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Laxity and compliance following primary ACL reconstruction using hamstring tendon in short graft

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INTRODUCTION

Laximetric measurement is widely used for diagnosis of acute anterior cruciate ligament rupture **[1]**. However, no study has been done on the evolution of laxity and compliance after ACL reconstruction.
We observed in only a few patients that the laximetric curve of the operated knee **was getting closer to that of the normal knee during the first postoperative year.**

AIM

This study was carried out to analyze the laximetric and compliance evolutions of primary ACL reconstruction using hamstring tendons in short grafts.

We suspected that they witness the ligamentization process and allow adaptation of postoperative care for each patient.

METHOD

47 patients (37 men, 10 women) with a mean age of 28.2 ± 9.6 years, operated for primary ACLR using hamstring tendons (short graft) associated or not with an extra-articular procedure, were enrolled between November 2013 and January 2016. Inclusion criteria were patients with a primary ACL rupture and sufficient follow-up (FU) Exclusion criteria were multi ligamentous injuries, re rupture or insufficient FU. The patients were evaluated with GNRB arthrometer **[1]** before surgery, then at 15 days, 1, 3, 6, 9 months, 1 year postoperatively and at the last FU. **The mean FU period was 14.6 ± 3.0 months**.

The side-to-side differences in the anterior tibial translation (Delta L in mm) was measured at 30 and 60 N every time, 90 N from 3 months and 134 N from 6 months. The scatter plot was modelized with a polynomial trend curve **[2]** to obtain a coefficient of determination above 0.999. Graft compliance, capacity of the graft to stretch according to strength, was defined by the director coefficient of the tangent line at a given point of the force-deformation curve (Fig.1). **Differential compliance (Delta C in µm/N) was calculated between operated and healthy knees.**

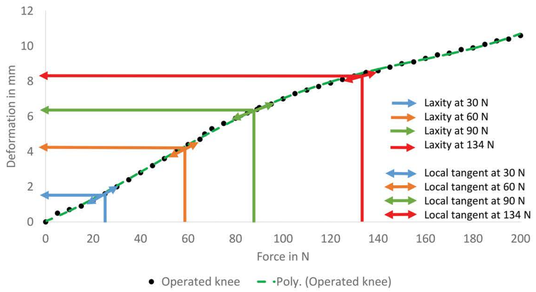


Fig 1. Example of force –deformation curve and definitions of laxity and compliance (local tangent line)

RESULTS

Fig 2. Evolution of DeltaL during follow-up

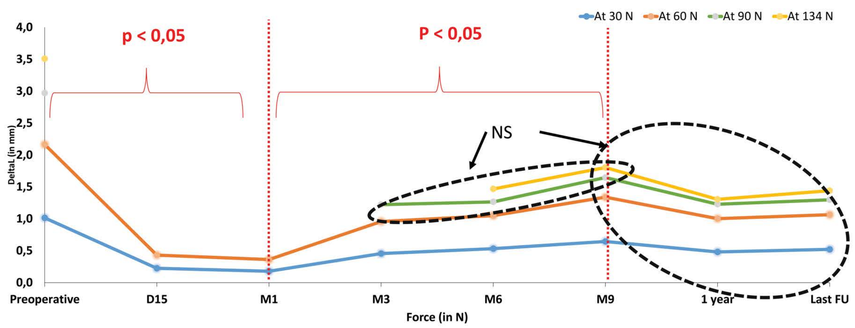
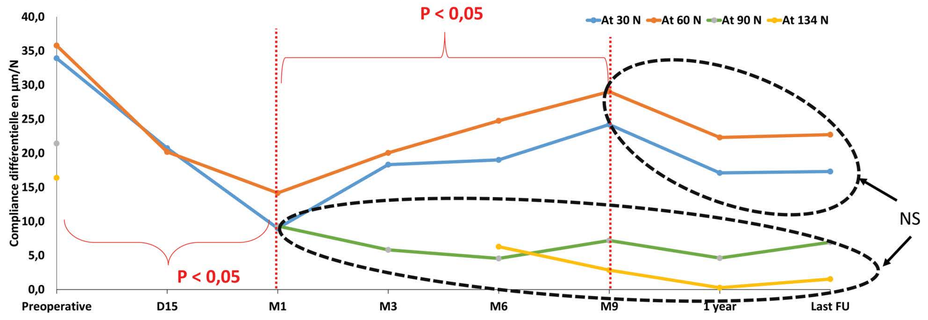


Fig 3. Evolution of DeltaC during follow-up



- DeltaL and DeltaC significantly decreased between preoperative and M1 for every range of force.
- Between M1 and M9, ΔL increased significantly at 30 N(+ 0.47 mm) and 60N (+ 0.98 mm). There was no difference for 90 and 134 N..
- DeltaC also increased significantly between M1 and M9 at 30 N(+ 15.22 µm/N) and 60N (+ 14.87 µm/N then decreased near a significative threshold between M9 and last FU at 30 (p = 0.07) and 60 N (p =0.06).
- There was no significative difference between M9 and last FU at 90 and 134N for DeltaL or DeltaC.

CONCLUSION

- Our study reported a **3-stage evolution of graft laxity and compliance after ACLR**. Between immediate postop and 1 month, we observed a good laxity and compliance restoration. There was a period of fragility between 1 and 9 months postoperatively followed by a stabilization of mechanical properties.
- These results are **significant for low range of force (30 and 60 N).**
- **First biomechanical study** on the postoperative graft evolution with a comparison to a healthy knee.
- It follows the biological description of the ligamentization process **[3-4]** : a first period of necrosis and non specific inflammatory response, then neovascularization and cellular multiplication and to finish, maturation process.
- The laximetric profile of the graft after ACL reconstruction witnesses the biological transformations during the ligamentization process.
- **Slackening comes in the early weeks postoperatively**. We recommend the protection of the ACL reconstruction with an articulated brace during the period of fragility **[5-6]**.
- Avoid returning to pivot sports without a laximetric evaluation.

CONTACT INFORMATION

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