (89.3%). When we compared this with the subgroups that did not return to sport because of fear of re-injury and because of an unstable knee, we found that the difference in knee outcome scores between these 3 groups were statistically significant. **Conclusion:** Sixty-two per cent of our patients returned to their previous level of sport at 5 years after ACL reconstruction. Fear of re-injury is an important psychological factor for these patients not returning to sports. Our results would allow the attending surgeon to counsel the ACL deficient patient who is considering surgical reconstruction the likelihood of eventual return to sports.

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Introduction

Complete anterior cruciate ligament (ACL) rupture results in a mechanically unstable knee. ACL reconstruction is recommended in athletes to help restore knee stability for return to pivoting sports. It has also been established that an active individual with a non-functioning ACL is susceptible to meniscal injury.¹

Unrestricted participation in sports and return to the pre-injury level is often considered an indicator of the success

of ACL reconstruction. The results on return to sports after ACL reconstruction have been varied.²⁻⁶ The ability of the patients to return to sports after ACL reconstruction is governed by various factors which include the postoperative knee function, social reasons, psychological hindrances such as fear of re-injury and even monetary considerations in professional athletes.

There is a lack of literature in the Asian context regarding return to sports after ACL reconstruction. This makes it

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difficult for the attending physician to counsel the ACL deficient patient who is considering surgical reconstruction on the likelihood of eventual return to sports. Figures quoted from literature in studies done in the Western world may not be directly relevant to our Asian context due to difference in culture and attitudes towards sports.

We undertook a review our patients 5 years after ACL reconstruction to determine how many of them returned to their previous activity levels. We wanted to find out the reasons for them not returning to their previous levels of sports if they had not done so.

Patients and Methods

All patients who underwent primary ACL reconstruction in our hospital between January 2000 and December 2000 were identified. Patients with concomitant meniscal tears and chondral lesions were included. Patients who underwent revision ACL surgery or knee multi-ligament reconstructions were excluded.

Based on the above inclusion criteria, 146 patients were identified for assessment. These patients had surgery performed by any one of 3 surgeons who regularly performed ACL reconstructions. With approval by the hospital ethics committee and funding from the hospital research grant, we proceeded to recall these patients. Sixty-four patients were successfully recalled. The remaining 51 patients were non-contactable and another 31 were not keen to participate in this research.

The mean age of our patients was 24.8 years (range, 18 to 40). There were 61 males (95.3%) and 3 females (4.7%). There were 43 (67.2%) recreational athletes and 21 (32.8%) competitive athletes and 2 (3.1%) national level sportsmen. Our patients had surgery at an average of 8.7 months (standard deviation \pm 12.1) after their injury, with a range of 1 to 48 months after their injury.

All patients underwent arthroscopic single incision trans-tibial ACL reconstruction with double-looped autogenous semi-tendinosus and gracilis tendons. All grafts were fixed with close-looped Endobutton (Smith & Nephew, MA, USA) proximally. The grafts were fixed on the tibial side with staples (Smith & Nephew, MA, USA) or interference screws (Smith & Nephew, MA, USA) or a combination of both. Meniscal tears were either meniscectomised or repaired depending on the arthroscopic findings during surgery.

Postoperatively, all patients underwent a standard post-ACL reconstruction physiotherapy protocol. Unless they had a concomitant meniscal repair performed, all patients were allowed full weight bearing. For patients with meniscal repair performed, they were kept on non-weight bearing for 4 weeks. All post-ACL reconstructed patients had a knee brace applied on the operated limb and allowed 0 to 90

degrees of knee range of movement for 4 weeks post-surgery. All patients attended outpatient physiotherapy 1 to 3 times a week for up to 16 weeks post-surgery, supervised by a sports physiotherapist. They were started on a rehabilitation programme based on closed kinetic chain isometric and isotonic strengthening exercises of quadriceps and flexor muscles. Open chain exercises and straight line running was allowed at 12 weeks. A sport specific training programme was started 4 months after surgery. Patients were allowed to return to competitive sports at approximately 6 months post-surgery.

The patients completed the Lysholm Knee, Tegner activity and the Subjective International Knee Documentation Committee (IKDC) questionnaires. Clinical examination of the operated knee was performed according to the Objective IKDC evaluation form. The operated and non-operated knees were assessed with KT-1000 arthrometer at 134N at 30 degrees knee flexion. The difference, in millimeters for the anterior shift between the 2 knees was calculated.

The Lysholm knee score is a measure of knee function, symptoms and disability. It consists of 8 components related to knee function on a 100-point scale. The Tegner activity level is a scale devised to grade the patient's activity level and allows the pre-injury activity level and the present activity level to be documented. With the comparison of the pre-injury and post-surgery Tegner activity scores, we can determine if the patient has managed to return to his previous sporting level.

The IKDC rating scale consists of both a subjective questionnaire and an objective evaluation. The IKDC subjective score is a questionnaire with different subjective factors such as symptoms, sports activities, and ability to function. The objective IKDC grading has 7 domains related to the knee, reflecting both impairment and disability. The worst grading for first 3 key domains – presence of effusion, knee range of motion and ligament stability – determines the eventual IKDC grade. Patients are graded in 4 different grades – A, B, C and D – normal, nearly normal, abnormal and severely abnormal respectively.

All the patients in our cohort had a pre-injury Tegner activity level of 5 and above, which indicates that they engaged in some form of recreational sports at least twice a week. They were asked whether they had returned to their pre-injury level of sports at review. We defined return to sports for our patients as returning to same pre-injury type and level of sports. We looked at the pre-injury Tegner activity scores and compared the present activity level to ensure that the Tegner scores were maintained. We identified the group of patients who had not returned to their previous sports level because of social reasons, such as lack of time

to pursue sports due to work and family commitments. These patients were excluded. The remaining patients were divided into those who had maintained their Tegner activity levels and those who had not. For the patients that had not maintained their Tegner Score, we identified their reasons for not doing so.

Statistical analysis was performed using the SPSS statistical software version 11.0. The parametric, one-way ANOVA test was used to determine if the reasons for not returning to sports had any significant correlation to IKDC or Lysholm scores.

Results

Five-year Clinical Results

At 5 years, the mean Lysholm score was 85.2 (standard deviation \pm 11.3) and the mean subjective IKDC score was 79.5 (standard deviation \pm 15.2). 81.2% of our patients had normal or nearly normal knees (IKDC A or B) with the remaining 18.8% at IKDC grade C. The mean side-side difference for anterior translation using the KT-1000 arthrometer at 134N of traction at 30 degrees flexion was 1.2 mm (standard deviation \pm 1.3 mm). The median pre-injury Tegner activity level was 7 (standard deviation \pm 1.6) and the median 5-year post-surgery Tegner activity level was 6 (standard deviation \pm 1.6).

Return to Sports

Sixty-four patients were reviewed at 5 years after ACL reconstruction. Nineteen patients did not return to their pre-injury sports levels because of social reasons. These 19 patients were excluded from the analysis for return to sports. The remaining 45 patients were interviewed to determine if they had returned to their pre-injury sporting levels. Table 1 shows the breakdown of the patients into the various sub-groups.

Twenty-eight patients (62.2%) returned to their previous level of sports and had maintained their Tegner activity level. The remaining 17 patients (37.8%) did not return to their previous level of sports and had a drop in their Tegner activity levels.

Of the 17 patients who did not return to their previous level of sports, 9 (20%) had said that they did not return due to fear of injury and the remaining 8 (17.8%) said they had not returned because of persistent knee instability and pain.

We sub-divided our cohort and examined the outcome measures in each of the subgroup. We found that at 5 years, the subgroup of patients who had returned to sports (62.2%) had the best scores: Lysholm (88.5), subjective IKDC (84.6) and IKDC Grade A&B (89.3%). This was in contrast to those patients who did not return to sports because of an unstable knee (17.8%). At 5 years of follow-up, they had the lowest scores: Lysholm (72), subjective IKDC (60.1) and IKDC Grade A&B (50%). As for the subgroup of patients who did not return to sports because of fear of re-injury; they had intermediate scores: Lysholm (84), subjective IKDC (73.5) and IKDC Grade A&B (77.7%).

Figures 1 to 3 show the Lysholm Knee Scores, Subjective IKDC and IKDC grades across the 3 sub-groups respectively. The 3 figures summarise the finding that the patients who did return to their previous sports had the best Lysholm Knee Scores and Subjective IKDC Scores as well as had the largest number of Objective IKDC Grade A&B when compared to the other 2 groups.

Using the parametric, one-way ANOVA test, the differences in outcome scores in the 3 groups of patients were found to be statistically significant; Lysholm ($P = 0.020$), Subjective IKDC ($P = 0.001$) and Objective IKDC ($P = 0.028$).

Table 1. Breakdown of Patients Reviewed for Return to Sports

Total number of patients reviewed at 5 years	64	
No. of patients reviewed for return to sport (n)	45	Excluded 19 Patients – who did not return to sport because of social reasons
No. of patients who returned to previous level of sports	28 (62.2%)	
No. of patients who did not return to previous level of sports	17 (37.8%)	9 patients (20%) who did not return to previous level of sports because of fear 8 patients (17.8%) who did not return to previous level of sports because of unstable knee

Table 2. Summary of Clinical Outcomes

Category	No.	Lysholm knee score	Subjective IKDC score	Objective IKDC grade	Postoperative Tegner score
Return to sports	28	88.5	84.6	21 B, 4 A (89.3% normal), 3C	6
Fear	9	84.0	73.5	7B (77.7% normal), 2C	6
Unstable knee	8	72.0	60.1	4B (50% normal), 4C	4

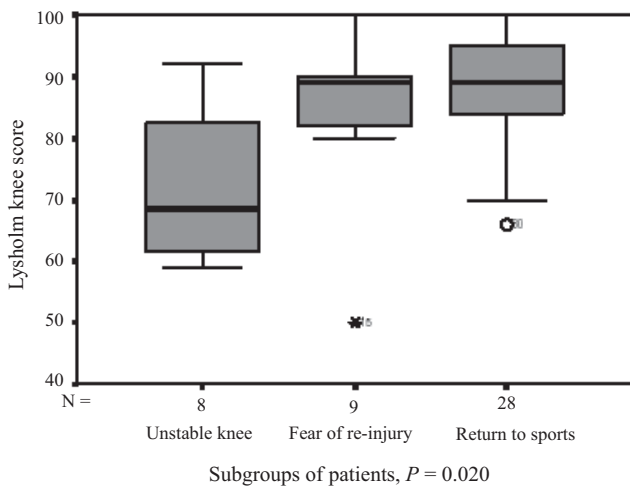


Fig. 1. Lysholm scores in the different subgroups.

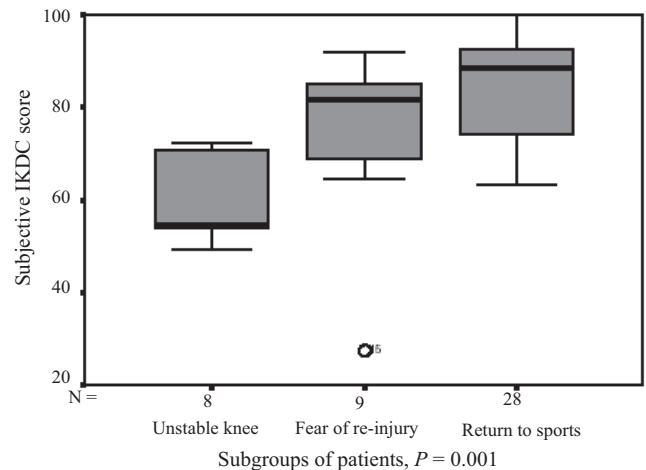


Fig. 2. Subjective IKDC scores in the different subgroups.

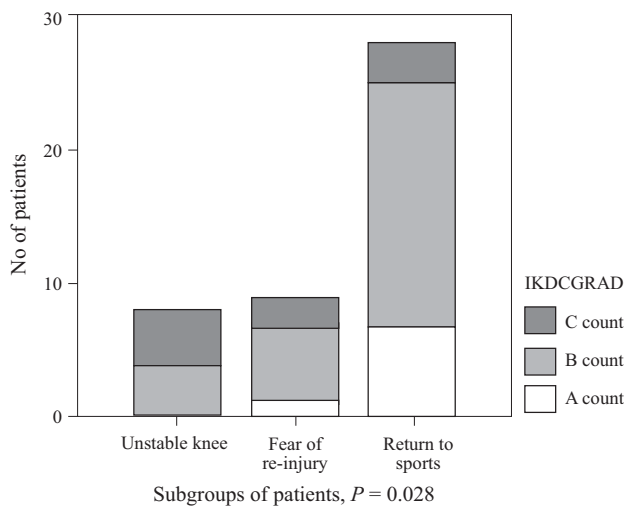


Fig. 3. Objective IKDC scores in the different subgroups.

Discussion

We reviewed the long-term outcome of a cohort of mainly recreational athletes at 5-year post-surgery. We found that our Lysholm, subjective IKDC, objective IKDC grades and KT-1000 arthrometer findings were comparable to previous published literature.⁷⁻⁹

Satku et al¹⁰ in 1986 found that at a mean interval of 6 years post-ACL injury, 46% of their cohort treated without reconstruction could return to pre-injury sports. Kostogiannis et al¹¹ in 2007 found similarly that 42% of conservatively-treated ACL injured patients returned to pre-injury sporting levels within 3 years without reconstruction. It may seem that conservative treatment of ACL injuries does lead to a fairly acceptable number of patients returning to their previous sporting level.

Kostogiannis et al¹¹ indicated that many in their cohort who returned to sport at the same Tegner level avoided contact sports as advised by the rehabilitation team. The

number of patients who have given up contact sport is often not reflected accurately in the Tegner activity scale, leading the authors to raise this inherent limitation of using the Tegner scale in such circumstances.

Noyes et al¹² also proposed the rule of thirds for chronic ACL injury treated with rehabilitation. They stated that one-third of patients resumed their previous recreational activities without reconstruction, one-third managed with reconstruction by modifying their activity level and one-third required reconstruction because of recurrent giving way episodes even in ADLs. Thus, it has been suggested that athletes who wish to return to their pre-injury level should undergo reconstruction, especially competitive athletes or in individuals engaging in pivoting sports.^{4,13} However, there are conflicting evidence in the literature. Myklebust et al¹⁴ who found that, in their 6- to 11-year follow-up of competitive handball players with ACL injuries, 91% of the players treated without reconstruction could return to their pre-injury activity level compared to 58% in the reconstructed group.

In our cohort, 62.2% returned to pre-injury sporting level. This shows a higher level of return to sports at 5 years compared to Satku's or Kostogiannis's conservatively-treated cohorts.^{10,11} This finding supports the theory that ACL reconstruction does lead to a higher proportion of patients returning to sports.

One of the outcome measures of success of ACL reconstruction is the return to previous level of activity. Reviewing the literature, we found that published data for return to the same level of sports post-ACL reconstruction were very varied. It ranged from 53% to 100%: 53% (Kvist),² 65% (Gobbi),³ 71.4% (Smith),⁴ 92% (Nakayama),⁵ and 100% (Fabbriciani).⁶

The literature suggests that competitive athletes are more likely to return to the same levels of sports when compared

to recreational athletes. This will account for the wide variation in the literature reporting return to sports after ACL reconstruction. Fabbriani et al⁶ reported that ACL reconstruction in 18 competitive rugby players saw all (100%) returned to rugby at 6 months and remained at competitive level at 2 years.

Smith et al⁴ found that 81% of their cohort of competitive athletes returned to sports within 12 months after surgery. At 43 months mean follow-up, it was found that this dropped to 71.4% of their initial cohort. More interestingly, 21.8% were competing despite major functional impairment in the operated knee.⁴

This study highlights 3 points. The motivation to return to sports in competitive athletes may be the factor that sees a higher percentage of them returning to competitive sports. Despite this fact, the second point is that even in a cohort of competitive athletes, we do see a significant number (28.6%) not returning to sports post-ACL reconstruction. The final point is that the time of review at 1 and approximately 3 years post-ACL reconstruction yielded different results. Thus, it is pertinent to look at return to sports beyond 1 to 2 years after ACL surgery.

All our patients did return to some level of sporting activity (lowest Tegner 4). The percentage of 62.2% returning to previous sporting level indicates that comparable to published data, a significant proportion of our reconstructed patients do not return to their previous sporting levels.

Although the rates of return to sports post-ACL reconstruction in recreational athletes are lower, Jerre et al¹⁵ found that, when comparing outcomes post-ACL reconstruction in recreational and competitive athletes, there were no significant differences in knee outcome scores detected between these 2 groups. This supports the notion that ACL reconstructions should be recommended to recreational athletes as well.

When we analysed the reasons for our patients not returning to their previous sporting levels and omitting those who had dropped out because of social reasons, we found that having an unstable knee and fear of re-injury were the 2 main reasons for them not returning to their previous sporting levels.

Gobbi et al³ found that there were no significant differences when using various knee outcome scores between athletes who “returned” to their sports at the same level (65%) and those that did not return to sports. This indicates that many patients with stable knee post-reconstruction were not returning to sports after surgery. This meant that for their cohort, knee outcome instruments like Lysholm and IKDC were not able to predict return to sports post-ACL reconstruction. The authors suggested the use of Marx knee activity rating and evaluation of the

athlete’s psychological profile as additional scales to determine which patients have a greater chance of returning to their pre-injury levels.³

Recent literature have highlighted that psycho-social issues have a significant role in return to active sports post-ACL reconstruction. Asano¹⁶ evaluated fear in sporting activity after ACL reconstruction and found that 66.1% experienced fear of re-injury at 9.3 months – the average time interval of returning to sport. Rathinam et al¹⁷ found that 71.7% of patients who did not return to their pre-injury intensity of sports feared instability even though the majority of them (70%) had no knee instability.

Kvist et al² reported that only 53% of their patients returned to their pre-injury level of activity at 3 to 4 years after ACL reconstruction. They used the Tampa Scale of Kinesiophobia (TSK) aimed at quantifying fear of re-injury due to movement and physical activity to evaluate their patients. They found that the patients who did not return to pre-injury levels scored higher on TSK, which meant that they had greater fear of pain, or re-injury and this was correlated to low knee-related quality of life.

Thomee et al^{18,19} suggested that self-efficacy belief is of major importance for rehabilitation outcome after sports-related injuries. The Knee Self-efficacy Scale (K-SES) has been used and shown to have good reliability, validity and responsiveness during rehabilitation for patients’ perceived self-efficacy of knee function post-ACL reconstruction.

In our cohort of patients, those who did not return to sports because of an unstable knee had the poorest subjective and objective knee scores. Twenty per cent of our patients did not return to their previous sporting levels because of fear and they had Lysholm and IKDC scores that were intermediate amongst the 3 groups; i.e., better than those who had unstable knees but worse than those who had returned to their previous sporting levels. These differences between the 3 groups were statistically significant. Possible factors that have been suggested for this are impaired knee proprioception and neuromuscular control resulting in decreased performance and increased fear of re-injury.²

It is important to point out that activity levels are difficult to assess. Eventhough a substantial number of people return to their pre-injury level of activity, it has been suggested that it is not always possible to determine if they are playing with the same behaviour and attitude.¹ That is, athletes involved in sports that involve cutting and jumping may modify the need for these activities. While in some cases, the athletes may return to their previous sporting level despite having an unstable or painful knee.⁴

It remains a challenge to improve the results of ACL reconstruction so that more of our patients may return to the same level of sports. Possible solutions include placing the ACL tunnels in the “correct” position – a more medial tibial

tunnel²⁰ and thus the femoral tunnel at 10 or 2 o'clock positions.^{21,22} The role of computer navigation for ACL reconstruction should be explored.²³ Another possible development is the progression to two-bundle ACL reconstruction techniques. Various authors have showed improved rotational stability and better clinical results compared to single-bundle ACL reconstruction.²⁴⁻²⁷

The authors feel that the postoperative psychological rehabilitation is critical. Our findings as well as other published literature show that there is a significant psychological component to return to previous sporting levels in patients after ACL reconstruction.

We recognised the limitations of our review, which include the retrospective nature of the study design, the high patient drop-out at 5 years' follow-up and the relative small sample size. The problem of loss to follow-up is well documented in Orthopaedic Sports Medicine studies, especially those with long follow-ups. This is due to the fact that many of the young and mobile population being followed-up, relocated within and outside the country during the review period. This led to calls for the creation of National Registries to follow-up post-ACL reconstruction patients. This has led to the setting up of the world's first ACL Registry in Oslo Sports, Trauma Research Centre, Norway in 2005. However despite its limitations, this review, the first published in Southeast Asia with a 5-year follow-up period, would be useful to Orthopaedic Sports Surgeons and Sports Medicine practitioners as they counsel their patients for surgery.

Conclusion

A significant proportion of our reconstructed patients do not return to their previous sporting levels. Fear of re-injury is an important psychological factor for these patients not returning to sports. Our results would allow the attending surgeon to counsel the ACL deficient patient who is considering surgical reconstruction the likelihood of an eventual return to sports.

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