Original article

Comparison of outcome after ACL reconstruction in terms of subjective assessment of symptoms and function and clinical assessment of ligament stability

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ABSTRACT

Background: The knee joint is frequently involved in sports and other injuries with Anterior cruciate ligament being a very common ligament to be injured. The Lachman test, pivot-shift test, and instrumented knee laxity examination are frequently used and reported for evaluation of ACL reconstruction. The aim of this study is to examine and evaluate the relationships between the clinical assessment of ligament stability and subjective assessment of symptoms and function after ACL reconstruction.

Methods: A total of 50 young and middle aged patients with unilateral knee ACL injury treated with ACL reconstruction using hamstring graft were evaluated for a minimum period of 1 year. Clinical assessment of ligament stability was done through Lachman and pivot-shift examination. Subjective variables of symptoms at follow-up included pain, swelling, instability and locking of knee. Subjective function at follow up included satisfaction with outcome, squatting, ascending or descending stairs, jumping, twisting and Lysholm score.

Results: Lachman Examination at follow-up had no significant ($P > .05$) relationship with pain, swelling, instability, locking, squatting, ascending or descending stairs, jumping, twisting, satisfaction with outcome and Lysholm score. Pivot-shift examination at follow-up had significant associations with patient satisfaction ($P = .04$), instability of knee ($P = .02$), difficulty during twisting ($P = .02$) and Lysholm score ($P = .01$).

Conclusion: Pivot-shift examination is a better measure than Lachman examination or instrumented knee laxity as far as patients' functional outcome and overall satisfaction is concerned.

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1. Introduction

The knee joint is frequently involved in sports injuries, vehicular accidents and during daily living activities with anterior cruciate ligament being a very common ligament involved in these injuries.

The measurement of knee laxity is clinically important for the diagnosis of ACL injury as well as for the comparison of pre and post surgical reconstruction and conservative treatment.

The Lachman test, pivot-shift test, and instrumented knee laxity examination are usually done for the diagnosis of ACL injury and these objective tests of ligament stability are frequently used and

reported for evaluation of ACL reconstruction. However it has been seen that the patients showing anterior knee laxity after ACL reconstruction do not necessarily have subjective symptoms or poor functional outcome.

So there is a need to explore the relationship between these clinical tests of ligament stability and functional outcome and subjective satisfaction after ACL reconstruction.

The purpose of our study was to examine and evaluate the relationships between the clinical assessment of ligament stability and subjective assessment of symptoms and function after ACL reconstruction.

2. Materials and methods

This prospective study was conducted in Department of Orthopaedics of a tertiary care hospital from August 2013 to December 2015.

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A total of 50 young and middle aged patients with unilateral knee Acl injury requiring ACL reconstruction with or without grade 1 meniscal injury (not requiring operative treatment) were evaluated for a minimum period of 1 year (mean, 18.6 months; range, 13–26 months). Quadrupled hamstring autograft fixed with endobutton in the femoral side and interference screw in the tibial tunnel was used for ACL reconstruction. Their complete preoperative, surgical, and postoperative subjective and objective data were recorded. Data regarding subjective symptoms and functional ability were filled by patients themselves in the form of questionnaires while the results of clinical examination of laxity were completed by the surgeon. Clinical assessment of ligament stability at 12 months follow-up was done through Lachman and pivot-shift examination. Lachman examination was performed by a single surgeon and was graded according to International Knee Documentation Committee (IKDC) criteria, comparing the ACL-reconstructed knee with the normal contralateral knee: A, normal (–1 to 2 mm); B, nearly normal (3–5 mm); C, abnormal (6–10 mm); D, severely abnormal (>10 mm).¹

Pivot-shift examination was performed by another surgeon and was also graded according to IKDC criteria (ACL reconstructed knee not compared with the contralateral knee): A, normal (none); B, nearly normal (+, glide); C, abnormal (++, clunk); D, severely abnormal (+++, gross). The person performing the Pivot-shift examination was blinded to Lachman knee laxity results. Patients were blinded to the Lachman and pivot-shift examination results.

Subjective variables of symptoms at follow-up included pain, swelling, instability and locking of knee. These variables were graded on scale of none, mild, moderate, and severe and for statistical simplicity divided into two groups as none and present (mild, moderate, or severe). Subjective function at follow up included satisfaction with outcome, squatting, ascending or descending stairs, jumping, twisting and Lysholm score. Limitation and difficulty with squatting, ascending stairs or descending stairs, jumping, and twisting were graded as none, mild, moderate, and severe and collapsed to a scale of none and present (mild, moderate, and severe). Satisfaction with outcome was assessed on an ordinal scale of excellent, good, and poor and collapsed to a scale of satisfied and not satisfied (good and poor). Lysholm score was graded on a 0 to 100 scale. The independent samples t test was performed for comparison of continuous variables for 2 groups, 1-way analysis of variance for comparison of continuous variables for more than 2 groups, the χ^2 test for comparison of proportions. Correlations between Lachman grade, pivot-shift grade, was determined using Spearman's ρ . All reported *P* values are 2-tailed with an α level of 0.05 indicating statistical significance.

3. Results

Mean age of the patients was 28.9 years. Most of them (92%) were males. Right knee was involved in 64% (32/50) of the cases.

Mean follow up period was 18.6 months (range 13–26 months). Most common mode of injury was slip and twisting injury. Forty percent (20/50) of patients had an IKDC grade A Lachman examination, 38% (19/50) had an IKDC grade B examination, and 22% (11/50) had an IKDC grade C examination. 64 percent (32/50) of patients had an IKDC grade A pivot shift examination, 28% (14/50) had an IKDC grade B examination, and 8% (4/50) had an IKDC grade C examination. There were significant correlations between Lachman grade and pivot-shift grade (Spearman's $r = 0.77$; $P < 0.001$).

Lachman Examination at follow-up had no significant ($P > 0.05$) relationship with pain, swelling, instability, locking, squatting, ascending or descending stairs, jumping, twisting, satisfaction with outcome and Lysholm score (Table 1). Pivot-shift examination at follow-up had no significant ($P > 0.05$) relationship with pain, swelling, locking, squatting, ascending or descending stairs and jumping (Table 1).

Pivot-shift examination at follow-up had significant associations with patient satisfaction ($P = 0.04$), instability of knee ($P = 0.02$), difficulty during twisting ($P = 0.02$) and Lysholm score ($P = 0.01$) (Table 1). For patient satisfaction with outcome, instability and Lysholm score, patients with IKDC grade C pivot-shift examinations demonstrated significantly ($P < 0.05$) more dysfunction than patients with IKDC grade A or B pivot-shift examinations, and patients with IKDC grade B pivot-shift examinations demonstrated significantly ($P < 0.05$) more dysfunction than patients with IKDC grade A examinations.

4. Discussion

The ACL is an important restraint to anterior tibial translation and tibial rotation and contributes to the overall stability of the knee. ACL being one of the commonest ligaments to be injured in knee injuries, large number of ACL reconstruction are being done.

Objective assessment of ACL laxity by Lachman examination and pivot-shift examination is valuable in the diagnosis of ACL injury and is frequently reported after ACL reconstruction. However, the relationships between clinical assessment of ligament laxity and subjective assessment of symptoms and function after ACL reconstruction have not been well defined. In this study, we examined a group of patients having ACL injury with or without concurrent grade 1 meniscal injury who underwent primary ACL reconstruction, and we found that the pivot-shift examination, when compared to Lachman examination, has significant associations with certain subjective symptoms and function after ACL reconstruction. Patients who on examination showed higher IKDC pivot-shift grades had more symptoms of instability and had lower Lysholm score and had less satisfaction with outcome. No significant association can be established with IKDC Lachman examination grades and different symptoms

Table 1
Relationships between subjective variables and Lachman and pivot-shift examinations.

Subjective variable	Lachman examination				Pivot-shift examination			
	Grade A	Grade B	Grade C	<i>P</i>	Grade A	Grade B	Grade C	<i>P</i>
Pain	60% (12/20)	68% (13/19)	64% (7/11)	0.86	63% (20/32)	64% (9/14)	75% (3/4)	0.88
Swelling	45% (9/20)	53% (10/19)	45% (5/11)	0.87	47% (15/32)	57% (8/14)	25% (1/4)	0.51
Instability	40% (8/20)	42% (8/19)	55% (6/11)	0.72	31% (10/32)	71% (10/14)	75% (3/4)	0.02
Locking	20% (5/25)	21% (4/19)	18% (2/11)	0.98	25% (8/32)	14% (2/14)	25% (1/4)	0.44
Difficulty in squatting	56% (10/18)	69% (11/16)	75% (6/8)	0.56	72% (21/29)	78% (7/9)	75% (3/4)	0.94
Difficulty in climbing or descending stairs	50% (9/18)	58% (11/19)	55% (6/11)	0.89	50% (15/30)	57% (8/14)	75% (3/4)	0.51
Difficulty in jumping	56% (9/16)	83% (6/14)	38% (3/8)	0.62	44% (11/25)	50% (5/10)	67% (2/3)	0.74
Difficulty in twisting	21% (3/14)	27% (4/15)	50% (4/8)	0.34	16% (4/25)	50% (4/8)	75% (3/4)	0.02
Knee satisfaction	33% (6/18)	53% (10/19)	45% (5/11)	0.49	30% (9/30)	64% (9/14)	75% (3/4)	0.04
Lysholm score	86.9 (2.38)	85.57 (5.14)	83.27 (5.69)	0.10	87.75 (2.47)	83.35 (4.25)	76.25 (1.70)	<0.001

examined in our study and these grades also correlated poorly with the functional outcome.

Similar results were found by Kocher et al.² which showed no significant relationship between Lachman test and subjective symptoms (pain, swelling, partial giving way, full giving way, locking, crepitus, stiffness, limping) and function (satisfaction with outcome, walking, squatting, ascending and descending stairs, running, cutting, jumping, twisting, activity limitation, sports level, ADL level, work level, knee function, sports participation, and Lysholm score) after ACL reconstruction. However in contradistinction to the Lachman test pivot-shift test showed significant relationship with these subjective symptoms and functional outcome.

Sernert et al.³ also found little relationship between the follow-up Lachman examination and functional testing or subjective assessment.

Jakob et al.^{4,5} and others have emphasized the functional importance of the pivot-shift sign for symptoms of giving way.^{6,7} We also find that the results of the pivot-shift examination was significantly associated with most of subjective symptoms and functional outcome. These findings support the importance of the pivot-shift phenomenon and its clinical relevance for the diagnosis of ACL injury as well as for the comparison of pre and post surgical reconstruction.

The pivot-shift examination had significant correlation with Lachman examination but the pivot-shift examination showed significant univariate associations with more subjective parameters and functional outcome as compared with Lachman test which was also seen by Kocher et al.²

The limitation of this study was that instrumented knee laxity examination was not performed. However, various studies have found^{8,9,3,10} little or no relationship between instrumented knee laxity and functional outcome after ACL reconstruction as measured by the different functional scores, sports participation, and overall satisfaction.

Kocher et al.² found no significant relationship between instrumented knee laxity test results and various symptoms and functional outcome. Streich et al.¹¹ found similar results. While they found no correlation between the functional clinical scores (IKDC, respectively, Lysholm score) and the anteroposterior translation measured by the KT-1000 arthrometer, they found a significant relationship between the pivot shift and the clinical assessment scores.

Snyder-Mackler et al.¹² and Eastlack et al.¹³ found no significant differences in instrumented knee laxity between copers and noncopers in ACL deficient knees. Furthermore, measurements of anterior laxity were not correlated with subjective measures of functional outcome (Lysholm score, global knee function, and the Knee Outcome Survey). Also studying ACL-deficient copers versus noncopers. Lephart et al. and Engstrom et al. also found no significant relationship between instrumented knee laxity and functional outcome in ACL-deficient athletes (Iowa Athletic Knee Rating Scale, Tegner activity score, functional impairment, and functional performance tests).^{14,15}

To define the relationship between objective assessment of ligament stability and subjective assessment of symptoms and function after ACL reconstruction is not easy and straight forward and it is not always necessary that the patient having increased

knee laxity on objective physical examination (impairment) will have worse symptoms and function (disability) and vice versa.

After ACL reconstruction pivot-shift examination results showed specific associations with certain subjective symptoms and functional parameters while on the other hand Lachman examination, did not have significant associations with the symptoms and functional outcome and various other studies have shown same for the instrumented knee laxity test and therefore Lachman and instrumented knee laxity may be good tests for diagnosing ACL tear but they qualify poorly as far as comparison of pre and post ACL reconstruction subjective satisfaction and functional outcome is concerned. In view of these observations it seems clear that one of the main targets of any outcome evaluation of ACL treatment should be the precise documentation of transverse plane rotatory stability and therefore it is clear that after ACL reconstruction, the pivot-shift examination is a better measure than instrumented knee laxity or Lachman examination as far as patients' functional outcome and overall satisfaction is concerned.

Conflicts of interest

The authors have none to declare.

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