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Experimental In-Vitro Study: Biomechanical Insight of Postero-Lateral Corner Lesions in Case of ACL Injury and Double-Bundle Reconstruction.

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Summary:
In-vitro evaluation of static and dynamic laxity after postero-lateral-corner lesions associate with ACL injury and after isolated ACL reconstruction. In such combined lesions a standard double-bundle ACL reconstruction hardly controls the external rotations underlining the need of additional surgical procedures.

Abstract:
INTRODUCTION
The presence of combined lesions could result in a residual laxity following isolated anterior cruciate ligament (ACL) reconstruction [1]. The aim of this study was to assess, in an in-vitro trials, static as well as dynamic laxity after an isolated ACL reconstruction in the setting of ACL injury combining controlled lesions of several postero-lateral-corner (PLC) structures. Further, the contribution of an anatomical PLC reconstruction was investigated as well.

METHODS
The study was performed in 7 fresh-frozen joints. The joints were analyzed in the following conditions: intact, after ACL-resection, popliteus complex (PC) resection, after double-bundle ACL reconstruction, after lateral collateral ligament (LCL) resection and after an anatomical PLC reconstruction.
Testing parameters were defined as:
- Anterior displacement at 30° and 90° of flexion (AP30, AP90) applying 130N load;
- External Rotation at 30° and 90° of flexion (EXT30, EXT90) applying 5Nm torque;
- Anterior-Posterior Displacement and External-Internal rotation during manual Pivot-Shift (PS) test.

Kinematics was acquired by an optical localizer and a custom-made software; a testing rig and a dynamometer/ torquemeter were used to control the limb position and the applied force/torque.
Intraclass Correlation Coefficient (ICC) was evaluated in order to assess the test-retest repeatability for each tested parameters.

Paired student t-test was conducted in order to assess any difference between the tested conditions. Statistical significance was set at $P<0.05$. All the kinematics and statistical analysis were performed using unique MATLAB (Mathworks, USA) function designed and implemented specifically for the present study.

RESULTS
The results demonstrate an excellent correlation for each test, for all the static laxity parameters we found ICC=0.9.

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Isolated ACL reconstruction was efficient for combined ACL and PC lesions reducing AP30 displacement from (9.7±2.9)mm to (6.3±1.4)mm after the double-bundle surgical technique.

The same statistically significant differences were confirmed during AP90 test. Moreover, during this latter even ACL surgery versus LCL resection showed a $p<0.05$. For both AP30 and AP90 PLC reconstruction did not significantly affect the displacement. The EXT30 resulted significantly affected by PC resection compared to the isolated ACL-resection.

The analysis of EXT90 underlined a $p<0.05$ between the data concerning LCL-resection and those following PLC surgery. The EXT90 after LCL resection equal to (30.2±7.7)° was significantly reduces by PLC surgery achieving a value of (25.5±6.8)°.

The assessment of dynamic laxity did not show any significance.

DISCUSSION

The most important finding of the present work was that EXT rotation has increased by PC lesion and then was weakly influenced by ACL reconstruction at 30°. At deeper flexion the data trend suggested that isolated ACL reconstruction hardly controls a combined injury involving all the lateral structures, while adding a PLC reconstruction significantly reduced laxity. Indeed, there is the need to consider additional surgical procedures to restore the postoperative laxity after such combined lesions.

The assessment of dynamic laxity did not show any significance, probably due to the high variability between knees' behaviour during this complex movement [2] and the relative small sample size.

REFERENCES

[1] Signorelli et. J Scand 2013
[2] Lopomo et al. J Orthop res 2010