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Precision of Radiostereometric Analysis for use in biomechanical experiments – Evaluation and Comparison with a 3D Camera System

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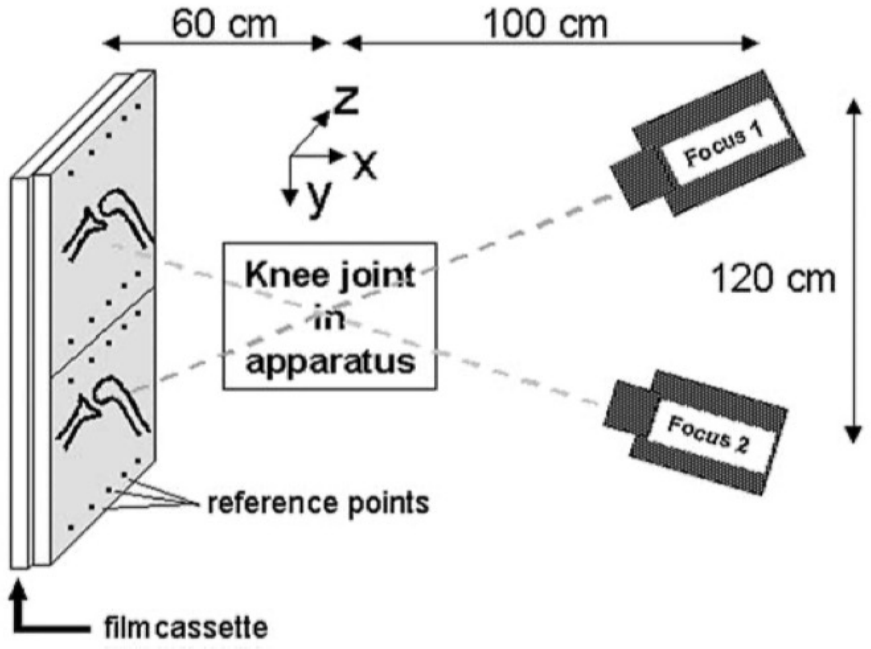
Disclosures

The authors have no conflicts of interest to disclose

Introduction

- Radiostereometric Analysis (RSA) uses the concept of digital image correlation (DIC) to determine the position of radiopaque markers in a three-dimensional space



Tienen et al. KSSTA (2005)

→Tracking of radiopaque tantalum markers

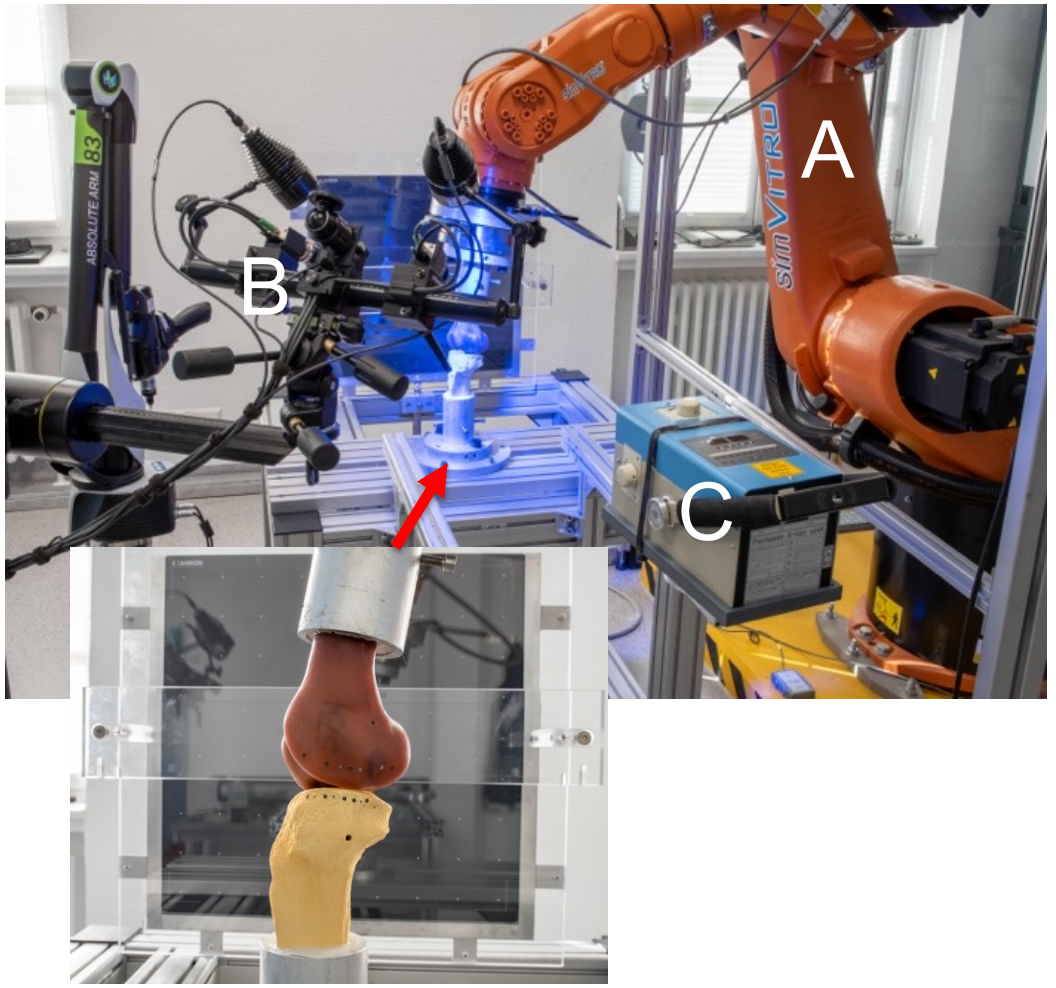
→Can be injected into tissues

→ no direct optical visibility of the tracked object is necessary, thereby allowing assessment of movements of intraarticular structures.

Purpose → To compare a novel RSA setup to a commercial 3D camera system regarding its precision.

Methods

- Application of 1 mm Tantalum markers and 1.4 mm optical markers to sawbones
- Movement of the femur by robotic test system (A)
  - Position accuracy ± 0.05 mm
  - Test. Protocol (n = 10)
    - 3 mm anterior translation → 3 mm medial translation → return to home position
- Quantification of movement by eithter custom-made RSA system (C) or commercial optical tracking system (B; ARAMIS, GOM GmbH)
- Statistical analysis with PRISM (GraphPad Software)
  - Difference between techniques: t-test
  - Correlation: Pearsons correlation



Results

For anterior translation, the measured movement was 3,040 mm (SD 0,005) in the optical tracking group and 3,039 (SD 0,094) in the RSA group.

→ No significant differences (P > 0.05)

For medial translation, the measured movement was 2,857 mm (SD 0,020) in the optical tracking group and 2,798 (SD 0,153) in the RSA group.

→ No significant differences (P > 0.05)

Near-perfect correlation between the techniques with a correlation of 0,97 (95 % CI 0,93 – 0,98).

Conclusion

The presented RSA system can precisely determine knee motions with an accuracy of < 0,2 mm and is therefore well suited for tracking of joint movements in biomechanical experiments.

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Thank you!

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