Anterior knee pain and sensitivity after anterior cruciate ligament: its impact on sports

JP Oliveira¹, F Fonseca², JC Noronha³

Abstract

Introduction
Anterior knee pain and sensitivity deficits are frequently present at medium and long term after an arthroscopic anterior cruciate ligament reconstruction. The objectives of this study are to, on a sports population, identify and compare its rate of occurrence, localization and temporal evolution using two different types of autografts: bone-patellar tendon-bone versus semitendinosus-gracilis.

Materials and methods
Fifty male patients have been selected with a minimum follow-up of 2 years. In 50%, the autograft chosen was patellar tendon-bone. Anterior knee pain and sensitivity deficits have been clinically evaluated and subjective tests have been applied.

Results
At 2 weeks postoperative follow-up, anterior knee pain was less reported when semitendinosus-gracilis was used for harvesting (32% vs. 21.7%, P<0.05), and this group had less duration of pain complaints (P<0.05). Hypoesthesia was present in 56% of the patients of the semitendinosus-gracilis group (P<0.05), and this group had less duration of those deficits (6.6 vs. 12 months, P<0.05). On both groups, hypoesthesia was mostly reported at the infrapatellar branch of the saphenous nerve (100% Bone-patellar Tendon-Bone (BTB) vs. 57.1% semitendinosus-gracilis). High maintenance of activity level and lesser time until sports authorization was present on the patellar tendon-bone group (P>0.05). Knee walking test was mainly positive with patellar tendon-bone autograft (72% vs. 28%, P<0.05) and the Lysholm and IKDC-SKF scores were similar for both groups.

Conclusion
Anterior knee pain and sensitivity deficits are a reality after an anatomic arthroscopic anterior cruciate ligament reconstruction, being important to understand that its presence is correlated with the kind of graft chosen. However, and on a sports population, these complaints were not associated with poor knee function.

Introduction
The importance of anterior cruciate ligament (ACL) on the normal function of the knee is well established and recognized, especially in sports that require rotation. Injuries of the ACL are common in the athletic population. The incidence rate has recently been reported to be between 36.9 and 60.9 per 100,000 persons. It is estimated in the United States that over 200,000 ACL injuries occur every year with a correspondingly high number of reconstruction performed. In fact, anterior cruciate ligament reconstruction (ACLr) has become one of the most common procedures performed by orthopaedic surgeons today. Indications for primary ACLr include patients with symptomatic instability or those wishing to return to high-level ACL-dependent sport. ACLr goal is to create a replica of the original ACL, which due to its three-dimensional texture, is not possible. However, it is possible to do an approximate reconstruction, given the advances in biomechanics, the respect for the anatomy and isometry, a choice of graft more similar to the original ACL and a more friendly rehabilitation according to the ligamentization phases.

After the introduction of arthroscopy, the results in terms of restoring the laxity and return to sports activities have been generally satisfactory. However, complications do exist in relation to the kind of graft selected in the form of sensitivity deficits (SDs) and anterior knee pain (AKP), which are two of the actual major causes of donor-site problems after ACLr.

We hypothesized that altered sensation and pain are more extensive when compared to previous reports and may subjectively impact upon function on a sports population. We aimed to identify and compare the rate of occurrence, localization and temporal evolution of AKP and SD, as well as their consequences on the recuperation and functional outcomes on the first 2 years postoperative follow-up on patients with sports motivation. The patients have been submitted to an anatomic arthroscopic ACLr by the same surgeon, with two different types of autografts—bone-patellar tendon-bone (BTB) versus semitendinosus-gracilis (SG)—because, and according to our current knowledge, studies like this have never ever been reported, especially with this kind of population nor with the technique described.

Materials and methods
This work conforms to the values laid down in the Declaration of Helsinki (1964). The protocol of this study has been approved by the relevant ethical committee related to our institution in which it was performed.

Licensee OA Publishing London 2013. Creative Commons Attribution License (CC-BY)

All subjects gave full informed consent to participate in this study.

A retrospective cohort study was performed. Fifty patients with sports motivation and isolated ACL rupture have been randomly selected. All these patients were male, age ranging from 17 to 44 years old, had no clinical or chirurgical history and have been submitted to an anatomic arthroscopic ACLr by the same surgeon and followed an identical rehabilitation protocol. In half of the cases, the autograft chosen was BTB (BTB group) and, in the other half, a four-strand SG (SG group). The minimum postoperative follow-up was 2 years; the selected athletes were operated between January 2007 and December 2008.

For clinical evaluation of those athletes, the postoperative AKP and SD were studied at 15 days and 2 years postoperative follow-up and, in the cases that it was positive, its localization according to the anatomical distribution of the lateral sural cutaneous nerve, saphenous nerve (SN) and infragenicular branch of saphenous nerve (IGBSN) was established. The hypoaesthetic area was defined by comparing sensation of light touch applied simultaneously at both the operated and non-operated lower leg. The data collected from this observation have been correlated with the rehabilitation program, day-to-day life and sports activities. Additionally, the population has been divided according to its Tegner activity level scale (TALS)⁹ and four subjective tests have been applied: visual analogue scale, knee walking test (KWT), Lysholm knee scoring scale (LKSS)¹⁰ and International Knee Documentation Committee-Subjective Knee Form (IKDC-SKF)¹¹. The KWT was considered positive whenever the patients report inability to kneel or knee walk due to AKP.

Patients’ records were registered into a database and processed statistically by PASW Statistics (Software Version 18.0). A P-value < 0.05 was considered statistically significant.

Surgical technique

All patients underwent an anatomic arthroscopic ACLr, and none of the patients had reconstruction in the acute phase of the injury. There were no revision procedures. Patients were prepared for surgery in an identical manner. All were supine with a tourniquet placed over the proximal thigh that had been inflated after the autograft was collected. The procedure was carried out in a standard manner based on manufacturer’s recommendations. Standard medial and lateral parapatellar arthroscopic portals through vertical incisions were used. Additional procedures to meniscal defects were carried out as necessary. Hoffa fat pad and the distal part of ACL were preserved as possible. The femoral tunnel was drilled with a knee flexion of 110° by the in-and-out technique, and the placements of both tunnels were made according to the single anatomic bundle concept². The grafts were fixed with bioabsorbable interference screws.

On the BTB autograft, a central longitudinal patellar incision, with 5 to 6 cm, was made. The IGBSN was preserved as possible and the peritendon was first identified and sutured at the end. A 10 mm thick BTB was shaped as a parallelepiped bone block. The bone defect of the patella, at the end, was fulfilled by autograft collected from the tunnels (Figures 1 and 2).

Figure 1: Central longitudinal patellar incision.

Figure 2: Sparing the infragenicular branch of the saphenous nerve.
Results

Baseline population and results of the questionnaire are summarized in Tables 1 and 2.

The two groups differ ($P<0.05$) in terms of age and time to surgery as well as for athletic level.

About 27.1% of the patients reported AKP at 15 days after surgery (32% BTB vs. 21.7% SG, $P>0.05$). On the SG group, the athletes reported pain for less time ($0.8 \pm 1.3$ months, $P<0.05$). Most of the BTB group reported their pain on the patellar tendon (44%) and on the SG group the majority described it as being diffuse (65.2%).

At 15 days postoperative follow-up, hypoesthesia was reported more on the BTB group (84% vs. 56%, $P<0.05$), whereas at 2 years postoperative follow-up, the differences between both groups were lesser (40% vs. 20%, $P>0.05$). On the SG group, the athletes reported hypoesthesia during less time ($6.6 \pm 9.6$ months, $P<0.05$). On both groups, the hypoesthesia was mostly reported on the area innervated by the IGBSN (100% BTB vs. 57.1% SG).

Maintenance of the activity level (categorized by the TALS) was superior on the BTB group (68% vs. 60%, $P>0.05$), and the average time until sports medical authorization was also inferior on this group (6.5 vs. 6.9 months, $P>0.05$).

None of the patients, of both groups, reported that AKP nor hypoesthesia interfered in their day life activities.

The KWT was positive on a larger group of patients with BTB autograft (72% vs. 28%, $P<0.05$). The LKSS and IKDC-SKF were similar ($P>0.05$) for both ACLr techniques.

Discussion

It appears to be agreed in the literature that the restoration of full extension compared with the non-injured side after ACLr is essential to avoid postoperative discomfort in the anterior knee region \cite{14-16}.

For the SG autograft, with the knee flexed at a 90° of flexion and the hip externally rotated, a 3–4 cm oblique incision according to the Boon ‘safe area’ was made\cite{13}. Both semitendinosus and gracilis were identified and separated from their adhesions. Keeping the knee flexed at 90°, an open tendon stripper was used (Figures 3 and 4).
Table 1 Baseline population

<table>
<thead>
<tr>
<th></th>
<th>BTB</th>
<th>SG</th>
<th>p value</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>25.8 ± 5.2</td>
<td>33.4 ± 8.8</td>
<td>0.001</td>
<td>Mann–Whitney U</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>24.0 ± 2.1</td>
<td>23.4 ± 1.8</td>
<td>0.417</td>
<td>Mann–Whitney U</td>
</tr>
<tr>
<td>Lesion—surgery (months)</td>
<td>2.8 ± 2.3</td>
<td>5.2 ± 3.8</td>
<td>0.022</td>
<td>Mann–Whitney U</td>
</tr>
<tr>
<td>Sports aetiology</td>
<td>23 (92%)</td>
<td>20 (80%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Dominant limb</td>
<td>16 (64%)</td>
<td>15 (60%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>TALS preoperative</td>
<td>7.7 ± 1.1</td>
<td>6.6 ± 1.0</td>
<td>0.020</td>
<td>Mann–Whitney U</td>
</tr>
</tbody>
</table>

Arthornthurasook and Gaew-Im, Horner and Dellon, Hunter et al., and Kartus et al. have shown in dissection studies that the IGBSN is in danger when the incision is made close or above the anterior tibial tubercle and on the medial side of the knee joint. Correspondingly, medial knee incisions can jeopardize the SN.

The published literature is not clear about the morbidity effects after grafting the ACL with BTB or SG. Patellar tendon harvesting results in damage of the IGBSN, and gives donor-site pain along with functional restriction. On the other hand, when hamstring tendons autografts are used for harvesting, a branch of the IGBSN might also be jeopardized, probably at the stripping stage and, occasionally, numbness in the skin supplied by the SN may also occur. Eriksson reported that the area of disturbed sensitivity after harvesting either SG or BTB autograft is comparable but with less clinical importance than SG. For Corry et al. and Spicer et al., SG grafts significantly reduce anterior knee symptoms and rarely cause limitation in activity.

In a sports population, we found that a part of the differences between both groups on AKP and SD gives BTB more donor-site morbidity; the harvesting with BTB allowed a higher maintenance of the activity level as well as less time until sports authorization.

Bertram et al. reported that the incidence of AKP is lower with SG (14%) than with BTB (47%). These data have been supported by Eriksson who has shown in prospective randomized studies that patients operated with SG autografts have fewer AKP and less donor-site morbidity than those using BTB, both at short and long term. With a 2-year postoperative follow-up, Kartus et al. reported approximately 20% of patients with difficulty or were unable to perform the KWT after grafting with SG. Corry et al. show that only 6% of patients had pain when kneeling 2 years after reconstruction with SG autografts, compared with 31% using BTB.

After 15 days of postoperative follow-up, we report an AKP rate similar or slightly below previous studies (32% BTB vs. 21.7% SG). The level of pain was not statistically different among both groups, but its duration was, highlighting that at 2-years postoperative it was around zero. The difficulty on knee and knee walking, according to the literature, was more prevalent in the BTB group. Apart from the prospective randomized study made by Brandson et al. who showed that suturing the patellar tendon defect and bone grafting the defect in the patella did not reduce AKP or donor-site morbidity, special care was taken during suturing the peritendon because of the nerve and vascular endings localized there and the patellar defect was bone grafted. In our study, after BTB harvesting, pain was mainly localized at the patellar tendon while with SG it was diffuse.

Incidence and sensitivity area loss due to IGBSN damage has previously been reported after harvesting with BTB. Portland et al. found that 59% had sensitivity loss after ACLr with a vertical incision. The incidence of IGBSN injury after ACLr harvesting with SG was reported by Kjaergaard et al., being 88% at 12 days and 84% at 12 months, when using an oblique incision for approaching the graft. Jameson et al. reported that 26.4% of the SD was located at the SN area when SG was used for harvesting. Apart from the initial differences in terms of SD at 15-days postoperative follow-up and hypoesthesia duration where statistically different, being inferior in SG group, those complaints decreased with time, being inferior to the literature at 2 years postoperative follow-up. The results achieved could be justified by the Boom et al. approach and the careful dissection of SG before tenotomy.

Another interesting finding was that on a sport population, donor-site morbidity, regardless of the type of graft used, did not change nor decrease the LKSS or IKDC-SKF. This indicates that SD or AKP is not associated with poor knee function.

As previously reported by Kartus et al., we agree that some of the differences reported about donor-site morbidity after harvesting ACL with SG or BTB can be due to the fact that after patellar tendon harvest, the pressure when kneeling is applied directly on, or close to, the incision where the injured nerve is located. By that, we suggest that special care should be taken for not doing a strictly vertical incision and, instead of it, should be done slightly oblique.

Licensee OA Publishing London 2013. Creative Commons Attribution License (CC-BY)

Other important finding by Rubin et al., who reported that isolated donor-site morbidity was negligible after ACL surgery when the contralateral patellar tendon was used as a graft, motivates us to consider harvesting only with semitendinosus from both knees or in a four-strand semitendinosus graft, sparing the gracilis.

We acknowledge the limitations of our study. The retrospective nature may cast doubt on patient recollection of events in the period after surgery. A control group using other incision may have strengthened our conclusions. Data on associated injuries and procedures were not collected. This questionnaire was specifically designed for this study and was not previously validated. Ideally, a clinical double-blind review and assessment of subjective sensory loss would have been more reliable. In addition, the baseline population had some statistical differences and a bias was noticed by the surgeon for the use of BTB on a more active and young population.

**Conclusion**

AKP and SDs are a reality after anatomic arthroscopic ACLr, being important not only to inform the patients of the high risks of extensive altered sensation and pain over the lower leg during the consenting process, but also, to understand that its presence is correlated with the kind of graft chosen. With the technique described here, we achieved good results on both AKP and SD groups in a sports population, especially at 2 years postoperative follow-up, and their presence had no impact on day-to-day activities or knee function. For that, we recommend extra caution in order to respect the nerves and vascular structures that surround the ACL during the reconstruction.

**Abbreviations list**

ACL, anterior cruciate ligament; ACLr, anterior cruciate ligament reconstruction; AKP, anterior knee pain; BTB, bone-patellar tendon-bone; IGBSN, infragenicular branch of saphenous nerve; IKDC-SKF, International Knee Documentation Committee–Subjective Knee Form; KWT, knee walking test; LKSS, Lysholm knee scoring scale; SD, sensitivity deficit; SG, semitendinosus-gracilis; SN, saphenous nerve; TALS, Tegner activity level scale.

**References**


<table>
<thead>
<tr>
<th>Table 2 Results</th>
<th>BTB</th>
<th>SG</th>
<th>p value</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>TALS postoperative</td>
<td>7.2 ± 1.3</td>
<td>6.0 ± 1.0</td>
<td>0.020</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td>TALS preoperative = postoperative</td>
<td>17 (68%)</td>
<td>15 (60%)</td>
<td>0.370</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td>Sports authorization (months)</td>
<td>6.5 ± 1.8</td>
<td>6.9 ± 1.4</td>
<td>0.222</td>
<td>Mann–Whitney U</td>
</tr>
<tr>
<td>15 days postoperative hypoesthesia</td>
<td>21 (84%)</td>
<td>14 (56%)</td>
<td>0.031</td>
<td>Chi square</td>
</tr>
<tr>
<td>Hypoesthesia at 2 years postoperative</td>
<td>10 (40%)</td>
<td>5 (20%)</td>
<td>0.123</td>
<td>Chi square</td>
</tr>
<tr>
<td>Hypoesthesia duration (months)</td>
<td>12.0 ± 10.6</td>
<td>6.6 ± 9.6</td>
<td>0.026</td>
<td>Mann–Whitney U</td>
</tr>
<tr>
<td>LSCN</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>IGBSN</td>
<td>21 (84%)</td>
<td>8 (32%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN</td>
<td>0 (0%)</td>
<td>6 (24%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>15 days post-operative AKP</td>
<td>8 (32%)</td>
<td>5 (21.7%)</td>
<td>0.333</td>
<td>Chi square</td>
</tr>
<tr>
<td>AKP at 2 years postoperative</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AKP duration (months)</td>
<td>2.7 ± 7.3</td>
<td>0.8 ± 1.3</td>
<td>0.000</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td>Pain at diffuse</td>
<td>7 (28%)</td>
<td>15 (65.2%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pain at patella</td>
<td>4 (16%)</td>
<td>0 (0%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pain at ATT</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pain at patellar tendon</td>
<td>11 (44%)</td>
<td>0 (0%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>VAS at activity</td>
<td>1.4 ± 1.1</td>
<td>1.0 ± 0.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>KWT (+)</td>
<td>18 (72%)</td>
<td>7 (28%)</td>
<td>0.002</td>
<td>Chi Square</td>
</tr>
<tr>
<td>LKSS</td>
<td>97.4 ± 4.1</td>
<td>98.7 ± 2.0</td>
<td>0.237</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td>IKDC-SKF</td>
<td>94.1 ± 4.0</td>
<td>95.2 ± 3.4</td>
<td>0.130</td>
<td>Mann-Whitney U</td>
</tr>
</tbody>
</table>

**Research study**


