A STRUCTURED FRAMEWORK FOR STANDARDIZED 3D LEG ALIGNMENT ANALYSIS: AN INTERNATIONAL DELPHI CONSENSUS STUDY

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1. **Introduction**

   3D bone models are increasingly adopted for leg alignment analysis, but there is substantial variability in the methods and underlying principles used to derive axes and joint orientations from 3D bone models.

2. **Objectives**

   To reach consensus on a structured framework for standardized 3D leg alignment analysis based on 3D bone models.

3. **Methods**

   A Delphi study was performed in four rounds. Rounds 1 and 2 involved a steering and rating group that developed 31 statements based on principles preserving the complexity of 3D anatomical structures, identified through a systematic review. These statements encompassed deriving joint centres and joint orientations, and defining coordinate systems using 3D bone models. In Rounds 3 and 4, an international panel of 35 experts evaluated these statements. Consensus was defined as ≥80% agreement.

4. **Results**

   Of the 31 statements, 26 achieved consensus in Round 3. Five statements were refined and subsequently all achieved consensus in Round 4. Experts agreed on utilising all available relevant surface data to define joint centres, joint orientations, and individual femoral and tibial coordinate systems alongside a combined leg coordinate system, and adopting central 3D axes for femoral version and tibial torsion.

5. **Conclusion**

   This international Delphi consensus study provides a structured framework for a standardized 3D leg alignment analysis based on 3D bone models. By utilizing all relevant surface data, this framework provides a more accurate representation of joint geometries compared to traditional landmark-based methods. Future research should focus on validating the methods adhering to these principles in diverse clinical settings.

6. **References**