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A Standardized Technique in Performing Pivot-Shift Test on the Knee Joint Provided More Consistent Acceleration Curve Shape, Allowing to Highlight Side-to-Side Differences

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Summary:
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Abstract:
Introduction:
The pivot-shift (PS) test is commonly used to evaluate knee joint dynamic laxity; the PS maneuver is yet highly surgeon-specific and difficult to quantify, thus creating high variability in objective grading. Several non-invasive devices and methods have been proposed to quantify the PS phenomenon, above all, using acceleration [1] and inertial sensors [2,3] The aim of this study was to analyze acceleration signal, evaluating the variability in performing both the surgeon-specific technique and a standardized technique, quantified by means of a triaxial acceleration sensor. We hypothesized that the standardized maneuver would be able to better discriminate PS grade compared to the surgeon-specific one.

Methods:
A complete lower body specimen was used for the study. Two different instability grades were created on right and left knee, cutting the ACL and the ACL plus the anterior horn of lateral meniscus, respectively. Twelve expert surgeons performed 3 repetitions of PS test based on their preferred technique followed by a standardized one. A triaxial acceleration sensor skin-fixed to the proximal tibia [3] was used. Comparisons on normalized acceleration curves were performed analyzing side-to-side differences between the surgeon-specific technique and the standardized technique (Independent Student's t-test). Signals with evidence of major inconsistencies were excluded. Statistical significance was set at the 95% level ($p < 0.05$).

Results:
Mean acceleration curves for the personal technique presented low differences - both in shape and in values - between right and left limb; generally the right limb presented lower values of acceleration on the whole curve, but they - and above all the value about the maximum and minimum peak - were not statistically different. Standardized technique highlighted bigger side-to-side differences on the whole curves, above all for what concerned the values between the maximum and minimum peak, that were statistically different. The shape were also different, highlighting an inflexion between the maximum and minimum value for the right limb. Moreover the variability between the tests performed with standardized technique was reduced, compared to the personal one.

Conclusions:
We found a reduction of the variability of the curve between tester when using the standardized maneuver. Moreover the trend of the acceleration curves more coherent in standardized PS. Although further studies are required, the acceleration parameter - when standardized technique is performed - seems sensitive enough to allow discrimination of instability grades during PS test.

References:
[1] Hoshino Y, et al. In vivo measurement of the pivot-shift test in the anterior cruciate ligament-deficient knee using an electromagnetic device. Am J Sports Med. 2007 Jul;35(7):1098-104
[2] Lopomo N, et al. Quantitative assessment of pivot-shift using inertial sensors. Knee Surg Sports Traumatol Arthrosc. 2012 Apr;20(4):713-7
[3] Lopomo N, et al. An original clinical methodology for non-invasive assessment of pivot-shift test. Comput Methods Biomech Biomed Engin. 2011 Jul 5. [Epub].