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CLINICAL COMPARISON BETWEEN FEMORAL TRANSFIXATION AND BIOSCREW FIXATION USING HAMSTRING TENDON GRAFT FOR ACL RECONSTRUCTION AT ORTHOPAEDICS DEPARTMENT OF JLNMCH, BHAGALPUR, BIHAR

Orthopaedics

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ABSTRACT

Background: One of the popular graft choices for ACL reconstruction have been Hamstrings tendon autograft. Thereis no consensus on the ideal technique of fixation of hamstrings graft to femoral condyle. Theoretically we hypothesized that transfixation method of hamstrings graft fixation to femoral condyle should be superior to bio-interference screw fixation technique. Hence aim of our study is to compare this two fixation methods of hamstrings autografts clinically.

Methods: 50 clinically and radiologically proven ACL deficient fighting soldiers are selected for the study. In groupA; 25 patients underwent ACL reconstruction with Bioscrew using aperture technique on femoral side. Other 25 patients in group B underwent ACL reconstruction with transfixation screw using cortico-cancellous fixation technique on femoral side. In both groups quadrupled semitendinosus autograft is utilized. All the patients evaluated for functional outcome at the end of 6 weeks and at 6 months and at the end of 1 year following the procedure. The subjects are evaluated using the modified Lysholm knee score and knee laxity is measured by Rolimeter.

Results: At 01 year post op. there was no statistically significant difference in both groups in terms of Manual laitytests,Rollimeter laity measurement and Lysholm knee score.The overall satisfactory result (Excellent + Good) in both the groups at 01 year follow up were 98% by Lysholm score.

Conclusions: Transfixation and Bioscrew fixation showed comparable results in manual knee laxity tests,instrumental knee laxity tests using Rolimeter, Lyslohm scores and high patient satisfaction, with almost 96% of patients in both groups returned to their pre-injury levels.

KEYWORDS

ACL reconstruction, Transfixation, Bioscrew

INTRODUCTION

The Anterior cruciate ligament is one of the most frequently injured ligaments of the knee. One of the popular graft choices for ACL reconstruction have been Hamstrings tendon autograft. There is no consensus on the ideal technique of fixation of hamstrings graft to femoral condyle. Techniques of graft fixation involving fixation at a point away from the joint line have been associated with graft elongation and tunnel expansion. The use of bio absorbable interference screw has been widely popularized in the hamstring as well as bone patellar tendon bone autograft in the ACL reconstruction. It has the advantage of direct tendon to bone healing with acceptable initial biomechanical fixation strength. However the micro motion between the graft and the interference screw within the tunnel during cyclic loading may lead to slippage of graft and result in secondary lengthening and loosening of the graft. The femoral transversal technique (Transfix) combines the characteristics of high failure load, less loss of tension during repetitive loading cycle, and fixation closure to the joint line. Theoretically we hypothesized that transfixation method of hamstrings graft fixation to femoral condyle should be superior to bio-interference screw fixation technique. Hence aim of our study is to compare this two fixation methods of hamstrings autografts in terms of manual and rolimeter laxity testing and lysholm functional knee score in ACL reconstruction.

MATERIAL AND METHODS

It is a prospective study of the cohort with ACL insufficiency treated with arthroscopic assisted ACL reconstruction using autogenous quadrupled hamstring tendon graft using transfixation technique in one group and bioscrew fixation in other group performed at Department of Orthopaedics, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar over a period of 12 months from October 2019 to September 2020. 50 young serving soldiers between 18 to 40 yrs of age with clinically and radiologically proven ACL deficiency are included in the study after acute inflammatory phase of the injury has subsided (4-6 weeks). Patients with associated PCL, MCL, LCL and meniscal injuries greater than grade II injuries are excluded from the study. Similarly articular cartilage injuries, previous knee surgeries and bilateral ACL tears are kept out of the study. Patients were divided into two groups by computer generated random number table. In group A, 25 patients underwent ACL reconstruction with Bioscrew using aperture technique on femoral side. Other 25 patients in group B underwent ACL reconstruction with transfixation screw using cortico-cancellous fixation technique on femoral side Figure 1. In both groups quadrupled semitendinosus autograft is utilized. In both the groups Bioscrew fixation is carried out on tibial side. It is longitudinal study with the subjects evaluated at multiple points in time. All the patients evaluated for functional outcome at the end of 6 weeks and at 6 months and at the end of 1 year following the procedure. All the patients operated upon by a single surgeon under standard conditions using a standard technique of ACL reconstruction. A standard rehabilitation protocol followed in both the groups. The subjects are evaluated using the modified Lysholm knee scoring system (1985) and post-operative knee laxity is measured by Rolimeter (Figure 2).

Statistical analysis

Data analysis done by using SPSS (Statistical package for social sciences) version 20:0. Two independent sample t-test used to find the significant difference between bioscrew group and transfixation group for quantitative data variables. Chi-square test/Fisher's exact test used to find the association between bioscrew group and transfixation group for qualitative data variables. P-value <0.05 considered as significant.

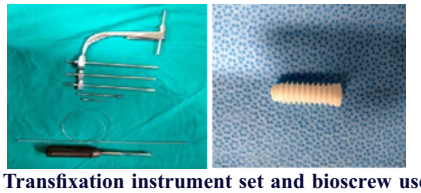

Figure 1: Transfixation instrument set and bioscrew used in the study.

Figure 2: Postoperative X-ray after transfixation method.

RESULTS

Both the groups were comparable with respect to age, sex and other demographic profiles (Table 1). The results of Pre-operative and post-operative Lachman test were statistically analyzed and there was no statistical significance in both the groups with P value of 0.999 preoperatively and 0.754 post-operatively. Similarly the results of pre and post-operative pivot shift showed no significant difference in both the groups. P=0.999 pre-operatively and p=0.999 post operatively (Table 2). The results of pre-operative and post-operative measurement by Rolimeter were statistically analyzed and there was no statistical significance in both the groups with p value of 0.891 preoperatively and 0.511 post operatively after 01 year (Table 3). At 01 year follow up post-operatively 10 cases (40%) in bioscrew group and 11 cases (44%) in transfixation had excellent Lysholm score (>91). Good score (77-90) was seen in 15 cases (60%) of bioscrew group and 13 cases (52%) of transfixation group. The overall satisfactory result (excellent+good) in both the groups at 1 year follow up were 98% by Lysholm score (Table 4). 24 patients (96%) in bioscrew group and 24 patients (96%) in transfixation group were able to achieve pre-injury activity level (Figure 3). Postoperatively 9 cases (36%) in bioscrew group and 6 cases (24%) in transfixation group complained of knee pain, 1 case (4%) in bioscrew group complained of giving away during normal activities of life whereas, 7 cases (28%) in bioscrew groups and 6 cases (24%) in transfixation group complained of a slight sense of giving away during exertion or playing. 1 case (4%) in bioscrew group and 2 cases in transfixation group (8%) had swelling in the knee joint during exertion (Table 5).

Table : 1 Demographic Profile of patients in both groups

Group	No. of patients	Age (years)		p-value	Weight (kg)		p-value
		Mean	SD		Mean	SD	
Bioscrew group	25	30.80	2.75	0.957	73.40	5.22	0.978
Transfixation group	25	30.84	2.48		73.36	5.13	

Table : 2Manual laxity test (Lachman test and Pivot shift test) comparison for both groups are and 01 year postoperative

Lachman test		Lachman Test grade				p-value	Pivot shift Test				p-value
		Nil	Grade 1	Grade II	Grade III		Nil	Grade 1	Grade II	Grade III	
Preoperative	A	0	3	19	3	0.999	0	20	2	3	0.999
	B	0	3	18	4		0	19	3	3	
Postoperative	A	5	19	1	0	0.754	24	1	0	0	0.999
	B	8	16	1	0		24	1	0	0	

Table : 3Laxity measurement by Rollimeter in both groups pre and post op at 01 year follow up

Rolimeter (mm)	Bioscrew Group A			Transfixation Group B			p-value
	No. of patients	Mean	SD	No. of patients	Mean	SD	
Preoperative	25	7.12	1.92	23	7.20	2.16	0.891
Postoperative	25	3.78	1.04	24	3.58	1.02	0.511

Table : 4Lysholm score in both groups pre and 01 year post operatively

Rolimeter (mm)	Bioscrew Group A			Transfixation Group B			p-value
	No. of patients	Mean	SD	No. of patients	Mean	SD	
Preoperative	25	56.60	6.49	25	54.88	5.26	0.309
Postoperative	25	88.00	5.16	25	88.08	5.65	0.959

Table : 5Post operative symptoms in both groups

Postoperative symptoms	Bioscrew Group A	Transfixation Group B	Total	p-value
Knee pain	9	6	15	0.538
Giving way during normal activity	0	1	1	0.999
Giving way during exertion or playing	7	6	13	0.999
Swelling	1	2	3	0.999
Locking	0	0	0	

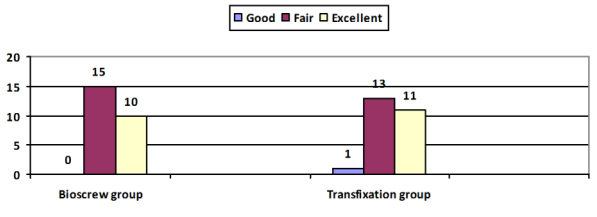

Figure 3: Analysis of Lysholm score in both groups 1 year post operatively

DISCUSSION

The reconstruction of the Anterior cruciate ligament (ACL) with hamstring tendons can be performed using different femoral fixation methods. The primary goal of initial fixation in ACL reconstruction is to resist graft slippage until tendon-to-bone healing occurs; ACL grafts should be stable enough to withstand the physiologic loads applied to the knee during activities of daily living (ADLs). Moreover, graft fixation should also allow for the application of accelerated rehabilitation protocols. Ultimately, successful tendon to bone healing should occur without tunnel widening. The native ACL resists an estimated load of up to 454 N during activities of daily living. The initial fixation of a soft-tissue graft should be able to resist this magnitude of load to be successful. A major cause for concern with the use of hamstring autografts is the soft tissue can take up to 12 weeks to heal in the osseous tunnel. There is currently no gold standard for the fixation of soft tissue grafts for ACL reconstruction. There are 2 types of femoral fixation for ACL grafts in bone tunnels.

Direct fixation (aperture fixation) as seen with interference screw, refers to compression of the soft tissue to allow direct contact healing between the graft and the bone surface without the development of a fibrous inter zone normally seen in non-anatomic fixation methods. The use of bio absorbable interference screws has the advantage of direct tendon-to-bone healing with acceptable initial biomechanical fixation strength. However, the micromotion between the graft and the interference screw within the tunnel during a cyclic loading may lead to a slipping of the graft and result in a secondary lengthening and loosening of the graft.

Indirect fixation (suspensary fixation) suspends the graft in the bone tunnel and one of the method of indirect fixation is cortical-cancellous suspension systems, such as cross-pin fixation which utilizes a transcondylar suspension pin placed perpendicular to the graft. According to numerous studies. cross-pin femoral fixation has been shown to provide high fixation strength and sufficient resistance against slippage. In a biomechanical study comparing nine different femoral fixation devices with various fixation mechanisms, cortical-cancellous suspension fixation achieved with transcondylar devices

seemed to offer the best results in terms of graft elongation, fixation strength, and stiffness when compared to fixation via compression, expansion, cortical suspension, and cancellous suspension. Recent biomechanical analysis have shown that the transfixdevice provides less laxity but greater stiffness and pull-out strength when compared to bioscrews. With this inmind, we hypothesized a stiffer construct and a more stable knee using the transfixation technique; and purpose of the study is to compare these two different methods of fixation of hamstring graft to femoral condyle and assess the functional outcome.
Manual laxity testing of all the patient in both the groups were carried out by Anterior Drawer test, Lachman test and Pivot shift test. None of the patients in both groups had grade III laxity 01 year post-operatively. Post-operatively at 01 year follow up, 01 case (4%) in each of the two groups had a positive Pivot shift test with a "Glide" (Grade-I), whereas remaining 24 cases (96%) in both the groups had a negative Pivot shift test. Thus manual laxity tests performed at 01 year follow-up in all the patients in both the groups did not show statistically significant difference between bioscrew and transfixation method of hamstring graft fixation in our study.

In the study by Tim Rose et al, the clinical laxity examination conducted 12 months after the surgery. This prospective study was conducted on 68 patients, out of which 38 underwent hamstring fixation using transfixation device and 30 with bioscrew fixation. In that study, four patients in each group showed a positive result for the pivot shifting phenomenon. However study revealed no significant difference between two groups in manual laxity testing which is comparable to our study.

We assessed the objective laxity measurement by rolimeter arthrometer (Aircast). The mean post-operative rolimeter measurement at 01 year follow up was 4.00±1.08 SD in bioscrew group and 3.70±0.98 SD in transfixation group which was not statistically significant (p=0.362). Thus rolimeter laxity measurement in both the groups was also comparable. In the study by Luca Capuano et al, there was no statistically significant difference between two groups in Rolimeter laxity testing. Also in the study by Tim Rose et al there was no significant difference in the knee laxity testing using the rolimeter device between the two groups.[5] These results were similar to our rolimeter laxity testing results.

Postoperatively 9 cases (36%) in bioscrew group and 6 cases (24%) in transfixation group complained of knee pain. Knee pain is slightly less in transfixation group; however difference is not statistically significant (p=0.538). 1 case (4%) in bioscrew group complained of giving away during normal activities of life whereas, 7 cases (28%) in bioscrew groups and 6 cases (24%) in transfixation group complained of a slight sense of giving away during exertion or playing. One case (4%) bioscrew group and 2 cases in transfixation group (8%) had swelling in the knee joint during exertion

Overall results of ACL reconstruction in both the groups were assessed by Lysholm knee score. All patients strictly followed the rehabilitation protocol and were evaluated according to Lysholm score. In this series Lysholm score was recorded at 6 months and 1 year postoperatively. Patients were not allowed to return to full active military duty or sports activities during their rehabilitation program and they were placed in lowmedical category mentioning their restricted employability. The overall satisfactory result (excellent + good) in both the groups at 01 year follow up was 95%. Out of these 19 patients (95%) in bioscrew group and 19 patients (95%) in transfixation group were able to achieve pre-injury activity level. In a study by Luca Capuano et al; at 13 months follow up, all patients except 1 had functionally normal IKDC objective scores. Study revealed no significant difference between two groups as for as IKDC score is concerned.[15] Similarly In the study by Rose et al, clinical comparison between bioscrew and transfixation technique of femoral fixation using Hamstring graft, ninety percent of all patients had functionally normal or near normal IKDC knee ligament rating and Lysholm score between two groups.

CONCLUSION

To conclude, in our study both the techniques of ACL reconstruction i.e. transfixation and bioscrew fixation showed comparable results in manual knee laxity tests, instrumental knee laxity tests using Rolimeter, Lyslohm scores and high patient satisfaction, with almost 96% of patients in both groups returned to their pre-injury levels. Hence, we disapproved our hypothesis that ACL reconstruction using transfixation device at the femoral end leads to less knee laxity and therefore to a better clinical outcome for the patient. The clinical result in this study clarified that this technique is an effective and safe method for femoral hamstring fixation in ACL reconstruction, however further studies are needed with larger group and longer follow up to confirm this findings.

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