Ability to Achieve Gap Balancing with Instrumented Navigated Total Knee Arthroplasty-A Review of the first 273 Cases

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INTRODUCTION: Appropriate management of the soft tissue envelope at the time of the surgery is critical to the long-term success of total knee arthroplasty (TKA). In this regard, this study evaluated the ability to achieve the targeted gap balance in terms of mediolateral (ML) laxity and gap values when using a computer-assisted orthopedic surgery system featuring a force-controlled intraarticular distractor.

METHODS: The first 273 cases performed by 24 surgeons were reported without any exclusions, and for each case, the 1) final ML laxity and 2) final average ML gap were compared to their pre-defined targets. For both parameters, the signed and unsigned differentials were reported. Kolmogorov-Smirnov (KS) test was used to evaluate laxity curve differences between surgeons. Cumulative sum control chart (CUSUM) on a surgeon basis was used to assess surgeon's learning curve.

RESULTS: Both the average signed ML laxity and ML gap differentials were neutral throughout the full arc of flexion: from -0.04mm to 0.27mm and from -0.51mm to 1.04mm, respectively. Both the average unsigned ML laxity and ML gap differentials were linear: from 1.04mm to 1.30mm and from 1.40mm to 2.04mm, respectively. Laxity curves of both ML gap difference and ML average gap tend to be surgeon-specific as p-values from KS test were less than 0.05. The CUSUM analysis of surgical times demonstrated either a short learning duration or absence of a discernable learning pattern for surgeons.

DISCUSSION: Despite data from all the users (not only design surgeons) involved with this pilot release being considered and the inclusion of the learning curve cases, there was a high ability to achieve the targeted gap balance throughout the arc of flexion using the proposed method. Further evaluation may encompass the impact of the femoral planning parameters and implant choices.

SIGNIFICANCE/CLINICAL RELEVANCE: (1-2 sentences): This study indicated that navigated TKA with a force-controlled intraarticular distractor can achieve proposed gap balance throughout the arc of flexion.

IMAGES AND TABLES:

Figure 1: Signed ML differential laxity (A), example of signed ML differential laxity for individual surgeons (B), and unsigned ML differential laxity (C).

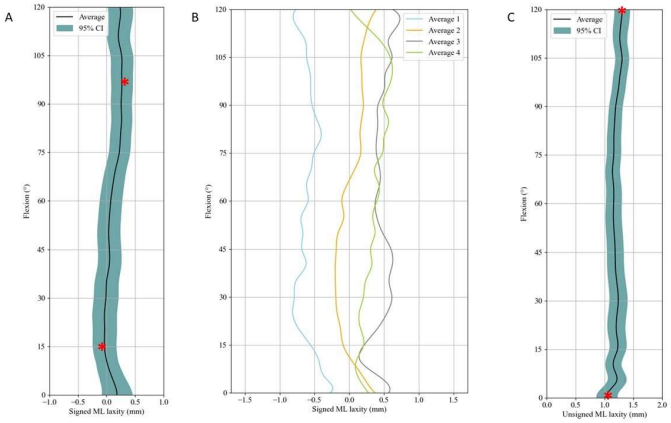

Figure 2: Signed ML laxity of average gap values (A), example of signed ML average gap difference for individual surgeons(B), and unsigned ML laxity of average gap values (C).