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Original Research Article

Bioabsorbable screws versus metallic interference screw fixation in anterior cruciate ligament reconstruction using hamstring autograft: comparative analysis of functional outcome

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ABSTRACT

Background: This prospective comparative study aimed to evaluate the functional outcomes of bioabsorbable screws versus titanium interference screws for anterior cruciate ligament (ACL) reconstruction using hamstring autograft.
Methods: The study included 30 patients who underwent ACL reconstruction with a quadrupled hamstring graft; 15 were fixed with titanium interference screws and 15 with bioabsorbable screws. The patients were followed up for six months post-surgery. The functional outcomes were evaluated using the Lysholm score. The data were analyzed using SPSS version 22.0.
Results: There was no significant difference in the functional outcomes between the two groups at the six-month follow-up.
Conclusions: Our study shows that there was 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.

Keywords: Anterior cruciate ligament reconstruction, Bioabsorbable interference screw, Functional outcome, Hamstring autograft, Metallic interference screw

INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is a commonly performed surgical procedure to restore knee stability and function after ACL injury. The use of hamstring autografts has become increasingly popular due to their favorable outcomes and decreased morbidity compared to other graft sources.[1] The use of interference screws for graft fixation has also been widely adopted as a successful method, but concerns regarding potential complications such as screw migration, hardware irritation, and breakage have been raised.[2]

To address these concerns, the use of bioabsorbable screws has emerged as an alternative to metallic interference screws for ACL graft fixation. Bioabsorbable screws have the advantage of being absorbed by the body over time, eliminating the need for hardware removal and potentially reducing the risk of complications associated with metallic screws.[3] However, their efficacy in comparison to metallic screws remains a topic of debate.

The aim of this study was to compare the functional outcomes of ACL reconstruction using hamstring autograft fixation with either bioabsorbable screws or metallic interference screws. This comparative analysis will provide valuable insights into the use of these two fixation methods and help guide surgeons in their decision-making process.

A recent meta-analysis by Chen et al compared the clinical outcomes of ACL reconstruction with

bioabsorbable screws versus metallic interference screws. The authors found no significant difference in knee stability, functional outcomes, or the incidence of complications between the two fixation methods.[4] These findings are supported by several other studies that have also reported similar clinical outcomes with both fixation methods.[5,6]

However, there are also studies that have reported advantages of one fixation method over the other. For instance, a randomized controlled trial by Sun et al reported that patients who underwent ACL reconstruction with bioabsorbable screws had significantly better subjective knee scores and lower rates of tunnel widening compared to those with metallic interference screws.[7] Another study by Jansson et al reported similar findings of less tunnel widening in the bioabsorbable screw group, but no significant difference in functional outcomes or complications between the two groups.[8]

While the existing literature provides some evidence for the use of bioabsorbable screws in ACL reconstruction, more studies are needed to establish their efficacy compared to metallic screws. Additionally, factors such as cost, availability, and surgeon preference should also be considered in decision-making.

The use of hamstring autografts for ACL reconstruction has become increasingly popular, and both metallic interference screws and bioabsorbable screws have been used for graft fixation. While both methods have been reported to yield favorable clinical outcomes, the use of bioabsorbable screws offers potential advantages such as elimination of the need for hardware removal and potentially reducing the risk of complications associated with metallic screws. However, more studies are needed to establish the efficacy of bioabsorbable screws in comparison to metallic screws. This study aimed to provide further insights into the use of these two fixation methods and their impact on functional outcomes following ACL reconstruction.

Aims and objectives

To determine the functional outcomes between bioabsorbable and metallic screw fixation in anterior cruciate ligament (ACL) reconstruction.

METHODS

Study type and design

This study was a prospective comparative analysis of functional outcome between two groups of patients who underwent arthroscopic anterior cruciate ligament reconstruction with quadrupled hamstring graft with titanium interference screw and bioabsorbable interference screw, respectively. The study included patients who were treated between August 2020 and March 2022 at The Oxford Medical College, Hospital and Research Centre, Bangalore, India.

Sample size

A total of 30 patients were included in this study, with 15 patients in each group selected by using sealed envelope method. The first group underwent arthroscopic-assisted anterior cruciate ligament reconstruction with quadrupled hamstring graft with a titanium interference screw, while the second group underwent the same procedure with a bioabsorbable interference screw.

Inclusion criteria

Patients with closed growth plate. Primary ACL surgery. 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. Any co-existing local conditions in the form of active articular infection, inflammatory joint disease. Metabolic bone disease. Neoplastic disease

Surgical procedure

All patients underwent arthroscopic-assisted anterior cruciate ligament reconstruction with quadrupled hamstring graft under spinal anesthesia. The graft was fixed to the femur and tibia using either a titanium interference screw or a bioabsorbable interference screw, depending on the group to which the patient was assigned.

Follow-up

The period of follow-up in this study was 6 months after the surgical procedure. All patients were assessed for functional outcomes using various validated scoring systems at 6 months after surgery.

Ethical approval

This study was approved by the Institutional Ethics Committee of Oxford Medical College, Hospital and Research Centre, Bangalore. All patients provided written informed consent before the surgical procedure.

Data analysis

The statistical analysis plan for this study involved the comparison of functional outcomes between the two groups of patients using various validated scoring systems. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Inferential statistics, including independent t-

tests and Mann-Whitney U tests, were used to compare the mean scores between the two groups at different time points. A p value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS.

RESULTS

The study included 30 patients who underwent arthroscopic-assisted anterior cruciate ligament reconstruction with quadrupled hamstring graft. The age of the patients ranged from 20 to 55 years with a mean age of 31 years. The majority of the patients (73.33%) were female.

Table 1: Demographic and clinical characteristics of the study population.

Characteristics		N	%
Age (in years)	20-25	4	13.33
	26-30	6	20.00
	31-35	11	36.67
	36-40	5	16.67
	41-45	2	6.67
	46-50	1	3.33
	51-55	1	3.33
Sex	Male	8	26.67
	Female	22	73.33
Side involved	Right	21	70.00
	Left	9	30.00
Mode of injury	Sports	10	33.33
	Fall	5	16.67
	RTA	15	50.00
Associated injury	medial meniscus tear	7	23.33
	lateral meniscus tear	4	13.33
	Both	2	6.67
	Nil	17	56.67

In terms of the side involved, 70% of the patients had their right knee operated on, while the remaining 30% had their left knee operated on. Regarding the mode of injury, 50% of the patients had road traffic accidents (RTA) as the cause of their ACL injury, followed by sports-related injuries (33.33%) and falls (16.67%).

The study also investigated associated injuries and found that 56.67% of the patients had no associated injuries, while 23.33% had a medial meniscus tear, 13.33% had a lateral meniscus tear, and 6.67% had both. These findings suggest that ACL injuries can be caused by a variety of factors and can occur in both genders, with RTA being the most common mode of injury in this study.

The Table 2 presented in the outcome section of the article shows the results of the study in terms of the functional outcomes of patients who underwent arthroscopic-assisted anterior cruciate ligament reconstruction with quadrupled hamstring graft using either titanium or bioabsorbable screws.

Of the 15 patients in the titanium screw group, 11 patients (73.33%) had a good outcome, 3 patients (20%) had a fair outcome, and 1 patient (6.67%) had a poor outcome. In the bioabsorbable screw group, 10 patients (66.67%) had a good outcome, 3 patients (20%) had a fair outcome, and 2 patients (13.33%) had a poor outcome.

However, statistical analysis revealed no significant difference between the two groups in terms of functional outcomes (p=0.8266). Therefore, it can be concluded that both titanium and bioabsorbable screws have similar outcomes in terms of functional recovery following arthroscopic-assisted anterior cruciate ligament reconstruction with quadrupled hamstring graft.

One patient had post-operative infection and patient presented on 10th post-operative day with fever, pain and inability to move the limb. Septic arthritis was suspected and patient treated with open arthrotomy and joint debridement and antibiotics for 4 weeks and infection subsided. The most common intraoperative complication proposed for bioabsorbable interference screw were screw breakage, graft injury and aseptic effusion or synovitis of knee joint, but we did not encounter such problems in our study.

Table 2: Comparison of outcome.

Outcome	Titanium screw gp. (n=15)	%	Bio-abs screw gp. (n=15)	%	P value
Good	11	73.33	10	66.67	
Fair	3	20.00	3	20.00	0.8266
Poor	1	6.67	2	13.30	

DISCUSSION

Anterior cruciate ligament (ACL) reconstruction is a widely performed surgical procedure for the treatment of ACL injuries. One of the key factors in the success of ACL reconstruction is the choice of fixation method for the graft. The use of interference screws for graft fixation is a well-established technique, with metallic and bioabsorbable screws being the most commonly used options. However, there is still controversy regarding the best type of screw to use for ACL reconstruction.

The present study compared the functional outcomes of patients who underwent ACL reconstruction with quadrupled hamstring graft using either titanium or bioabsorbable interference screws. The results showed no significant difference between the two groups in terms of functional recovery. These findings are consistent with previous studies that have compared the outcomes of metallic and bioabsorbable screws for ACL reconstruction.

A study by Kanaya et al compared the outcomes of ACL reconstruction using hamstring autografts with either titanium or bioabsorbable screws in a larger sample size of 80 patients. The study found no significant difference in the outcomes between the two groups, with both groups showing similar rates of functional recovery and graft stability.[9]

Similarly, a study by Huang et al compared the outcomes of ACL reconstruction using hamstring autografts with either titanium or bioabsorbable screws in 47 patients. The study found no significant difference in the outcomes between the two groups, with both groups showing similar rates of functional recovery and graft stability.[10]

However, other studies have reported conflicting results. A study by Maletis et al compared the outcomes of ACL reconstruction using patellar tendon autografts with either titanium or bioabsorbable screws in 108 patients. The study found that the bioabsorbable screw group had a higher rate of graft failure and required more revision surgeries than the titanium screw group.[11]

Similarly, a study by Shen et al compared the outcomes of ACL reconstruction using hamstring autografts with either titanium or bioabsorbable screws in 90 patients. The study found that the titanium screw group had better outcomes in terms of graft stability and functional recovery than the bioabsorbable screw group.[12]

The conflicting results from these studies may be due to differences in study design, sample size, and surgical techniques used. It is also important to note that the choice of screw type for ACL reconstruction should be based on several factors, including the patient's age, activity level, and comorbidities, as well as the surgeon's experience and preference.

In summary, the present study found no significant difference in the functional outcomes of patients who underwent ACL reconstruction with quadrupled hamstring graft using either titanium or bioabsorbable interference screws. These findings are consistent with previous studies that have compared the outcomes of metallic and bioabsorbable screws for ACL reconstruction. However, further studies with larger sample sizes and longer follow-up periods are needed to fully evaluate the effectiveness of these two screw types.

It is important to note that the sample size in this study was relatively small, which may limit the power of the statistical analysis to detect significant differences between the two groups. Additionally, the follow-up period was only 6 months, and longer-term follow-up may be necessary to fully evaluate the effectiveness of these two screw types.

CONCLUSION

In our study, we sought to compare the outcomes of ACL reconstruction using bio-absorbable versus metal interference screws. After analyzing the results, we found that they were quite comparable to already published reports of similar comparative studies. Our findings indicate that the choice of screw material does not seem to have a significant impact on the functional outcome of the surgery.

It is worth noting that the success of ACL reconstruction is primarily dependent on the correct surgical technique, precise placement of the graft, and effective rehabilitation methods. Therefore, the fixation device used, whether it be a titanium or bioabsorbable screw, does not appear to be a decisive factor in the success of the surgery.

However, it is essential to consider the cost-effectiveness and potential complications associated with each type of screw when making a decision in surgical management. While both types of screws have their advantages and disadvantages, it is crucial to weigh these factors carefully. Ultimately, the decision should be based on the individual patient's needs and circumstances, as well as the surgeon's expertise and experience.

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