



Original article

Comparison of grafts for anatomical reconstruction of the ACL: patellar versus semitendinosus/gracilis[☆]



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ABSTRACT

Objective: To compare the functional results from surgical treatment for anatomical reconstruction of the anterior cruciate ligament (ACL) with a single band, using two types of autologous grafts.

Methods: Twenty-seven patients who underwent anatomical reconstruction of the ACL by means of the Chambat technique were evaluated prospectively. They were divided into two groups: A, with 14 patients, using grafts from flexor tendons; and B, with 13 patients, using grafts from the patellar tendon. In both groups, fixation was performed using an absorbable interference screw.

Results: Based on the Lysholm score, group A presented a mean score of 71.6 in the first month, while B presented 75. At the end of the sixth month, both groups presented 96.6. Evaluation of the total IKDC showed that in the first month, the majority of the patients, both in group A (85.7%) and in group B (76.9%), presented a knee assessment that was close to normal. In the sixth month, 92.9% of group A had normal presentations, and 100% of group B.

Conclusion: According to the Lysholm functional evaluation and the IKDC subjective assessment, there was no statistically significant difference in the results between the groups, and the results were better in the sixth month.

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Comparação dos enxertos para reconstrução anatômica do LCA: patelar versus semitendíneo/grácil

R E S U M O

Palavras-chave:

Reconstrução do ligamento cruzado anterior
Transplantes
Tendões

Objetivo: Comparar o resultado funcional do tratamento cirúrgico da reconstrução anatômica do ligamento cruzado anterior (LCA) com banda única com o uso de dois tipos de enxerto autólogos.

Métodos: Foram avaliados prospectivamente 27 pacientes, submetidos à reconstrução anatômica do LCA pela técnica de Chambat, divididos em dois grupos: A, com 14 e uso como enxerto dos tendões flexores; e B, com 13 e uso como enxerto do tendão patelar. Em ambos os grupos foi feita fixação com parafuso de interferência absorvível.

Resultados: Com base no escore de Lysholm, o grupo A apresentou pontuação média de 71,6 no primeiro mês, enquanto o B apresentou 75. Já no fim do sexto mês ambos apresentaram 96,6. A avaliação do IKDC total mostrou que no primeiro mês a maioria dos pacientes, tanto no grupo A (85,7%) no grupo B (76,9%), apresentava uma avaliação do joelho próximo do normal e no sexto mês o grupo A apresentou 92,9% como normal e o grupo B, 100%.

Conclusão: Os resultados, segundo avaliação funcional de Lysholm e subjetiva do IKDC, não apresentaram diferenças estatisticamente significantes entre os grupos e foram melhores no sexto mês.

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Introduction

Surgery to reconstruct the anterior cruciate ligament (ACL) is frequently performed within orthopedic practice.¹

The ACL acts as an essential stabilizer within the biomechanics of the knee. In addition to being considered to be the primary stabilizer against anterior translation of the tibia, it acts as a secondary stabilizer against excessive internal rotation and valgus and varus stress.¹

Studies have also demonstrated that it diminishes the possibility of joint degeneration, since it promotes protection for the cartilage and menisci.²

Tearing of this important ligament is common in high-performance sports. In making changes in direction or rapid deceleration with the foot planted on the ground, individuals may promote valgus stress and stress through internal or external rotation, thereby injuring the ligament without direct trauma. Once the injury has become established, the patient will present frequent episodes of instability, pain, edema and diminished function. For this reason, the possibility of returning to sports activities with the same vigor and the same mobility is low.³

Choosing the best autologous graft for ACL reconstruction, in knees with insufficiency of this ligament, is a matter for discussion. Grafts taken from the central third of the patellar ligament, as described by Campbell,⁴ were widely used in the 1980s and 1990s. At the end of the 1990s, use of the semitendinosus and gracilis flexor tendons was described by Macey⁵ and these grafts started to be used more frequently.⁶

The ACL is composed of two bands: posterolateral, which mainly stabilizes rotational movements; and anteromedial, which stabilizes movements of anteroposterior translation. Through anatomical studies, a tendency toward ACL

reconstruction using the single-band anatomical technique has been noted.^{7,8}

Today, with technological advances, arthroscopic intra-articular reconstruction makes it possible to reduce postoperative morbidity,⁹ but divergences between surgeons still exist regarding the best graft to use.

Materials and methods

This was a blinded randomized controlled clinical trial. Twenty-seven patients of both sexes (25 males, 92.6%, and two females, 7.4%) aged 18–48 years (mean: 31.7) who presented ACL injuries were prospectively evaluated. The right side was affected in 19 (70.4%) and the left side in eight (29.6%). Twelve (44%) presented lesions of the medial meniscus and one patient had lesions of both the medial and the lateral meniscus.

The inclusion criteria required that the patients should present a unilateral ACL tear and the absence of surgical antecedents or previous pathological conditions in the knee affected.

These patients were randomly divided into two groups, through a draw that determined the type of graft (patellar or flexor) to be used in ACL reconstruction surgery.

Group A, composed of 14 patients, underwent ACL reconstruction using autologous grafts from the flexor tendons, while group B, with 13 patients, received a graft from the patellar tendon.

In both groups, the single-band anatomical technique was used for arthroscopic intra-articular ACL reconstruction, and graft fixation was ensured using an absorbable interference screw.⁸

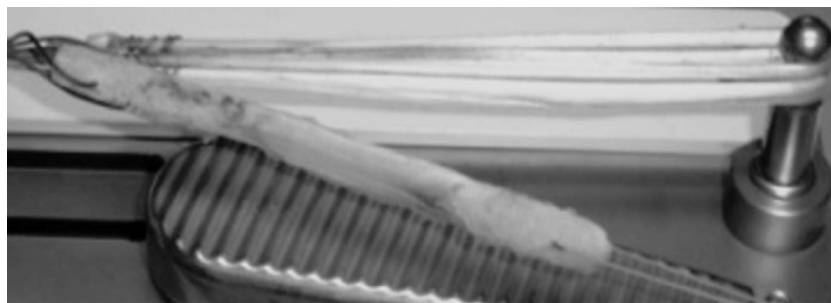


Fig. 1 – (A) Flexor tendon; (B) patellar tendon.

After the reconstruction, both groups were referred to the same early rehabilitation program, which was conducted individually by trained professionals.

All the patients were evaluated at the outpatient clinic by the same researcher, one, three and six months after the operation. The International Knee Documentation Committee (IKDC) 2000¹⁰ and Lysholm protocols were followed.¹¹ The IKDC is composed of 10 objective questions, subdivided into seven on symptoms, two on sports activities and one on functionality before and after the injury. The modified Lysholm scale is composed of eight questions in which the options are closed responses, such that the final result is expressed thus: from 95 to 100 points as “excellent”; from 84 to 94 as “good”; from 65 to 83 as “fair”; and 64 or under as “poor”.¹¹ After the data-gathering, these data were subjected to descriptive statistical analysis using percentage frequencies.

The statistical analysis was performed using the following software: SPSS® V17, Minitab® 16 and Excel Office® 2010. The confidence interval (*p*) of 95% was used in parametric statistical tests, since the data were quantitative and continuous, and the central limit theorem was used, which ensured normal distribution. Thus, there was no need to test the normality of the residuals and parametric tests were used directly, given that these are more powerful than nonparametric tests such as ANOVA and equality of two proportions.



Fig. 2 – Guide adapted for the femur.

Surgical technique

The two groups differed regarding the graft to be used (Fig. 1), which was harvested from the respective donor areas using routine procedures. The reconstruction was done using the Chambat technique and was the same for both groups.¹²

After arthroscopy and treatment of associated lesions, the tunnels were constructed independently, from inside to outside. By means of a lateral access, 2 cm above the lateral epicondyle, a guidewire was introduced using a tibial guide adapted for constructing a femoral tunnel, at an angle of 80–90° (Figs. 2 and 3), which emerged between the joints, between the origins of the two bands (the footprints) of the lateral condyle at the anatomical location of the ACL on the femur. Using this guidewire, progressive drilling with a bit corresponding to the thickness of the graft was performed.

The tibial tunnel was constructed with the remains of the ACL on the tibia as a reference point, or in parallel to the posterior margin of the anterior cornu of the lateral meniscus,

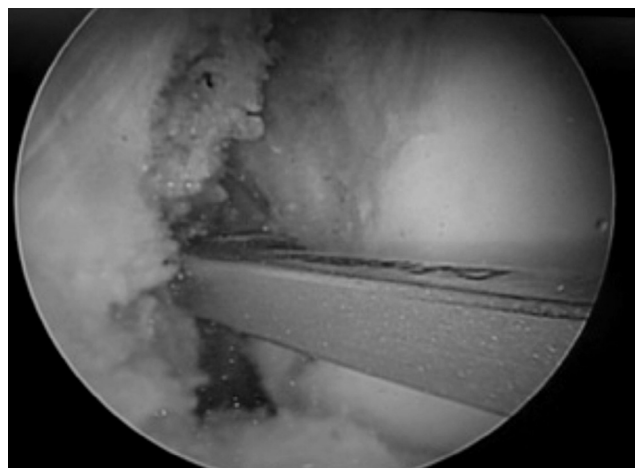


Fig. 3 – Arthroscopic view of the guide adapted for the femur.

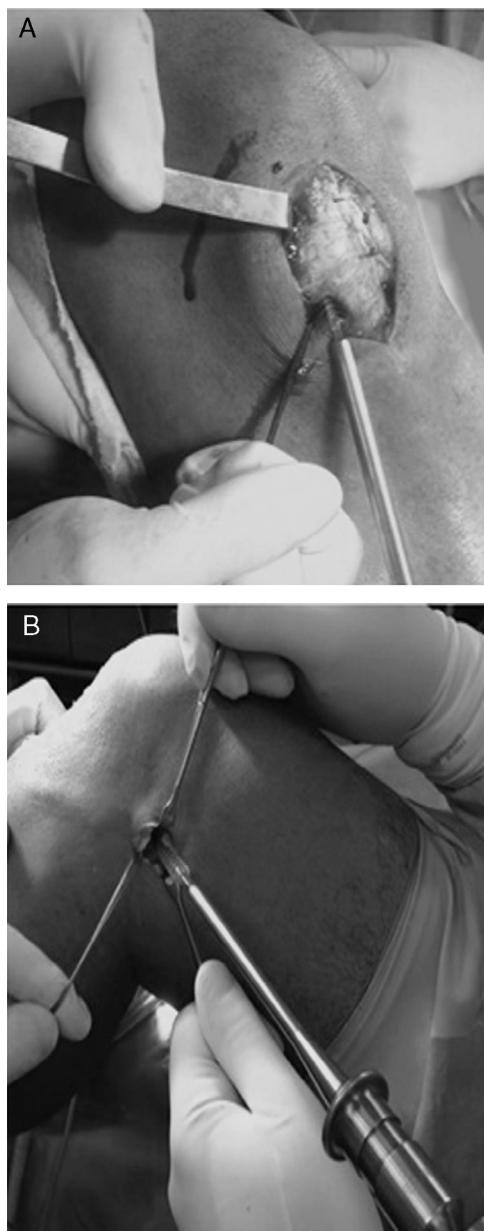


Fig. 4 – Graft fixation using absorbable screw: (A) tibial fixation; (B) femoral fixation.

with progressive drilling. The graft was passed through from distally to proximally, using two Ethibond 2.0 threads. After this, the graft was fixed using absorbable interference screws in the femur and tibia, respectively¹³ (Fig. 4).

Results

To analyze the results from the groups after the surgical treatment, the parameters from the IKDC index and the functional parameters from the Lysholm scale were used in the first, third and sixth months after the operation.

The Lysholm functional scale presented a mean score of 71.6 out of 100 in group A, in the first month, while group B

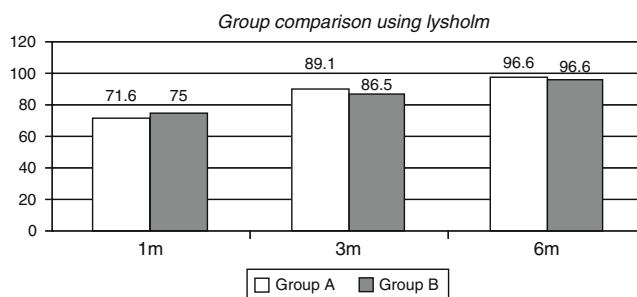


Fig. 5 – Comparison between the groups according to the Lysholm scale.

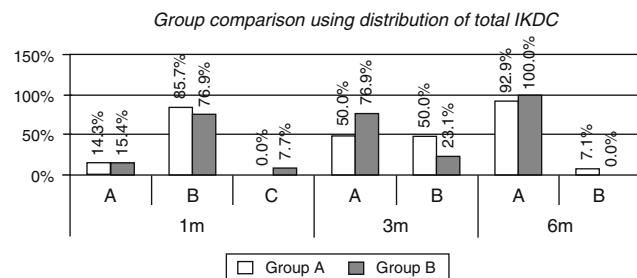


Fig. 6 – Comparison between the groups according to the total IKDC scale.

presented mean of 75. At the end of the sixth month, they presented the same mean scores of 96.6 (Fig. 5).

The evaluation using the IKDC scale showed that in the first month, the knee assessments on the majority of the patients were close to normal, both in group A (85.7%) and in group B (76.9%). In the sixth month, 92.9% of the patients in group A were assessed as normal and 100% in group B. However, statistically, neither the Lysholm nor the IKDC scale presented any significant differences, with $p > 0.05$ (Fig. 6).

Both groups presented limitations regarding the range of motion in the first month after the operation. In relation to flexion, 14.3% of the patients in group A and 7.7% in group B presented limitations. In relation to extension in the first month, group A was already free from limitations, while 15.4% of the patients in group B presented limitations. After the rehabilitation with physiotherapy, there were improvements among the patients in both groups and no joint range-of-motion deficits were seen in the sixth month. Statistically, there were no significant differences between the groups.

From the evaluation using the IKDC scale, the criteria of graft donor area and anterior knee pain did not present any statistically significant differences at the end of the sixth month, in both groups (Figs. 7 and 8). Group B presented two cases of healing that was delayed until the third month.

In the evaluation using the Lachman test, the results in group B were better in the third and sixth months, with translation of 1–2 mm in 100%, while in group A, 42.9% of the patients presented translation of 3–5 mm (Table 1).

Regarding the anterior drawer test, there were statistical differences in the first and third months. In the first month, 57.1% of group A presented anterior translation of 0–2 mm, while 100% of group B presented this. In the third month, 35.7% of group A presented anterior translation of 0–2 mm,

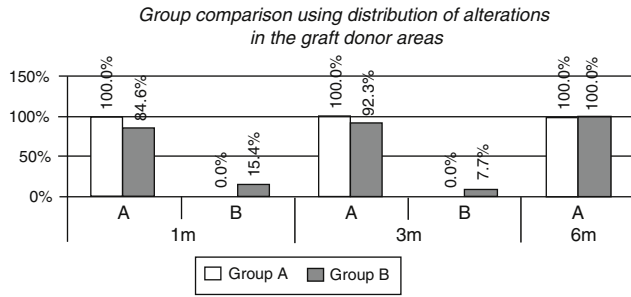


Fig. 7 – Comparison between the groups regarding alterations in the graft donor areas.

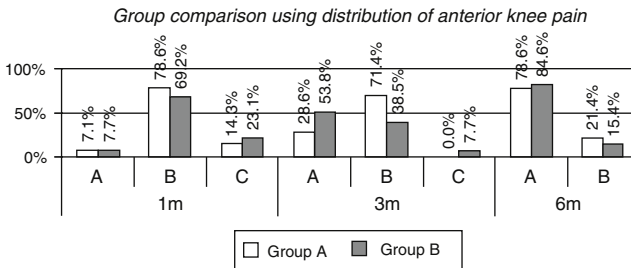


Fig. 8 – Comparison between the groups regarding anterior knee pain.

while there was a fall to 84.6% in group B. At the end of the sixth month, group B presented a tendency toward less anteriorization of the tibia (Table 2).

Regarding the ligament evaluation overall (i.e. Lachman, “full stop”, anterior drawer, posteriorization of the tibia, medial and lateral opening and pivot shift), groups A and B did not present any differences in their results, in any of the evaluations.

Table 1 – Comparison between the groups through assessment by means of the Lachman test.

Lachman		Group A		Group B		p-Value
		N	%	N	%	
1 m	A	11	78.6%	13	100%	0.077
	B	3	21.4%	0	0%	0.077
3 m	A	8	57.1%	13	100%	0.007
	B	6	42.9%	0	0%	0.007
6 m	A	8	57.1%	13	100%	0.007
	B	6	42.9%	0	0%	0.007

Table 2 – Comparison between the groups through assessment by means of the anterior drawer test.

Anterior drawer		Group A		Group B		p-Value
		N	%	N	%	
1 m	A	8	57.1%	13	100%	0.007
	B	6	42.9%	0	0%	0.007
3 m	A	5	35.7%	11	84.6%	0.010
	B	9	64.3%	2	15.4%	0.010
6 m	A	5	35.7%	9	69.2%	0.082
	B	9	64.3%	4	30.8%	0.082

Discussion

ACL reconstruction has been widely discussed over recent years. These injuries occur frequently, especially in the age group from 20 to 40 years. For a long time, the patellar tendon was chosen as the main source of grafts,¹⁴ but because of the morbidities presented, some authors have chosen to use flexor tendons. This has led to many comparative studies.⁹

In 2001, Eriksson et al.¹⁵ demonstrated that using the patellar tendon produced a slight advantage in relation to stability. On the other hand, in a meta-analysis in 2005, Prodrornos et al.¹⁶ showed that instability and laxity among grafts from the flexor tendons occurred because of the fixation methods used, and that if methods that were more effective were used, the results were similar to those using grafts from the patellar tendon.^{17,18}

In the present study, it was decided to fix the grafts from the patellar and flexor tendons, both in the tibial and in the femoral tunnel, using an absorbable interference screw, since this has been shown to present excellent fixation results, with adequate stiffness.¹⁹⁻²²

In addition to good fixation, the objective nowadays is to achieve anatomical reconstruction of the ACL, so as to reestablish the structural and biomechanical properties of the knee,^{7,8} especially in relation to rotational instability.⁸ Recent studies have compared anatomic ACL reconstruction using a double band and a single band.^{7,23} According to Misonoo et al.,⁷ there are no statistical differences regarding rotational stability. In the present study, it was decided to perform anatomical reconstruction using a single band, since the technique presents lower complexity and lower cost and it facilitates possible revisions.⁷

The present study did not present any statistically significant difference in comparative analysis between grafts from the patellar and flexor tendons, as observed using the Lysholm method, which subjectively evaluates knee function and produced excellent results at the end of the sixth month. This result has also been seen in other published studies.^{9,22,24}

As also observed by other authors, no difference in graft use was observed when this was assessed using the IKDC scale.²⁴⁻²⁶

In 2003, Jansson et al.²⁷ conducted a prospective randomized study on 89 patients who were followed up for 21 months, in which they observed that ACL reconstruction using the patellar tendon presented limitation of extension during the first year and became normal by the end of this period. Goldblatt et al.²⁸ demonstrated in 2005 that patients in whom the patellar tendon was used as a graft presented greater extension deficits (5° or more), while those in whom the flexor tendons were used presented flexion deficits of 5° or more. In 2007, in a prospective study, Laxdal et al.²⁶ did not observe any statistically significant difference in range of motion between the groups studied, as also seen in the present study.

Some studies have shown that patients present greater complaints of pain in the anterior region of the knee, particularly when kneeling down, when the patellar tendon is used as a graft.^{9,25,27} In a study by Vasconcelos et al.,²⁵ among patients in whom grafts from the flexor tendons were used, the complaints of pain were mainly from the medial region.²⁵ However,

other studies have reported that there was no statistical difference in knee pain between the grafts used,^{15,18} in the same way as seen in the results from the present study.

Overall, the ligament evaluations in knees that underwent ACL reconstruction did not show any statistical differences between the groups observed, either in our study or in others.^{15,27,29} Using the anterior drawer test alone to evaluate the reconstructed tendon, it was observed over the first three postoperative months that the anterior translation of the tibia at flexion of 90° was greater in the group in which flexor tendons were used. After six months of evaluation, there was no difference between the groups.²² In the Lachman test, better results were observed in the third and sixth months after the operation, in the patients in whom the ligament reconstruction was performed using the patellar tendon. This result differed from what was observed in the study by Pinczewski et al.,²⁴ in which no difference between the groups after 10 years of follow-up.

The present study can be criticized in terms of the small number of patients selected ($n = 27$), the short length of follow-up, the greater proportion of male patients, the absence of statistical evaluation on associated lesions and the lack of arthrometer for greater precision of evaluation on the reconstructed ligament.

Conclusion

According to the Lysholm functional evaluation and the IKDC subjective assessment, there was no statistically significant difference in the results between the groups. It is suggested that in future studies, associated lesions should be evaluated, with longer follow-up and use of an arthrometer for assessments of greater precision.

Conflicts of interest

The authors declare no conflicts of interest.

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