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Validation and Reliability of the Hip-Spine Assessment Feature of a Novel Surgical Planning Tool

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Introduction

Dislocations remain a common cause of revision surgery following total hip arthroplasty (THA). The incidence of dislocations in a population with spinal pathologies has been reported to be up to 8%. As the frequency of spinal fusion procedures increases, and with an additional 17.6% of THA patients without lumbar fusion presenting with spinopelvic mobility issues, there is a growing consensus that functional cup placement should be considered. A novel surgical planning software offers a solution to allow surgeons to easily perform hip-spine assessments and functional cup planning. The purpose of this study was to determine the reliability and validity of this software.

Methods

Pre-operative stereoradiographic images (EOS Imaging, Paris, France) were obtained for 40 patients who underwent primary THA from October 2019-2021. Imaging included: standing anteroposterior pelvic (AP) view as well as standing and seated lateral views. To determine the reliability and validity of the new surgical planning software (Intellijoint VIEW™, Intellijoint Surgical, Kitchener, ON), spinopelvic parameters for each case were measured retrospectively. The resulting cup targets were compared to the recommended clinical targets from a 5-year follow-up study in a large cohort with a 0.8% dislocation rate¹. To evaluate user reliability, each image was read by three arthroplasty fellows and two researchers.

Relevant spinopelvic parameters required to complete the assessment included pelvic obliquity on the AP view, anterior pelvic plane tilt on the standing lateral view, and sacral slope on both lateral views. In addition to these necessary inputs, the reviewers also measured the pelvic incidence (PI) and lumbar lordosis (LL) angles on the standing lateral image.

Intraclass correlation coefficients (ICC) were performed on the delta sacral slope (dSS) and the PI-LL mismatch values. Sacral slope was selected since it has the largest impact on the calculated cup targets. PI-LL mismatch was chosen since it was used, along with dSS, to classify patients according to the reference study¹. These classifications provided clinically relevant cup target values to compare to the functional cup targets provided by the program. Agreement was defined as a cup position within the range or within 3° of a specific target (e.g., 40° Inclination) when no range was provided.

Results

There was excellent reliability amongst reviewers. The intraclass correlation coefficient among fellows was 0.89 and 0.88 for all reviewers when comparing dSS measurements. PI-LL mismatch showed similar reliability (0.91 for fellows, 0.92 for all reviewers).

Targets generated through the program were in agreement with the current literature in 100% of cases for inclination targets, and in 80% of cases for anteversion targets. In the cases that exceeded the agreement criteria, 50% were within 1ES, and there were no cases that exceeded the criteria by >3ES.

Conclusion

The novel surgical planning software yielded consistent results with excellent reliability when used by five different reviewers. The resultant target values were clinically meaningful and agree with current clinical recommendations, with differences in anteversion targets likely a product of the patient-specific nature of the software, in contrast to the use of broad categories.

Reference

1-BoneJointJ 2021;103-B(7 Supple B):17-24

Figures



Figure 1: Screen capture of a hip-spine assessment including the measurements that were included in this study and the resultant functional cup targets.

[Figure 1](#)