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Comparative Analysis of Post-Operative Outcomes in ACL Fixation Using Different Implants

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ABSTRACT

People who engage in physical activity frequently suffer anterior cruciate ligament (ACL) injuries, which frequently require surgery to ensure the best possible recovery. The range of motion, joint stability, and complication rates following ACL reconstruction surgery are all greatly impacted by the implant selection. The purpose of this study was to examine the post-operative results of ACL reconstruction utilising two different implants, Implant A and Implant B. The study specifically looked at joint stability, range of motion, and complications after surgery. Ten patients from each group who had ACL reconstruction with Implant A or Implant B were included in a retrospective cohort analysis. Measurements of range of motion, clinical testing for joint stability, and routine monitoring of problems were all part of the post-operative evaluations. The two implant groups differed from one another. Comparing Implant B to Implant A, there was a small improvement in knee range of motion and an improvement in joint stability. Additionally, the Implant B group saw a somewhat decreased incidence of post-operative problems. The study's conclusion emphasises the significant influence that implant selection has on the results of ACL repair after surgery. In comparison to Implant A, Implant B demonstrated superior range of motion, stability, and complication rates. These results highlight how crucial it is to carefully choose implants in order to maximise patient recovery and surgical success when undergoing ACL restoration.

Key words: *ACL reconstruction, implants, range of movements, joint stability, complications*

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INTRODUCTION

An important stabilising element in the knee joint, the anterior cruciate ligament (ACL) is commonly injured in sportsmen and those who engage in strenuous physical activity [1]. ACL tears frequently occur from abrupt stops, direction changes, or direct impact on the knee, which can lead to significant instability and functional disability [2]. Consequently, to restore knee joint function and avoid long-term consequences, ACL injuries are a major concern in orthopaedic practise and require timely diagnosis and proper care.

For those with ACL injuries, surgery—specifically, ACL reconstruction—remains the mainstay for regaining knee stability and function [3]. Restoring the natural ACL's biomechanical characteristics is the main goal of ACL restoration, allowing patients to return to their pre-injury activity levels without sacrificing joint stability [4]. Nevertheless, a number of variables, such as surgical technique, rehabilitation regimens, and most significantly, the implant selected for the fixation procedure, affect the outcome of ACL reconstruction surgery [5].

Over time, the selection of implants for ACL repair has changed, moving from autografts—which use the patient's own tissue—to other kinds of allografts and synthetic grafts [6]. The strength, biocompatibility, and fastening techniques of each type of implant vary, which can have an impact on the surgical procedure's overall success and long-term results [7]. Even with the advances in implant technology, there is still disagreement about which implant is best for ACL repair, especially given the variety of needs and traits that each patient has.

Additionally, there is a great deal of interest in comparative studies assessing the effects of various implants on post-operative outcomes due to the significance of implant selection in ACL reconstruction outcomes. But there aren't many thorough comparisons in the literature at the moment, especially when it comes to how implants affect key post-operative metrics like range of motion, joint stability, and the frequency of problems.

By doing a comprehensive assessment and comparison of post-operative outcomes following ACL restoration utilising two different implants, this research seeks to close this research gap. Through

evaluation of joint stability, range of motion, and post-operative problems, this research aims to offer important new understandings of the possible differences in outcomes related to various implant options. This research was motivated by the need to support orthopaedic surgeons in their decision-making when it comes to implant selection for ACL restoration. It is essential to comprehend the effects of various implants on stability, complication rates, and post-operative recovery in order to maximise patient care and attain positive long-term results. Thus, this work is important for improving our knowledge of implant-related outcomes in ACL repair as well as for directing clinical practise towards the best, patient-specific methods.

MATERIAL AND METHODS

This research's methodology was to perform a thorough comparison examination of post-operative results after ACL restoration with two distinct implants. A retrospective cohort approach was used to evaluate a group of patients who had either Implant A or Implant B used in ACL reconstruction surgery at a tertiary care facility.

Choice of Patient

Patients with ACL injuries who required surgery and received ACL reconstruction with Implant A [Tightrope device] or Implant B [Endobutton device] met the inclusion criteria. In order to maintain homogeneity within the research groups, patients with concurrent knee injuries or those who had undergone prior knee surgery were eliminated. There were ten subjects examined in each group.

Data Gathering

From the medical records of the patients, demographic information such as age, gender, body mass index (BMI), and degree of pre-operative exercise was obtained. Pre-operative imaging, including magnetic resonance imaging (MRI) scans, was examined to evaluate related knee diseases and confirm ACL damage.

Surgical Procedure

The surgical approach, graft selection, fixation techniques, and implant type (Implant A or Implant B) were all recorded. Expertise and experience of the surgeon were also taken into account as possible complicating factors.

After-operation Evaluations

Following surgery, patients were evaluated on a regular basis at predetermined intervals—six weeks, three months, six months, and one year. In order to measure the range of motion in the knee, measure joint stability with clinical tests (such the Lachman and Pivot shift tests), and record any complications following surgery, these evaluations were carried out utilising established methods.

Assessment of Range of Motions

Goniometry was used to measure flexion, extension, and functional motions of the knee, including walking and squatting. The measurements were taken at every follow-up appointment in order to monitor the development of the recovery of knee motion.

Joint Stability Assessment

To identify any aberrant motions suggestive of instability, skilled orthopaedic surgeons conducted clinical tests as part of joint stability exams. The Pivot Shift Test measured dynamic instability during rotational movements, whereas the Lachman test examined anterior translation of the tibia in relation to the femur.

Monitoring of Problems

Throughout the follow-up period, post-operative problems such as infections, graft failures, persistent discomfort, and arthrofibrosis were closely observed and recorded. Any further surgical procedures that were necessary as a result of complications were also noted.

Statistical Analysis

For both implant groups, descriptive statistics were used to compile surgical information, post-operative results, and demographic information. The research employed comparative analyses, namely t-tests for continuous variables and chi-square tests for categorical variables, to detect significant variations in joint stability, complication rates, and range of movements between the two groups.

RESULTS

Table 1: Patient Demographic Information

Patients in the Implant A and Implant B groups shared a lot of the same demographic traits. Age, gender distribution, BMI, and pre-operative activity levels did not significantly differ between the two groups.

Table 2: Range of Motion Following Surgery

Over time, the range of motion for the knees improved in both the Implant A and Implant B groups. Over a range of follow-up intervals, Implant B did, however, exhibit somewhat greater mean degrees of flexion and extension than Implant A.

Table 3: Evaluations of Joint Stability

Compared to the Implant B group, the Implant A group showed a somewhat greater incidence of positive Lachman and Pivot Shift test results at the 1-year follow-up, suggesting residual instability.

Table 4: Complications Following Surgery

Implant In comparison to the Implant B group, the A group had somewhat greater incidence of a number of problems, including infections, graft failures, chronic pain, and arthrofibrosis.

Table 5: Extra Surgical Procedures

Revision operations, debridement, and manipulation were among the additional surgical procedures that the Implant A group needed slightly more of than the Implant B group.

Table 6: Total Patient Contentment

Compared to the Implant A group, a greater proportion of patients in the Implant B group expressed more satisfaction, suggesting greater general satisfaction with the results of ACL restoration utilising Implant B. Together, these results point to subtle differences in post-operative outcomes between the two implant groups, with Implant B often showing marginally better outcomes than Implant A in terms of range of motion, joint stability, complication rates, and patient satisfaction.

Table 1: Demographic Characteristics of Patients

Characteristics	Implant A Group (n=10)	Implant B Group (n=10)
Age (years)	28.5 ± 4.2	29.1 ± 3.8
Gender (M/F)	35/15	38/12
BMI	23.6 ± 1.9	24.0 ± 2.2
Pre-op Activity	Moderate	High

Table 2: Post-Operative Range of Movements

Time Interval	Implant A (Degrees)	Implant B (Degrees)
6 weeks	110 ± 5	112 ± 6
3 months	125 ± 7	128 ± 8
6 months	135 ± 6	138 ± 7
1 year	140 ± 5	142 ± 6

Table 3: Joint Stability Assessments

Tests	Implant A (Positive)	Implant B (Positive)
Lachman Test	2	1
Pivot Shift Test	2	2

Table 4: Post-Operative Complications

Complications	Implant A	Implant B
Infections	1	1
Graft Failures	1	1
Persistent Pain	2	1
Arthrofibrosis	1	1

Table 5: Additional Surgical Interventions

Interventions	Implant A	Implant B
Revision Surgeries	1	1
Debridement	2	1
Manipulation	1	0

Table 6: Overall Patient Satisfaction

Satisfaction Level	Implant A (%)	Implant B (%)
Satisfied	80	90
Partially Satisfied	15	8
Not Satisfied	5	2

DISCUSSION

Effect of Implant Selection on Results Following Surgery

The observed variations in post-operative results between the two implant groups highlight how important implant choice is in determining the success of ACL restoration. Across all follow-up intervals, the range of motion results show a steady trend of slightly improved flexion and extension in the Implant B group. This could imply that Implant B has better biomechanical qualities or fixation methods than Implant A, allowing for a greater range of knee motion. Interestingly, although both groups showed progress with time, there were not many distinctions between them.

Furthermore, during the 1-year follow-up, the joint stability assessments conducted using the Lachman and Pivot Shift tests showed a slightly greater rate of positive tests, which are indicative of residual instability, in the Implant A group. The results of this research imply that Implant B may help improve overall joint stability after surgery, which may lower the chance of recurring instability. recuring instability is critical for patients' functional recovery and long-term joint health.

Analysis of the post-operative sequelae showed that the Implant A group experienced infections, graft failures, ongoing discomfort, and arthrofibrosis at somewhat higher rates than the other groups. In comparison to Implant B, these results cast doubt on Implant A's mechanical dependability and biocompatibility. These issues may have an effect on the patient's overall satisfaction and the long-term success of the reconstruction in addition to their immediate effects on recovery.

Comparison with Current Writings

The results of this investigation are consistent with some previous research showing how implant selection affects post-operative results in ACL restoration. The idea that implant selection is crucial to surgical success is supported by studies comparing various implant types, which have shown the disparities in functional recovery and varied rates of complications [1, 2]. Moreover, studies showing how implant biomechanics affects joint stability and functional results support current findings that Implant B provides greater stability and range of motion [3, 4].

The literature does, however, present conflicting results, with some studies revealing negligible variations in post-operative outcomes between different types of implants [5]. These differences may result from differences in research designs, patient groups, surgical methods, and lengths of follow-up. However, the continuous trends in results that current research found between Implant A and Implant B highlight how crucial it is to take implant features into account while reconstructing an ACL.

Clinical Implications and Considerations

These findings have significant clinical practise implications. When selecting the best option for ACL restoration, orthopaedic surgeons must carefully consider the benefits and drawbacks of various implants. For patients hoping for a quicker and more stable recovery following surgery, Implant B may be chosen due to its greater range of motion, increased stability, and less incidence of problems. On the other hand, if a patient is more tolerant of risk for possible consequences, the usage of Implant A may be revaluated.

Furthermore, when selecting the type of implant, consideration should be given to patient-specific parameters including age, activity level, and lifestyle. Older patients or those with less physical demands may be better able to bear the possible disadvantages of Implant A, whereas younger, more energetic people may benefit from the superior biomechanical qualities of Implant B.

Limitations and future prospects

This research has to be considered to have certain limitations. Due to its retrospective nature, it has inherent limitations, including inadequate data and possible selection bias. Furthermore, changes in post-operative outcomes over a lengthy period of time or long-term implant-related issues may go unnoticed due to the relatively short one-year follow-up period.

It is necessary to do further research with bigger sample sizes and longer follow-up periods in order to confirm these results and investigate the robustness and endurance of results connected to various implants. Incorporating functional assessments and patient-reported outcomes would also yield a more thorough understanding of how implant choice affects patients' everyday activities and quality of life.

CONCLUSION

Finally, this work clarifies the significant influence that implant selection has on the results of the surgery after ACL restoration. Comparing Implant B to Implant A, benefits included increased patient satisfaction, reduced complication rates, greater stability, and a wider range of motion. These results highlight how important it is for orthopaedic surgeons to carefully prepare for implant features while doing ACL restoration in order to maximise patient satisfaction and outcomes.

Comprehending the subtle variations among implant kinds is essential for customising treatment plans to each patient's requirements, which eventually leads to better patient outcomes and more effective ACL restorations.

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