COMPARISON OF INTERFERENCE SCREW AND TRANSCONDILAR IN THE ACL RECONSTRUCTION

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ABSTRACT

Objective: Femoral fixation in ACL reconstruction with flexor tendon grafts can vary greatly according to the provision of materials and the surgeon's experience. But studies comparing fixation systems are most often performed on cadavers or animals, without evaluating the clinical results, which affects their comparison with live human patients. This article evaluates the clinical and subjective outcomes of two methods of graft fixation to the femur (Titanium interference screw and titanium transcondylar device) to determine whether there is any difference between these methods. Methods: Forty patients with ACL injury were selected. Of these, 20 had their graft fixed to the femur with interference screw and 20 with the transcondylar device. All the patients were reevaluated at least two years postoperatively by the anterior drawer test, pivot shift test and Lachman test, as well as obtaining the Lysholm and IKDC (International Knee Documentation Committee) scores. Results: The results were not statistically different for the criteria evaluated, which leads to the conclusion that. Conclusion: Both forms of fixation are effective for this technique, within the parameters established. Level of Evidence II, Prospective Comparative study.

Keywords: Anterior cruciate ligament/injuries. Bone screws. Anterior cruciate ligament/surgery.

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INTRODUCTION

The reconstruction of the anterior cruciate ligament (ACL) is one of the surgeries performed most often in orthopedics. For this reason graft type and fixation methods are studied intensively. The ideal ACL replacement graft should have structural and mechanical properties similar to the native ligament; allow safe fixation and fast biological incorporation, besides limited morbidity of the donor site. This will depend on the surgeon's experience and preference, graft availability, the patient's level of activity and comorbidities, other surgeries and the patient's preference.[1]
The use of the tendons of the semitendinosus and gracilis, also known as flexor tendons, as an ACL substitute has been growing in recent years due to their characteristics that are similar or superior to other grafts and their lower donor-site morbidity.[2-6]
It is known that the biomechanical resistance of these tendons is as much as double the resistance of the ACL,[3,7,8] yet the weak link of this surgery is fixation of the tendons to the bone tunnel.[2,9-11] Inadequate fixation can lead to failure in biological integration of the graft and consequently, anterior knee laxity with positive Lachman, Anterior Drawer and Pivot Shift tests.[12]
There are many materials for the fixation of these tendons on the femur and on the tibia, and the surgical cost and technique vary a great deal.[13]

Today we have basically three types of material available for use in femoral fixation of the graft, according to the fixation principle[8]: compression mechanism (interference screw), which consists of compressing the graft against the wall of the bone tunnel formed; expansion mechanism (RigidFix®) based on the initial press-fit mechanism of the graft in the bone tunnel, increased with the introduction of transfixing pins; and suspension mechanism (transcondylar fixation systems, endobutton, etc.) where the graft is positioned "mounted/on horseback" in the fixation system, which can be based on spongy bone, more cortical bone or just cortical bone.
These fixation mechanisms should be rigid enough to protect the graft in the initial reconstruction period, allowing early physiotherapy, and preventing the graft from sliding and the biological fixation from failing.[8]
We know through other biomechanical studies that transcondylar fixation systems are strong enough to bear the load required in everyday activities and in early physiotherapy programs,[7,8,14-16] for fast return to physical activity.[3] However, titanium interference screws present biomechanical results that can compromise graft fixation when studied in cadavers, or non-human models.[3,8,9,11,14,15,17,18] But it is also known that in cadavers and in non-human models the bone mineral density

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might not be appropriate for comparison with live human beings, compromising the results.[3,19]

In the studies comparing transcondylar fixation methods with the interference screw in live human beings or where these fixation methods were investigated separately, the clinical results were similar and satisfactory.[7,20-23]

Accordingly, the objective of this study is to compare, in live human beings, the clinical and objective results of ACL reconstruction fixed on the femur with a transcondylar screw or with a titanium interference screw, and on the tibia with a titanium interference screw. The theory is that the clinical and objective results will be the same for both groups.

METHODS

After approval by the committee of ethics in research of our institution, we selected, between December 2002 and May 2005, forty patients that agreed to take part in the survey, and were divided into two groups of 20 patients each, one for fixation with transcondylar screw (group A), and the other with titanium interference screw (group B). The fixation technique was selected by drawing of lots at the surgical center. Tibial fixation was standard for both groups with titanium interference screw. We selected patients that had approached the principal surgeon with a profile of symptomatic ACL lesion, with indication of surgical reconstruction. Patients with bilateral lesions or osteoarthritis in the preoperative radiographies were excluded.

SURGICAL TECHNIQUE

After spinal anesthesia, the patient is prepared for surgery with aseptic technique. The surgeon creates a 4cm anteromedial access route approximately 2cm distal and 2cm medial to the anterior tibial tuberosity. Once the tendon of the gracilis was located at the pes anserinus, this is isolated and released from its vinculae. Its distal extremity is sutured with no. 2 woven polyester thread then we perform its desinsertion. We remove the tendon with a tenotome and repeat the procedure for the semitendinosus tendon. These tendons are cleaned, trimmed and their other extremity is sutured with the same type of thread. The four ends are joined forming a quadruple graft.

We then place a tourniquet on the patient's thigh and start the arthroscopy, handling any other associated problem in the meniscuses, cartilage or loose bodies, and if necessary we perform sulcoplasty.

We insert the tibial guide for ACL and create the tunnel with an 8 or 9mm drill according to the previous measurement of the graft. Then we position the femoral guide and drill of the same diameter.

In cases of fixation with transcondylar screw, at this point we use the U-shaped guide and insert the guide wire, then the graft is placed on this wire and pulled inside the tunnel, and fixed with the screw of predetermined size according to the guide. In the case of fixation with interference screw, the graft is pulled inside the tunnel by the guide wire then fixed by a titanium interference screw.

This is followed by tibial fixation using a 9 by 30mm titanium interference screw in all the cases.

All the patients were instructed to follow the same physiotherapy protocol, yet not performed at the same place. They were all monitored periodically during the first two postoperative months. In July 2007 they were all summoned for reevaluation, with the performance of a physical examination (for assessment of the Lachman, Anterior Drawer and Pivot Shift tests) and application of the IKDC and Lysholm forms. Only 14 of the 40 patients from group A returned for reevaluation, with one experiencing a new lesion 18 months after surgery, and it was not possible to evaluate the objective results. Of the group fixed with interference screw, 15 patients returned for evaluation. They were all reevaluated by the same principal surgeon.

The results of the IKDC, Lachman, anterior drawer and pivot shift tests were analyzed by Goodman's test[24,25] for contrasts between and within multinomial populations, and the values from the Lysholm scale were compared statistically by the non-parametric test of Mann-Whitney apud Zar[26] with $p>0.05$. Mean age, sex, lesion time and surgical time were also evaluated for each group.

RESULTS

Of the reevaluated patients we had 11 males and three females in group A, and 11 males and four females in B. The mean age of group A was 28.14 years, ranging from 16 to 38 years, and group B averaged 31.26 years, ranging from 15 to 47 years. As regards the time from surgery to reevaluation, group A averaged 35.84 months, and group B, 41.2 months. The mean surgical time of group A was 35.85 minutes with standard deviation of 6.31, while group B averaged 41.20 minutes with standard deviation of 8.60.

The results of the Lachman, Anterior Drawer and Pivot Shift tests, as well as the distribution of groups on the Lysholm and IKDC scales, are presented in Tables 1 to 5.

Table 1. *Distribution on the IKDC scale according to group.*

	IKDC				
Group	**A**	**B**	**C**	**D**	**total**
A	3	9	1	0	13
B	4	9	2	0	15

Table 2. *Distribution according to group in the Lachman test.*

	Lachman				
Group	**1+**	**2+**	**3+**	**4+**	**total**
A	10	3	0	0	13
B	8	6	1	0	15

Table 3. *Distribution according to group in the Anterior Drawer test.*

	Anterior Drawer				
Group	**1+**	**2+**	**3+**	**4+**	**total**
A	9	4	0	0	13
B	7	7	1	0	15

Table 4. *Distribution according to Pivot Shift Test group.*

	Pivot Shift				
Group	Negative	+	2+	3+	total
A	12	1	0	0	13
B	9	5	1	0	15

Table 5. *Median, minimum and maximum values of the Lysholm scale according to group.*

Group	Lysholm
A	94(56-100)
B	91(54-100)

In relation to complications, in group A one patient experienced rupture of the graft 18 months after surgery. One patient had to change the transcondylar screw due to pain caused by friction at the site of the screw head. One case presented complaints of partial buckling during moderate activity, one experienced flexion deficit of 10° and four cases appeared with patellofemoral pain.

In group B, an interference screw cut the graft at the point of introduction in the femur, and resuturing had to be performed for its fixation. Triple semitendinosus graft was used in one case, as the tendon of the gracilis was lost during its removal. We had two cases with complaints of partial buckling and four cases of patellofemoral pain.

DISCUSSION

The groups were similar in terms of time from lesion to surgery, mean age of the patients and sex, in spite of the strong tendency for cases involving male patients, yet similar in the two groups. The only difference found by us, but not mentioned in literature, was a slightly longer surgical time in the technique with interference screw, perhaps due to the need for more careful insertion of this screw to prevent the femoral posterior cortex from breaking or the screw from falling inside the joint.

In evaluating the results we observed that as regards the IKDC, Lysholm, Lachman, anterior drawer and Pivot Shift tests, the two fixation techniques have similar results, with a predominance of good or excellent results, which is similar to that presented in international literature, including when compared to patellar tendon graft. Even with group B have a greater tendency to Pivot Shift 1+ (five patients) when compared with group A (one patient), this degree of instability upon physical examination is considered a good result and usually asymptomatic.

We know that the load for interference screw fixation failure is lower than for the transcondylar screw,[2,8,9,14-16] yet it is apparently strong enough to support initial rehabilitation in ACL reconstruction and to allow graft integration in most cases. So more rigid fixation would be useful in cases where the patient overdoes activities in the postoperative period or even for more intense physiotherapy protocols.

However, what appears to be the weak point in ACL reconstruction surgery with flexor tendons is not the femoral part but rather the tibial,[17] which was not the focal point of this study.

Rose et al.[20] compared the results of 68 patients operated for ACL reconstruction with flexor tendons, with 38 fixed on the femur with Biotransfix® and 30 with bioabsorbable interference screw. The evaluations at 3, 6 and 12 months after surgery with regards to IKDC, anterior translation and Lysholm were similar, as were our results.

In another article, Charlton et al.[21] present the results of 65 patients (66 knees) where femoral fixation was performed with bioabsorbable interference with mean Lysholm results of 91 points, KT 1000 with difference of 2.03mm side-by-side and mean IKDC of 83 points, results similar to ours, mentioning that there is a tendency for worse results in the case of associated meniscus lesions. Now Luzo in 2002[22] presented the result of 157 patients where femoral fixation was accomplished with a transcondylar screw (Transfix®) with IKDC and Lysholm results that were also similar to the other articles and to that obtained by us.

In an excellent systemic review, Daniel Andersson et al.[27] conducted a comprehensive survey in literature on the surgical technique in ACL reconstruction and concluded that use of the transcondylar screw compared with metal or bioabsorbable interference screw produces clinically similar results.

As regards complications, in group A we had only one complication related to the type of femoral fixation, which was pain caused by friction at the head of the screw, which was protruding and had to be changed. This complication is rare, yet mentioned in literature,[7,28] and was resolved successfully with the established treatment. The other complications (graft rupture, previous pain and flexion deficit) are common findings in the ACL postoperative period. In group B one patient had the graft cut by the screw during its insertion, probably due to the incorrect choice of screw size, yet the solution was immediate with re-fixation of the graft that still presented sufficient length. This is a risk that can occur even when we use the patellar tendon, yet it is rare. The other complications were as expected for the graft used.

As weak points of this study there is the considerable loss of patients that did not appear at the final evaluation, probably due to the long follow-up time. This may affect the statistical result since we do not know whether the patients abandoned the follow-up as they were feeling well or were unhappy with the result. Another bias may be that the actual surgeon performed the final evaluation of the patients, yet the desire to have an impartial result might not have affected the results. The lack of an arthrometer (type KT 1000, for example) is also a negative factor, yet we attempted to reduce this bias with the physical examination being performed by the same surgeon, at the same time.

CONCLUSION

With our results we concluded that anterior cruciate ligament reconstruction with quadruple autologous graft of the flexor tendons fixed with a titanium interference screw on the tibia and titanium interference screw or transcondylar screw on the femur produce similar results in terms of the Lysholm and IKDC scales and regarding the Lachman, pivot shift and anterior drawer tests.

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