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論文審査担当者	主査：　和田郁雄 副査：　植木孝俊，大塚隆信

Abstract

Background Recently several authors have reported the quantitative evaluation of the pivot-shift test by using cutaneous fixation of an inertial sensors. [1-3] Before utilizing this sensor for clinical studies, it is necessary to evaluate the accuracy of cutaneous sensor in assessing rotational knee instability. To evaluate the accuracy of inertial sensors by comparing cutaneous and transosseous sensors for quantitative assessment of rotational knee instability, in order to demonstrate clinical applicability in a cadaveric setting.

Methods Eight freshly frozen human cadaveric knees were used in this study. Inertial sensors were fixed on the tibial tuberosity and directly fixed to the distal tibia bone. A single examiner performed the pivot shift test from flexion to extension on the intact knees and ACL deficient knees. The peak overall magnitude of acceleration and the maximum rotational angular velocity in the tibial superoinferior axis was repeatedly measured with the inertial sensor during the pivot shift test. Correlations between cutaneous and transosseous inertial sensors were evaluated, as well as statistical analysis for differences between ACL intact and ACL deficient knees.

Results Acceleration and angular velocity measured with the cutaneous sensor demonstrated a strong positive correlation with the transosseous sensor ($r = 0.86$ and $r = 0.83$). Comparison between cutaneous and transosseous sensor indicated significant difference for the peak overall magnitude of acceleration (cutaneous: 10.3 ± 5.2 m/s^2, transosseous: 14.3 ± 7.6 m/s^2 , $P<0.01$) and for the maximum internal angular

velocity (cutaneous: 189.5 ± 99.6 deg/s, transosseous: 225.1 ± 103.3 deg/s , $P<0.05$), but no significant difference for the maximum external rotation angular velocity (cutaneous: 176.1 ± 87.3 deg/s, transosseous: 195.9 ± 106.2 deg/s , N.S)

Conclusions There is a positive correlation between cutaneous and transosseous inertial sensors. Therefore, this study indicated that the cutaneous inertial sensors could be used clinically for quantifying rotational knee instability, irrespective of the place of utilization.

References

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