Laxity and compliance following primary anterior cruciate ligament reconstruction using hamstring tendon short grafts

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FACULTY DISCLOSURE

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  • No financial conflicts to disclose

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  • No financial conflicts to disclose

• Henri Robert
  • No financial conflicts to disclose
INTRODUCTION

PURPOSE
Analyze the evolution of postoperative laxity and compliance after ACLR using hamstring tendon short grafts

HYPOTHESIS
Mechanical properties are the reflection of ligamentization process
METHODS

- Surgical procedure: TLS [1]
  - 4 strand short graft
  - ALL reconstruction for pivot contact sport or explosive pivot shift test
- Exclusion: multiple ligament-injured knee or ACL revision
- Postoperative management:
  - Freezing brace for 15 days
  - D15: physiotherapy
  - M3: in-line sport recovery
  - 1 year: full return to sport authorization
• GNRB® laximetric evaluation
  • At 30N, 60N, 90N (from M3) and 134N (from M6)
  • Comparatively with the healthy knee

• Force-deformation curve
Arithmetic model: $y = ax^4 + bx^3 + cx^2 + dx + f$ (polynomial regression) [2]

METHODS

$\Delta L \text{ in mm} = \text{Operated knee laxity} - \text{Healthy knee laxity}$

Local compliance: director coefficient of the tangent line at a given point of the force-deformation curve

$\Delta C \text{ in } \mu m/N = \text{Operated knee compliance} - \text{Healthy knee compliance}$
METHODS

• Main outcome measure:
  • Paired Student’s t-test for ΔL and ΔC at 30, 60, 90 et 134N

• Subgroup analysis:
  • Age, gender, BMI, initial laxity, meniscal lesions, ALL reconstruction
    • Kruskall & Wallis or independent t-test
The cohort: 47 patients

Mean follow-up: 14.6 months

<table>
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<th>Age</th>
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<td>&gt; 30</td>
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<tr>
<td>Gender</td>
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RESULTS

- 47 patients, mean age 28 (13-46)
- Average follow-up: 14.6 months (12-22 months)

- Differential laxity $\Delta L$
  - From Preop to M1: significant decrease at 30 and 60 N
  - From M1 to M9 significant increase at 30 and 60 N, non-significant at 90 and 134 N
  - After M9: no significant difference

- Differential compliance $\Delta C$
  - Same evolution

- Subgroup analysis
  - No difference in term of age, gender, BMI, meniscal lesion, preoperative laxity or ALL reconstruction
DISCUSSION

First biomechanical study on laxity and compliance following ACL reconstruction

Strengths:
- Mean follow-up: 14.6 months (12 to 22 months)
- Large cohort
- Objective data = Reproducibility
- Comparison to healthy knee = Pairing

Weaknesses:
- No possible comparison to other studies
- No results for other types of grafts
- Small samples size for subgroup analysis
DISCUSSION

• Hamstring tendon graft ligamentization process: 3 stages [3-4]
  • Necrosis and non-specific inflammatory response (6 weeks)
  • Neovascularization and fibroblast colonization
  • Maturation (> 1 year)

• Biological evolution = Mechanical evolution

• Concordant with MRI analysis of SNQ [5-6]
• Laxity and compliance at low range of force = ligamentization reflection
  • Period of fragility between M1 and M9: necrosis and cellular colonization
  • After M9: laximetric stabilization ≃ graft maturation

• Laximetric follow-up after ACL reconstruction is important for postoperative management

• Avoidance of premature return to pivot contact sport
  • Not before 9 months
  • Wait for laximetric stabilization

CONCLUSION
REFERENCES


