

Clinical and Radiological Outcome Assessment Study between Aperture and Suspensory Fixation of Hamstring Autografts on Femoral Side in ACL Reconstruction

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Abstract

Background: Arthroscopically aided anterior cruciate ligament reconstruction using hamstring graft can be fixed to femoral condyle by suspensory and aperture fixation methods.

Objectives: To investigate functional outcomes with these fixation methods as measured by the Lysholm knee score of Hamstring autografts.

Methods: 50 patients of clinically and radiologically diagnosed ACL tear fulfilling the inclusion and exclusion criteria were randomized into two groups to undergo arthroscopic ACL reconstruction using quadrupled hamstring graft with suspensory (n=25) and aperture (n=25) fixation methods on femoral side. They were compared post operatively with Lysholm score, clinical laxity tests and percentage of tunnel enlargement using computed tomograms at 01 year.

Results: At the end of 6 months there was no much difference in Lysholm score between both the groups (P =0.63) and at the end of 01 year aperture group had slightly better outcome. However, the difference was not statistically significant (p =0.13). There were more tunnels widening in the suspensory group especially of the femoral

tunnel in the coronal plane. However, the amount of tunnel widening in both the groups was not significant statistically ($P = 0.071$ and $P = 0.963$).

Conclusions: Aperture and Suspensory fixation methods of hamstring graft at femoral condyle in ACL reconstruction are comparable clinically and there is no advantage of one particular method over other.

Keywords: Autografts, Aperture fixation, Suspensory fixation, ACL reconstruction, Lysholm score, Femoral tunnel.

Introduction-

The arthroscopically aid reconstruction of the anterior cruciate ligament (ACL) with an autogenous quadrupled hamstring graft has been the benchmark of treatment in ACL deficient knees, chiefly in young and athletic individuals. A graft with low morbidity; excellent cosmesis, power, and rigidity; and secure early fixation and amalgamation near the joint line are the ultimate goals of anterior cruciate ligament surgery. There are two types of graft fixation at the femoral end, namely: aperture fixation and suspensory fixation.[1,2].

There is at present no gold standard for the fixation of soft tissue grafts for ACL reconstruction. A chief cause for concern with the use of hamstring autografts is, the soft tissue can take up to 12 weeks to heal to the osseous tunnel.[3,4] Thus, a protected fixation technique is needed to endure the forces on the graft resulting from current rehabilitation protocols that allow for unrestricted ROM, weight bearing, and early return to athletic activity after ACL reconstruction.[5,6] The purpose of our study was to determine whether there is a difference in the tunnel widening with joint line fixation using interference screws (aperture fixation) versus EndoButton (suspensory fixation) of hamstring autografts in ACL reconstruction and does it affect the functional outcome.

Materials and Methods-

It was a prospective randomized study of 50 male patients with clinically and radiologically proven anterior cruciate ligament tear from Aug 2019 to June 2021. Approval of hospital ethical committee from the institution was taken and informed, valid consent from the patients taken before surgery. 50 patients were divided into two groups of 25 each by computer generated random number table. Patients in both groups were between 20 to 40 years age group.

All the patients underwent arthroscopic ACL reconstruction using quadrupled hamstring autograft. ACL auto graft in group A fixed to lateral femoral condyle with suspensory fixation method using EndoButton (Smith and Nephew).[7] utilized for fixation of hamstring graft to lateral condyle of femur. In all the patients graft on tibial side is fixed by Bioscrew (Smith and Nephew). All male patients with clinical and MRI

diagnosis of exclusive anterior or anterolateral instability with or without meniscal injuries which do not alter postoperative rehabilitation were included in the study. Patients with multi ligaments injury, previous knee surgeries, postoperative infection, meniscal injuries requiring repair were excluded from the study.

All the patients also evaluated by X-ray and MRI of knee preoperatively. Operations were done by different surgeons using anteromedial portal technique. All patients are subjected to same rehabilitation protocol for 06 weeks. Patients were hospitalized for 2 weeks post operatively and was sent on 6 weeks medical leave for convalescence and reviewed at 08 weeks, 6 months and at 01 year post operatively. Initial diameters of femoral and tibial tunnels were taken as per the drill bit used to make the tunnel, in turn based up on graft thickness used.

On follow up patients underwent a computed tomography scan at the end of 12 months to measure the amount of tunnel widening. Tunnel widening was measured by measuring the widest tunnel diameter on coronal and saggital views on CT. All patients underwent CT using same machine and measurements were performed by the same independent observer, who was a radiologist.

Statistical Analysis-

Analysis of data was done by using SPSS software ver. 22. Data were statistically described in terms of mean (\pm SD), frequencies (number of cases) and percentages when appropriate. Comparison of quantitative variables between the study groups was done using Student t test for independent samples if normally distributed. For comparing categorical data, Chi square test was performed. A probability value (p value) less than 0.05 was considered statistically significant.

Results-

Table 1- Associated Meniscal Injury in Study Groups

Arthroscopy findings	Suspensory fixation -A	Aperture fixation-B	Total
ACLtear	18	13	31
ACL+ Lateralmeniscustear	3	6	9
ACL+ Medialmeniscustear	4	3	7

ACL+			
Medial+	1	2	3
Lateral meniscuste ar			

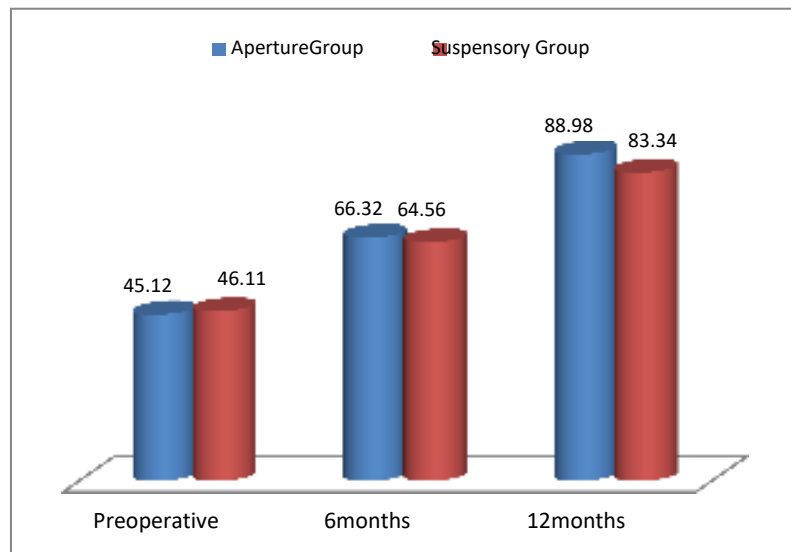
As per table 1

fifty cases underwent arthroscopy based on clinical examination and diagnosed as pure ACL but before ACL reconstruction many cases were detected with associated meniscal injuries. 70 % (18 out of 25 cases) suspensory group and 52% (13 out of 25 cases) aperture group were detected with pure ACL tear. 32% cases of suspensory group and 44% cases of aperture group were detected with medial, lateral or combined meniscal injuries. As associated meniscal injuries are very common with ACL they were included in inclusion criteria. No subjects in both group had postoperative thromboembolism or pressure sores.

Table 2- Tunnel widening Comparison in Both Groups at 12 month

Fixation method	Initial tunnel measurements postoperatively in mm		Tunnel widening at the end of 12 months			
	Femoral tunnel (mean) in mm	Tibial tunnel (mean) in mm	Femoral		Tibial	
			Coronal	Sagittal	Coronal	Sagittal
Suspensory A	8±0.59	8.33±0.41	42.31±3.77	27.42±2.06	37.252±2.22	30.69±2.16
Aperture B	7.95±0.44	8.97±0.75	34.78±2.13	25.44±1.38	28.991±2.28	26.78±2.05
Pvalue	0.51	0.60	0.07		0.93	

As per table 2 The initial femoral and tibial tunnel diameters were taken as per the diameter of the drill bit used to make the tunnel and there was no significant difference between the tunnel diameters. Amount of tunnel widening of femoral and tibial tunnels expressed as percentage of initial tunnel widths at the end of 12 months. There was more tunnel widening in the suspensory group especially of the femoral tunnels, over all maximum tunnel widening was seen in the coronal plain of the femoral tunnel in suspensory group. However, the amount of tunnel widening in both the groups was not significant statistically (P =0.07 and P =0.93).

Figure 1- Comparison of Knee score at 6 and 12 months

As per figure 1 Clinical outcome at the end of 6 months & 12 months was measured in terms of Lysholm and Gillquist knee Score, at the end of 6 months there was no significant difference between both the groups ($P = 0.63$) and at the end of 01 year aperture group had slightly better outcome. However, the difference was not statistically significant ($P = 0.13$)

Discussion-

All subjects in our study were young male serving athletes. By virtue of their job profile they go through rigorous training and sports activities like football, volley ball and basketball to keep them fit. Therefore, male athletes were selected for ease and homogeneity of patient population and to eliminate possible bias in the study. According to internationally published studies ACL injuries are very common in football players. In our study most common mode of injury was sports injury (64% of aperture group and 56% of suspensory group) which included football, volley ball, basketball, kabbadi mainly where patient sustained twisting injuries.

In our study postoperative Lysholm score was calculated at 6 months and 12 months interval and compared with various studies available at present. At 6 months interval there was no significant difference in functional outcome between both the groups as assessed by the Lysholm score. This suggests that in early stages there is no significant difference in outcome from surgery in both groups. There was significant improvement in Lysholm score after surgery in both groups from preoperative Lysholm score. In our study at a 12 months interval, comparative postoperative Lysholm score between aperture and suspensory group was not statistically significant ($p = 0.173$). Ping et al conducted a similar study with follow up of 29.5 months (12-46 months) on average.[7]

Tunnel widening after anterior cruciate ligament (ACL) reconstruction is a well-described phenomenon.[8]The basis of tunnel widening is multifactorial, with several possible mechanical and biological contributing factors.[9]Among the possible causes, mechanical factors such as graft tunnel motion, stress deprivation of bone within the tunnel wall, improper graft tunnel placement, tunnel positioning, graft fixation method, restorable implant degradation, access of joint fluid to the graft-bone interface, and bone quality and aggressive rehabilitation have been considered.[10,11]

Tunnel widening after ACL reconstruction can be clinically problematic, with excessive tunnel widening resulting in increased knee laxity and poor bone stock for revision reconstruction procedures.[12]in this type of fixation, vectors of resistance are parallel to and opposite the external forces, and they concentrate on the cortical bone of the distal femur, on the bone-device surface. Buelow et al performed a prospective nonrandomized trial comparing femoral fixation with a bioabsorbable interference screw with anEndoButton.[13,14] The results demonstrated ACL reconstruction with a doubled semitendinosus and gracilis tendon graft and associated femoral and tibial tunnel enlargement. The authors found considerably more tunnel widening in the grafts fixed with extracortical fixation.

Conclusion-

Both suspensory and aperture fixation of hamstring graft at femoral condyle in ACL reconstruction are comparable clinically and there is no advantage of one particular method over other. More tunnel widening in patients suspensory fixation group at the end of 12 months is not statistically significant and is not associated with inferior clinical outcomes or functional knee scores.

Source of Funding- None

Conflict of Interest- None declared

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