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EVALUATING FUNCTIONAL OUTCOME OR LATERAL EXTRAARTICULAR TENODESIS WITH ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH MODIFIED LEMAIRE PROCEDURE

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ABSTRACT

Background: the standard arthroscopic ACL (anterior cruciate ligament) reconstruction using different techniques and grafts has been linked with failure rates of nearly 16%. To decrease the need for revision ACL surgeries modified Lemaire's technique has been widely accepted which adds the procedure of tenodesis laterally and reduces the anterolateral laxity.

Aim: The present study aimed to evaluate the functional outcome of lateral extraarticular tenodesis with anterior cruciate ligament reconstruction with a modified Lemaire procedure.

Methods: The present study assessed 60 subjects who underwent modified Lemaire's procedure with ACL reconstruction at the Institute. The subjects were postoperatively followed at 6 months, 1 year, and 2 years. The parameters assessed were IKDC (International Knee Documentation Committee) scores, Tegner–Lysholm scoring, and pivot shift scores preoperatively and postoperatively.

Results: The study results showed that all 60 subjects that underwent modified Lemaire's procedure showed improvement in IKDC scores and Tegner-Lysholm scores and a significant reduction in pivot shift scores was also seen. A statistically significant difference was seen in preop Lysholm scores and 6-month Lysholm scores and at 1 and 2 years Lysholm scores with a p-value of <0.05.

Conclusions: The present study concludes that Lemaire's technique is a good technique that results in reduced rates of revision ACL surgeries with an improvement in postoperative IKDC scores and Tegner-Lysholm scores. Modified Lemaire's technique also assesses anterolateral deficiency with a reduction in the prevalence of pivot shift.

Keywords: Anterior cruciate ligament, anterolateral rotatory instability, modified Lemaire's technique, pivot shift, tenodesis

INTRODUCTION

The standard reconstruction of intraarticular anterior cruciate ligament (ACL) using arthroscopy with different grafts and

techniques has been shown to have varying incidences of failure with the failure rates reaching as high as 16% as reported in a few literature studies. To minimize the revision rates of anterior cruciate ligament reconstruction and failure rates associated with different surgical procedures, various studies from the existing literature have shown that augmentation of ACL repair or reconstruction by the addition of an extraarticular tenodesis laterally. Also, substantial literature research has been done to assess the anterolateral rotatory laxity.[1,2]

The most common procedure done to assess the anterolateral rotatory laxity includes the modified Lemaire's procedure where the IT band graft released in the proximal portion passes beneath the fibular collateral ligament and is attached to the lateral femoral condyle or Ellison's procedure where IT (iliotibial) band graft released in the distal portion pass beneath the FCL (fibular collateral ligament) and are secured at Gerdy's tubercle or anterolateral ligament (ALL)/fibular cruciate ligament reconstructions.[3]

Modified Lemaire's technique is one of the procedures that is done to decrease the rate of revision anterior cruciate ligament surgeries by the addition of tenodesis laterally and hence, reducing the anterolateral rotatory laxity. Existing literature data is scarce concerning the efficacy of adding extraarticular tenodesis procedure laterally to reduce the rate of ACL revision surgeries.[4] The present study aimed to evaluate the functional outcome of lateral extraarticular tenodesis with anterior cruciate ligament reconstruction with a modified Lemaire procedure.

MATERIALS AND METHODS

The present prospective observational clinical study was aimed to evaluate the functional outcome of lateral extraarticular tenodesis with anterior cruciate ligament reconstruction with a modified Lemaire procedure. The study subjects were from the Department of Orthopedics of the Institute. Verbal and written informed consent were taken from all the subjects before study participation.

The study included 60 subjects that had ruptured ACL and reported to the Institute. These subjects underwent modified Lemaire's procedure with ACL reconstruction at the Institute. The inclusion criteria for the study were subjects aged more than 17 years from both genders, involved in contact pivoting sports, high BMI (body mass index), generalized tendon and ligament laxity, revision ACL reconstruction subjects, grade >2 pivot shift, and high grade anterolateral rotatory instability subjects. The exclusion criteria for the study were medically unfit subjects with chronic diseases, lateral compartment osteoarthritis, posterolateral corner injury, coexisting neurovascular damage, and concomitant fractures around the knee.

All the included subjects were followed at 6 months, 1 year, and 2 years. After the final inclusion of the study subjects, detailed history was recorded for all the subjects. Preoperatively, anterior drawer test, Lachman, and pivot-shift scores were assessed for all the subjects. Also, subjective scores including IKDC (International Knee Documentation Committee) and Tegner–Lysholm scores were also assessed. The difference in mean preoperative and postoperative scores was calculated and summarized in Table 1.

Completion of ACL reconstruction was done with the standard technique with different autograft tendons. The knee was positioned at 80 degrees of flexion and rotation in near near-neutral position and a lateral skin incision around 6cm was placed just behind the lateral epicondyle 2 cm above the Gerdy's tubercle. This was followed by dissection down the subcutaneous IT band layer followed by graft harvesting of nearly 1.5cm wide and 7-8 cm in length from the posterior one-third of the entire band. Attachment of tibia to IT band graft was left intact at Gerdy's tubercle. The graft was then passed beneath the FCL by tunneling. The knee was then placed in 60-degree flexion and neutral rotation, and then the IT band graft was fixed to the lateral femoral condyle by tunnel drilling proximal and anterior to the femoral tunnel for ACL graft. To avoid collision of the tunnel, view scope is performed during the passage of the guide pin. Graft was then fixed with an interference screw based on tunnel and graft size. Sutures were used for the closure of the IT band.

Postoperative rehabilitation was similar to the standard construction of ACL. Weight-bearing was done with hinged knee support in the first four weeks using cold therapy and ankle-pump exercises were initiated in all the subjects. Strengthening exercises were also advised for hamstrings and quadriceps using the multiangle isometrics, closed chain exercises followed by open chain exercises to attain full ROM (range of motion) of the knee. After 12 weeks, impact loading exercises such as jumping and running to plyometrics were started.

The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, one-way ANOVA (analysis of variance), post-hoc analysis, Fisher exact test, and chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

The present prospective observational clinical study was aimed to evaluate the functional outcome of lateral extraarticular tenodesis with anterior cruciate ligament reconstruction with a modified Lemaire procedure. The present study assessed 60 subjects who underwent modified Lemaire's procedure with ACL reconstruction at the Institute. The subjects were postoperatively followed at 6 months, 1 year, and 2 years. The parameters assessed were IKDC (International Knee Documentation Committee) scores, Tegner–Lysholm scoring, and pivot shift scores preoperatively and postoperatively.

The age of the study subjects was 24.4±4.3 years with a 95% CI of 22.97-26.19. Preop pivot shift was 2 and 3 as minimum and maximum and mean shift was 2.5±0.3 and 95% CI was 2.51-2.84, whereas postop pivot shift was 0 and 1 as minimum and maximum and mean postop pivot shift was 0.2±0.4 with 95% CI of 0.03-0.1. Mean Lysholm preoperatively, 6 months Lysholm, 1-year Lysholm, and 2-year Lysholm was 26.0±2.4, 94.6±2.0, 96.1±1.4, and 97.1±0.6 showing a significant increase from preop to postop to 6 months, 1 year, and 2-years with $p<0.05$. Mean preoperative IKDC was 28.4±1.5 which significantly increased to 94.7±1.4 at 6 months IKDC to 96.5±0.7 at 1-year IKDC, and to 97.3±0.4 at 2-years IKDC with $p<0.05$ (Table 1).

It was seen that for demographic data and distribution of the study subjects, there were 86.7% (n=52) males and 13.3% (n=8) females in the present study. The mode of injury was RTA (road traffic accident) in 36.6% (n=22) study subjects, sports injury was the reason for injury in 43.3% (n=26) study subjects, and other modes were reported in 20% (n=12) study subjects. Sports participation type was recreational and professional in 60% (n=36) and 40% (n=24) study subjects respectively (Table 2).

On Wilcoxon signed rank test analysis for significance, z-scores were -4.7819 for preop vs postop pivot shift, Preop vs postop 6 months Lysholm, and Preop vs postop 6 months IKDC. Postop 6-months Lysholm vs 1-year Lysholm, Postop 1-year Lysholm vs 2 years Lysholm, and Postop 1-year IKDC vs 2 years IKDC were -3.913, -3.564, and -3.864 respectively. The p-value for Pre-op vs postop pivot shift, Preop vs postop 6 months Lysholm, Preop vs postop 6 months IKDC, Postop 6-months Lysholm vs 1-year Lysholm, Postop 1-year Lysholm vs 2 years Lysholm, and Postop 1-year IKDC vs 2 years IKDC was <0.05 showing statistical significance (Table 3).

DISCUSSION

The present study assessed 60 subjects who underwent modified Lemaire's procedure with ACL reconstruction at the Institute. The subjects were postoperatively followed at 6 months, 1 year, and 2 years. The parameters assessed were IKDC (International Knee Documentation Committee) scores, Tegner–Lysholm scoring, and pivot shift scores preoperatively and postoperatively. The study design of the present study was similar to the study design adopted by Song GY et al[5] in 2016 and Rezende FC et al[6] in 2015 where the study design similar to the present study was adopted by the authors in their respective studies.

It was seen that the age of the study subjects was 24.4±4.3 years with a 95% CI of 22.97-26.19. Preop pivot shift was 2 and 3 as minimum and maximum and mean shift was 2.5±0.3 and 95% CI was 2.51-2.84, whereas postop pivot shift was 0 and 1 as minimum and maximum and mean postop pivot shift was 0.2±0.4 with 95% CI of 0.03-0.1. Mean Lysholm preoperatively, 6 months Lysholm, 1-year Lysholm, and 2-year Lysholm was 26.0±2.4, 94.6±2.0, 96.1±1.4, and 97.1±0.6 showing a significant increase from preop to postop to 6 months, 1 year, and 2-years with $p<0.05$. Mean preoperative IKDC was 28.4±1.5 which significantly increased to 94.7±1.4 at 6 months IKDC to 96.5±0.7 at 1-year IKDC, and to 97.3±0.4 at 2-years IKDC with $p<0.05$. These data correlated with the studies of Felix ECR et al[7] in 2022 and Gokeler, A. et al[8] in 2022 where disease data reported by the authors was similar to the reports of the present study.

The study results showed that for demographic data and distribution of the study subjects, there were 86.7% (n=52) males and 13.3% (n=8) females in the present study. The mode of injury was RTA (road traffic accident) in 36.6% (n=22) study subjects, sports injury was the reason for injury in 43.3% (n=26) study subjects, and other modes were reported in 20% (n=12) study subjects. Sports participation type was recreational and professional in 60% (n=36) and 40% (n=24) study subjects respectively. These results were consistent with the findings of Nagelli CV et al[9] in 2017 and Beischer, S et al[10] in 2020 where demographics and distribution similar to the present study were reported by the authors in their respective studies.

Considering the Wilcoxon signed rank test analysis for significance, z-scores were -4.7819 for preop vs postop pivot shift, Preop vs postop 6 months Lysholm, and Preop vs postop 6 months IKDC. Postop 6-months Lysholm vs 1-year Lysholm, Postop 1-year Lysholm vs 2 years Lysholm, and Postop 1-year IKDC vs 2 years IKDC were -3.913, -3.564, and -3.864 respectively. The p-value for Pre-op vs postop pivot shift, Preop vs postop 6 months Lysholm, Preop vs postop 6 months

IKDC, Postop 6-months Lysholm vs 1-year Lysholm, Postop 1-year Lysholm vs 2 years Lysholm, and Postop 1-year IKDC vs 2 years IKDC was <0.05 showing statistical significance. These findings were in correlation with the studies of Ruffilli A et al[11] in 2016 and Vari N et al[12] in 2023 where similar significance for various parameters similar to the present study was reported by the authors in their respective studies.

CONCLUSION

Considering its limitations, the present study concludes that Lemaire's technique is a good technique that results in reduced rates of revision ACL surgeries with an improvement in postoperative IKDC scores and Tegner-Lysholm scores. Modified Lemaire's technique also assesses anterolateral deficiency with a reduction in the prevalence of pivot shift.

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TABLES

Characteristics	Minimum	Maximum	Mean ± S. D	95% CI
Age (years)	18	35	24.4±4.3	22.97-26.19
Preop pivot shift	2	3	2.5±0.3	2.51-2.84
Postop pivot shift	0	1	0.2±0.4	0.03-0.1

Preop Lysholm	20	28	26.0±2.4	25.25-27.11
6 months Lysholm	90	96	94.6±2.0	94-95.57
1-year Lysholm	90	96	96.1±1.4	95.7596.86
2-yaers Lysholm	94	96	97.1±0.6	96.96-97.51
Preop IKDC	25	30	28.4±1.5	27.58-28.77
6 months IKDC	90	96	94.7±1.4	94.29-95.46
1-year IKDC	93	96	96.5±0.7	96.37-97.04
2-years IKDC	95	97	97.3±0.4	97.27-97.68

Table 1: Demographic and descriptive data on the study subjects

Injury mode	**Number (n)**	**Percentage (%)**
Sports Injury	26	43.3
RTA	22	36.6
Others	12	20
Gender		
Males	52	86.7
Females	8	13.3
Sports participation type		
Recreational	36	60
Professional	24	40

Table 2: Demographics and distribution of the study subjects

Stats	**Pre-op vs postop pivot shift**	**Preop vs postop 6months Lysholm**	**Preop vs postop 6months IKDC**	**Postop 6-months Lysholm vs 1-year Lysholm**	**Postop 1-year Lysholm vs 2 years Lysholm**	**Postop 1-year IKDC vs 2 years IKDC**
Z	-4.7819	-4.7819	-4.7819	-3.913	-3.564	-3.864
p-value	**<0.05**	**<0.05**	**<0.05**	**<0.05**	**<0.05**	**<0.05**

Table 3: Wilcoxon signed rank test for assessing significance