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Comparison of functional outcome of arthroscopic anterior cruciate ligament reconstruction using quadrupled semitendinosus and gracilis graft fixed with bioabsorbable interference screw against titanium interference screw

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Abstract

Background: Knee injuries are more common due to exponential increase in road traffic accidents and more involvement in sports related activities by common people. Anterior cruciate ligament injury is one of the most common injuries around knee and poses quiet a lot management controversy.

Aims and Objectives: To do comparative analysis of the functional outcome of Arthroscopic Anterior Cruciate Ligament Reconstruction using quadrupled semitendinosus and gracilis graft with endobutton as femoral fixation device and bioabsorbable interference screw against titanium interference screw as tibial fixation devices respectively.

Materials and Methods: 60 Patients with ACL tear attending out patient department of a tertiary care hospital were recruited in this prospective, comparative study. Detailed proforma consisting of patient information, Lysholm and Gillquist scoring scale were administered pre and postoperatively for patient. The difference in clinical outcome of both groups was compared. Out of 60 patients 30 patients underwent ACL reconstruction using Titanium screw and 30 patients underwent ACL reconstruction using Bioabsorbable screw. All patients were followed up for a period of 6 months post operatively. Improvement in patient condition was measured in terms of improved Knee range of motion, walking with or without support, any instability, any locking of knee, any pain while activity.

Results: Mean preoperative Lysholm score for Titanium group was 52.60 and postoperative score is 85.56. Mean preoperative Lysholm score for Bioabsorbable Group is 54.70 mean postoperative score for group is 87.63. The increase in both scores was statistically significant when compared within the groups. And when both groups are compared, there was no significant difference between 2 groups. Few of our patients presented with anterior knee pain in immediate post-operative period which subsided with physiotherapy and medication, none of them had chronic knee pain.

Conclusion: Our study shows that there is no difference in functional outcome whether bioabsorbable or titanium interference screw was used.

Keywords: anterior cruciate ligament reconstruction, quadrupled semitendinosus graft, gracilis graft, bioabsorbable interference screw, titanium interference screw

Introduction

Incidence of anterior cruciate ligament reconstruction had increased significantly in the past decade¹ owing to the increased number of road traffic accidents and more involvement in sports activities. Indications for surgical treatment are repeated symptoms of knee instability. Arthroscopic ACL reconstruction have become gold standard and open reconstruction have become almost obsolete nowadays. Anterior cruciate ligament has a pivot role in function and stability of the knee joint along with all other ligaments, being a prime stabilizer preventing the anterior translation of tibia over femur^[2]. Acute anterior cruciate ligament injury causes recurrent episodes of instability, pain and decreased motion. Anterior cruciate ligament injury is associated with meniscal injury and early onset of osteoarthritis^[3].

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Nowadays, usage of soft tissue grafts is increasing in number than bone patellar tendon bone graft. Graft fixation during ACL reconstruction can be achieved with use of either metal screws or bioabsorbable screws. Bioabsorbable screws usage provide better visibility in postoperative MRI and also avoid removal at later stage. However, there are controversies regarding the ideal graft, ideal fixation device, ideal time and technique of reconstruction. With this intention the current study was carried out to compare functional outcome of Arthroscopic Anterior Cruciate Ligament Reconstruction using quadrupled semitendinosus and gracilis graft with endobutton as femoral fixation device and bioabsorbable interference screw against titanium interference screw as tibial fixation devices respectively

Materials and Methods

This was a prospective comparative study in 60 patients with ACL tear attending out patient Orthopedics department in Kamineni Hospital, a tertiary care hospital in Hyderabad, Telangana catering to the health needs of people in and around Hyderabad. Sample size selected based on hospital admission rate and medical records.

Number of patients admitting with ACL injury, based on previous admissions were 65 in the year 2017 and 78 in the year 2018. Total 60 patients have been operated under Orthopaedic Department at Kamineni hospital, LB Nagar during the study period of June 2018 to June 2019. In the present study 60 patients who fulfilled inclusion criteria were studied. Out of 60 patients 30 patients underwent ACL reconstruction using Titanium screw and 30 patients underwent ACL reconstruction using Bioabsorbable screw.

Inclusion criteria

- Patients with closed growth plate
- Primary ACL surgery
- Patients with associated meniscal injuries
- No evidence of multiple ligament injury
- No previous knee surgeries
- No ligamentous injury to contralateral knee

Exclusion criteria

- Additional ligamentous laxity in affected knee
- Previous ACL surgery of either knee
- Chronic muscle disorders and metabolic bone disease
- Any co-existing local conditions in the form of
 - Active articular infection
 - Inflammatory joint disease
- Neoplastic disease

All patients were followed up for a period of 6 months post operatively. Detailed proforma consisting of patient information, Lysholm and Gillquist scoring scale were administered pre and postoperatively for patient. The difference in clinical outcome of both groups was compared. Improvement in patient condition was measured in terms of improved Knee range of motion, walking with or without support, any instability, any locking of knee, any pain while activity.

All patients are operated under spinal anaesthesia. Anterior cruciate ligament is probed to analyse the amount of tear. If unstable meniscal injuries are found they are treated with partial meniscectomy and debridement depending on the site and type of the tear. Anterior Cruciate Ligament Reconstruction was conducted using quadrupled semitendinosus and gracilis graft with endo-button as femoral

fixation device and bioabsorbable interference screw against titanium interference screw as tibial fixation devices respectively in the two groups.

Results

60 Cases of arthroscopy assisted Anterior cruciate ligament reconstruction with quadrupled hamstring tendon graft using endobutton as the femoral fixation device and titanium interference screw (no=30) and bioabsorbable interference screw (no=30) as tibial fixation device respectively was followed for 6 months. The mean follow up was 6 months.

Table 1: Age Distribution

Age	Patients	Percentage
<20	6	10%
21-30	28	46.66%
31-40	12	20%
41-50	10	16.66%
51-60	4	6.66%
Total	60	100%

Majority of the patients were between 21-30 years of age at 46.66%, followed by those between 31-40 years at 20%, 41-50 years at 16.66%, less than 20 years at 10% and between 51-60 years at 6.66%.

Table 2: Gender distribution

Sex	Patients	Percentage
Male	54	90%
Female	6	10%
Total	60	100%

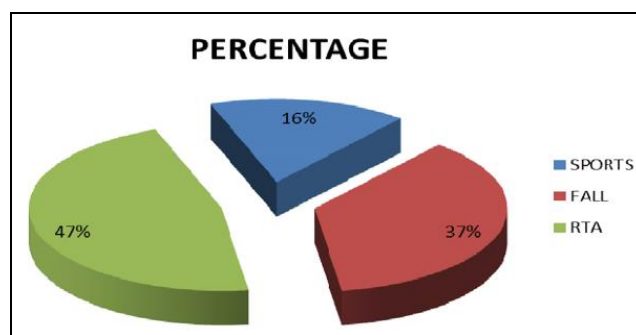


Fig 1: Mode of injury

Table 3: Titanium Screw Group Rom

ROM	PREOP (Titanium vs Bioabsorbable)	POSTOP (Titanium vs Bioabsorbable)
0-90	4(13.33%)	0
0-100	12(40%)	0
0-110	11(36.66%)	0
0-120	03(10%)	3(10%)
0-130	0	4(13.33%)
0-140	0	23(76.66%)
Total	30(100%)	30(100%)

Table 4: Bioabsorbable Screw Group Rom

Rom	Preop	Postop
0-80	5(16.66)	0
0-90	10(33.33%)	0
0-100	12(40%)	0
0-110	2(6.66%)	1(3.33%)
0-120	1(3.33%)	7(23.33%)
0-130	0	3(10%)
0-140	0	19(63.33%)

Table 5: Associated injury

Associated Injury	Patients	Percentage
Medial Meniscus Tear	19	31.66%
Lateral Meniscus Tear	15	25%
Both	8	13.33%
Nil	18	30%

Table 6: Lachman's Test Titanium Screw Group Vs Bioabsorbable Screw Group

Lachmans Test	PREOP (Titanium vs Bioabsorbable)	POSTOP (Titanium vs Bioabsorbable)
No laxity	0 vs 0	18(60%) vs 18 (60%)
Grade 1 laxity	0 vs 0	9(30%) vs 12(40%)
Grade 2 laxity	0 vs 0	3(10%) vs 0
Grade 3 laxity	1(3.33%) vs 0	0 vs 0
Grade 4 laxity	29(96.66%) vs 30 (100%)	0 vs 0

Table 7: Pivot Shift Test For Titanium Screw Group Vs Bioabsorbable Screw

Pivot Shift Test	PREOP (Titanium vs Bioabsorbable)	POSTOP (Titanium vs Bioabsorbable)
Positive	26(86.66%) vs 23(76.66%)	0 vs 0
Negative	4(13.33%) vs 7(23.33%)	30(100%) vs 30 (100%)

Table 8: 6 Months Post-Operative Lysholm And Gillquist Score For Titanium And Bioabsorbable Screw Group

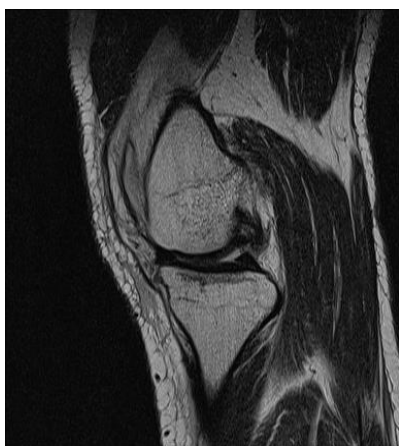
Results	Titanium	Bioabsorbable
Excellent	6(20%)	2 (6.66%)
Good	16(53.33%)	21 (70%)
Fair	8(26.66%)	7 (23.33%)
Poor	0	0



Pic 2: Post-Op flexion of knee



Pic 3: Post-Op Knee X-ray



Patient 1: Pic 1: Pre-OP MRI (titanium interference screw),



Pic 4: Post-Op Full knee extension



Pic 1: Pre-Op MRI



Pic 2: Post op flexion of Right knee

Case 2: (Bioabsorbable interference screw)



Pic 3: Post-op knee x ray



Pic 4: Post-op full extension of Rt knee

Discussion

Majority of the patients were between 21-30 years of age at 46.66%, followed by those between 31-40 years at 20%, 41-50 years at 16.66%, less than 20 years at 10% and between 51-60 years at 6.66%. Majority of the patients in our study were males at 90% and females at 10% of the study sample. Mode of injury included sports injury in 16%, fall in 37% and 47% had road traffic accidents. Range of movements were restricted from 0-120 degrees preoperatively, that improved to beyond 120 degrees in most of the patients of either of the groups.

Mean preoperative Lysholm score was 52.60 (SD: 12.77, Standard error of means: 2.33) for Titanium screw group and 54.70 (SD: 12.76, standard error of means: 2.33) for Bioabsorbable group. Mean 6 months postoperative Lysholm score in Titanium screw group was 85.56 (SD: 7.78, Standard error of means: 1.42) with median value of 90 and range between 74 to 100. Mean postoperative Lysholm score in Bioabsorbable screw group was 87.63 (SD: 6.86, Standard error of means: 1.25) with a median value of 88 and range between 72 to 100. The p value (significance) for Titanium screw group was 0.000 and for Bioabsorbable screw group was 0.001. This indicates that both Titanium screw and Bioabsorbable screw groups are significant ($p < 0.005$) when functional outcomes were measured with preoperative and 6 months postoperative Lysholm and Gillquist scores. The P value for postoperative evaluation of Lysholm scores between the two groups showed NO STATISTICAL SIGNIFICANCE ($p = 0.307$). This indicates that there is no significant statistical difference between the two groups in respect of postoperative functional outcomes. No significant adverse events except for transient anterior knee pain was noted in our patients.

Sanders T and others studied the incidence of age and sex differences in anterior cruciate ligament injury and stated that the incidence of ACL injury is significantly more in males

compared to females [4]. Hagino T reported the incidence of meniscal tears associated with ACL injury and found Medial meniscus to be more commonly involved than lateral meniscus [5]. Recent development and advancement in soft tissue fixation devices studies have proven hamstring grafts to be superior in strength and avoiding extensor mechanism disruption compared to bone patellar tendon bone graft [6]. Edgar *et al.* [7] compared the outcomes of patellar tendon and hamstring grafts and reported significantly improved outcome and improved quadriceps function at 6 months follow up but the outcomes equalised with time. Though the outcomes equalised the donor site morbidity was less with hamstring graft. Michael Wagner [8] recommended hamstring graft even in high level athletes. David D Greenberg [9] proposed allografts has a good alternative of graft but it carries the risk of disease transmission. In our study we used Quadrupled semitendinosus and gracilis graft in all patients which had greatest ultimate load to failure. Gonazalo reported patellar chondrosis and anterior knee pain with bone patellar tendon bone graft [10]. The fixation of the graft has been proved to be the site of failure rather than the graft itself irrespective of the type of graft especially in the early rehabilitation phase when the graft integration has not taken place and the fixation is of little significance after 8 to 12 weeks when graft has integrated with the bone as proposed by Dawn T Gulick [11]. Chae Gwan Kong [12] showed endobutton to be superior than cross pins in femoral fixation. Whereas Young Ho oh showed that a hybrid fixation with an endobutton and a bio screw in femoral tunnel provided adequate stability and stiffness [13]. We used endobuttons as femoral fixation device and titanium interference screw as tibial fixation device. Though there are concerns about the bungee effect of the graft while using endobutton causing movement of graft in the tunnel, tunnel widening and interference to graft incorporation, a recent study had reported tunnel widening was more with interference screw than the endobutton and attributed tunnel widening to biological factors rather than mechanical factors of the fixation device. In our study we used transportal single bundle reconstruction with quadrupled semitendinosus and gracilis graft placing the femoral tunnel between 10 30 and 11 o'clock position in the right knee and between 1 o'clock and 1 30 position in the left knee. Sonneri proposed that placing graft at 10 30 position and 1 30 position in single bundle reconstruction reconstructs portions of anteromedial and posterolateral bundles [14]. Masayoshi Yagi showed that anatomic reconstruction allowed better rotatory stability than nonanatomic placements of graft [15]. Asheesh Bedi showed that trans portal placement of tunnel achieved more lateral placement than the trans tibial drilling and trans tibial approach to achieve lateral tunnel placements resulted in over reaming of tibia [16]. Though double bundle reconstructions have gained attraction and studies have shown double bundle reconstruction to be superior in providing stability in high demand patients. Adachi, Ochi and Uchio showed no significant advantage of double bundle reconstruction than anatomic single bundle reconstruction in factors of stability and proprioception in general population [17]. The metallic screws distort the knee MRI wherein bioabsorbable screw avoids impairment of imaging. Apart from this, metallic screws have to be removed during surgical revision wherein bioabsorbable screws would have been degraded. Bioabsorbable screw is not associated with osteoporosis and stress in long-term interference with surrounding tissues [18]. The major disadvantages proposed for bioabsorbable screw are screw breakage at the time of insertion and postoperative

inflammatory reaction causing synovitis. We did not come across any such problems in our study. Since our study was a short term follow-up we could not comment about the arthritic changes post operatively. Fox *et al.* [19] reported 3 to 17% incidence of anterior knee pain, compared to almost nil in our study.

Conclusion

The results of our study were comparable with already published reports of comparative study done using bioabsorbable versus metal interference screws. Our study shows that there is no difference in functional outcome whether bioabsorbable or titanium interference screw was used. The success of ACL reconstruction depends on the correct technique used for the surgery, precise placement of graft and rehabilitation methods than on type of graft fixation device used, neither titanium nor bioabsorbable screws. Large scale study with long term follow up is required to corroborate findings of the study and to find out long term functional results in the two groups. The blunt metal or titanium screw has been the de facto standard in graft fixation. Since the alternate bioabsorbable screw overcomes some of the potential drawbacks, it should become the de facto standard in the future.

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