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Muscular isokinetic strength recovery after knee anterior cruciate ligament reconstruction revision: Preliminary study

Récupération de la force musculaire isocinétique après reprise de ligamentoplastie du genou : étude préliminaire

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Abstract

Method. – Thirty-nine revision of ACL reconstructions were evaluated: 23 primary ACL reconstructions with bone-patellar tendon-bone graft (BPTB) revised with hamstring tendon (HT) grafts, 10 primary ACL reconstructions with HT grafts revised with ipsilateral BPTB graft (iBPTB) and finally 6 primary ACL reconstructions with BPTB grafts revised with contralateral BPTB (cBPTB) grafts were compared with 78 primary ACL reconstructions (46 HT grafts and 32 BPTB grafts). Recovery of isokinetic muscle strength was evaluated at 4, 6 and 12 months post-revision surgery.

Results. – Deficits in muscle strength at 12 months post-revision ACL surgery were comparable to the one observed for primary ACL reconstruction with the same technique. At 4 and 6 months post-surgery, strength deficits for the knee extensors were less pronounced after revision ACL reconstruction with HT grafts (25% ± 16 vs. 37% ± 16; $P < 0.001$) and iBPTB grafts (41% ± 11 vs. 17% ± 17; $P < 0.001$).

Discussion. – Lower strength deficits for the knee extensors after revision ACL reconstruction with HT grafts can be explained by a less intensive rehabilitation program due to lower stakes in resuming sport activities. With cBPTB, donor-site morbidity could explain the decreased strength deficits for knee extensors.

Conclusion. – Deficits in isokinetic muscle strength after ACL revision seem similar to the ones observed after primary ACL reconstruction with the same surgical technique.

Keywords: Isokinetic; Anterior cruciate ligament reconstruction; Revision

Résumé

Objectif. – Mesurer la récupération de la force musculaire isocinétique du genou après reprise d'une reconstruction du ligament croisé antérieur du genou.

Méthode. – Trente-neuf reprises, 23 selon la technique aux ischio-jambiers (tendon patellaire repris par DIDT), 16 selon la technique au tendon patellaire homolatéral (10 DIDT repris par hTP) et controlatéral (6 TP repris par cTP) ont été comparés à 78 plasties de première intention (46 au DIDT et 32 au TP). La récupération de la force musculaire isocinétique a été mesurée à 4, 6 et 12 mois postopératoires.

Résultats. – Le déficit musculaire à 12 mois postopératoires après reprise de ligamentoplastie est comparable à celui observé après une ligamentoplastie réalisée de première intention selon la même technique. À 4 et 6 mois postopératoires, le déficit des extenseurs est inférieur après reprise selon la technique au DIDT (25 % ± 16 vs 37 % ± 16 ; $p < 0{,}001$) et après reprise selon la technique au TP controlatéral (17 % ± 17 vs 41 % ± 11 ; $p < 0{,}001$).

Discussion. – Le faible déficit des extenseurs après reprise au DIDT peut s'expliquer par un programme de rééducation qui a été moins intense étant donné un objectif de reprise sportive inférieur. Pour la technique au tendon patellaire controlatéral, la perte de force liée à la morbidité du prélèvement tendineux du genou controlatéral explique que le déficit des extenseurs soit plus faible.

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Conclusion. – Le déficit de force musculaire isocinétique après révision semble être identique à celui évalué après ligamentoplastie première réalisée selon la même technique chirurgicale.

Mots clés : Isocinétique ; Reconstruction du ligament croisé antérieur ; Reprise

1. English version

1.1. Introduction

The objective of anterior cruciate ligament (ACL) reconstruction is to correct functional instability of the knee and if possible resume sport activities at the same level.

In some cases however, ACL reconstruction graft fails and knee instability returns. According to different authors, revision ACL reconstruction rates vary between 3 to 8.9% regardless of the graft site (hamstrings or bone-patellar tendon-bone grafts) [12,15,20].

Various reasons can explain ACL reconstruction failure, in 32 to 70% of cases a new trauma to the knee is involved [13,18]. In 24 to 63% of cases, failure is due to surgical issues, i.e. misplaced graft reconstruction tunnels, graft tension and fixation defects [2,6]. In rarer cases (1%), graft rupture due to knee infections have been reported and intensive rehabilitation programs were also incriminated [1,11].

With prosthetic ligaments, some biological components are linked to ACL reconstruction failures (7%) [14]. A combination of the above listed causes is responsible for 37% of failure cases [13].

When the graft is torn, the decision for revision ACL reconstruction should be discussed [7]. Thus, the work-up for revision ACL reconstruction has to include an evaluation of knee instability and its clinical validation. Plain radiographs are essential for validating previous reconstruction tunnel placement and size as well as potential arthritis; furthermore, an MRI is needed to evaluate the medial meniscus' state.

Various grafts can be harvested such as hamstring tendon (HT) when bone-patellar tendon-bone (BPTB) has already been used or vice versa. The contralateral BPTB can also be used as a new graft. Other potential grafts include: contralateral HT, quadriceps tendon, allograft from a donor... [1].

After revision surgery, the rehabilitation program should be carefully designed to follow the same objectives defined after primary ACL reconstruction, i.e. limit postoperative pain and knee swelling to restore joint ROM, muscle strength and knee stability [19].

Isokinetic strength training after primary ACL reconstruction has been well documented and assessed with isokinetic dynamometers. Recovery of muscle strength depends, among other things, on the tendon graft used [3]. Loss of strength for knee extensors is to be expected with BPTB graft and loss of strength of knee flexors is predictable after surgery with HT grafts.

However, for revision ACL reconstruction, the recovery of muscle strength has not yet been properly evaluated due to the low number of patients who had this surgery. The objective of this work was to assess over a 12-month period the isokinetic strength of newly reconstructed knees with various tendon grafts. We also compared the results to primary ACL reconstructions.

1.2. Method

1.2.1. Population

Patients included had revision ACL reconstruction surgery between January 2001 and December 2010 and an evaluation of knee isokinetic strength at 4, 6 and 12 months postoperative. Only revision surgeries with HT grafts, ipsilateral or contralateral BPTB grafts were included.

This population was compared to a population of patients who had primary ACL reconstruction surgery with HT or BPTB grafts and similar longitudinal isokinetic strength evaluation during the same period.

Data were matched according to sex, age (± 2 years) and weight (± 2 kg) in order to compare patients who had revision ACL surgeries to patients with primary ACL reconstructions with the same types of graft. The various sport activities were collected even though this parameter could not be used for data matching.

Exclusion criteria: patients who had revision ACL surgeries without HT, ipsilateral or contralateral BPTB grafts, patients who experienced recurrent knee instability in spite of revision ACL reconstruction surgery and patients who did not benefit from three isokinetic evaluations over the 12-month postoperative period. Furthermore, patients who experienced postoperative complications such as anterior, posterior or dystrophic pain were taken out of the study because of the impact of this type of pain on isokinetic strength loss [5].

All the patients gave their informed consents to be involved in the study without any financial retribution and the isokinetic evaluation protocol was approved by the scientific committee of the physical medicine and rehabilitation department of the Nantes university hospital.

1.2.2. Standardized rehabilitation training protocol

Physical therapy started the day after surgery in order to drain the knee, restore active extension and joint ROM. Walking was resumed as soon as possible with crutches or canes for knee unloading. Patients were all sent to a rehabilitation center for 15 to 21 days in order to follow a standardized PM&R protocol monitored by physicians. The objective was to return to sedentary life 3 weeks post-surgery. No stretching or strength training of the hamstrings was authorized during a full month after revision ACL surgeries with HT grafts.