ACCURACY OF OCCLUSION-BASED DIGITAL MODEL SUPERIMPOSITION AFTER PREMOLAR EXTRACTIONS

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Introduction

- 3D digital model superimposition: radiation-free method that has gained increasing attention as an alternative to imaging-based approaches for assessing orthodontic tooth movement.
- Current radiation protection guidelines emphasize the importance of validating accurate approaches that avoid unnecessary exposure to ionizing radiation.
- AIM: evaluate the accuracy of digital model superimposition in patients treated with four-premolar extractions, using palatal rugae as the reference for the maxillary arch and occlusion for the mandibular arch, compared with the standard cone-beam computed tomography (CBCT)-based method.

Materials and methods

retrospective study

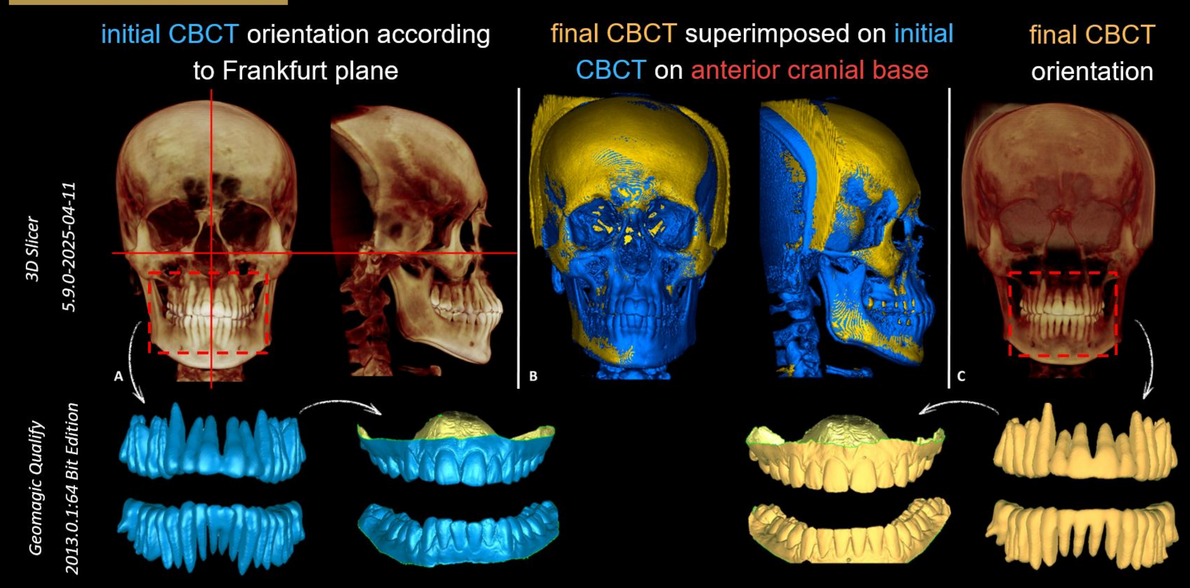
14 patients with CBCTs and digital models

4 main steps

- Steps 1 and 2 established the CBCT-based reference workflow by registering the digital models to their corresponding CBCT scans.
- In Step 3, the method under validation was performed using anatomical references.
- In Step 4, the proposed method was compared with the CBCT-based reference to assess its accuracy.

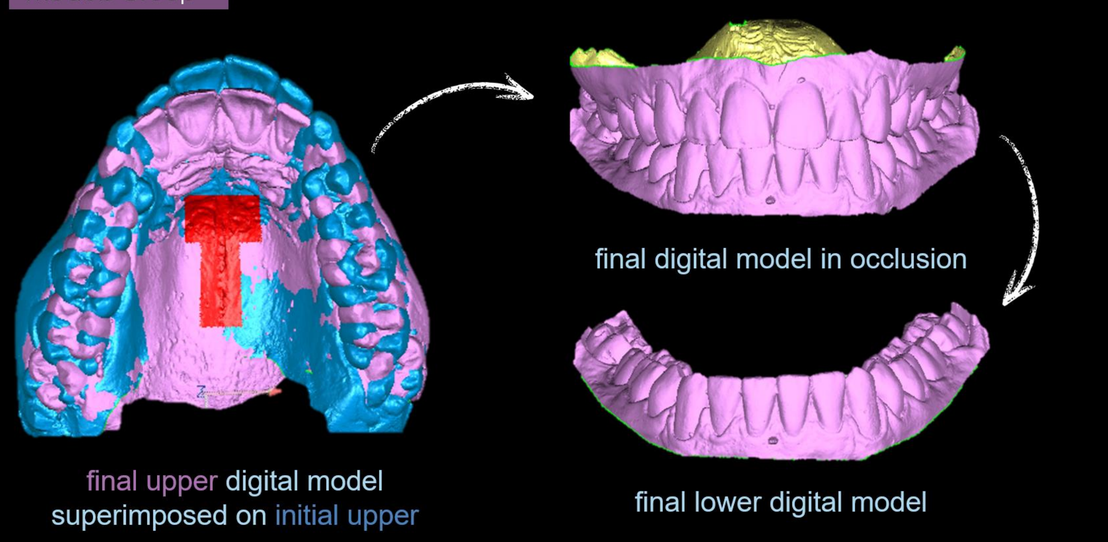
Steps 1 and 2

Tomography Group

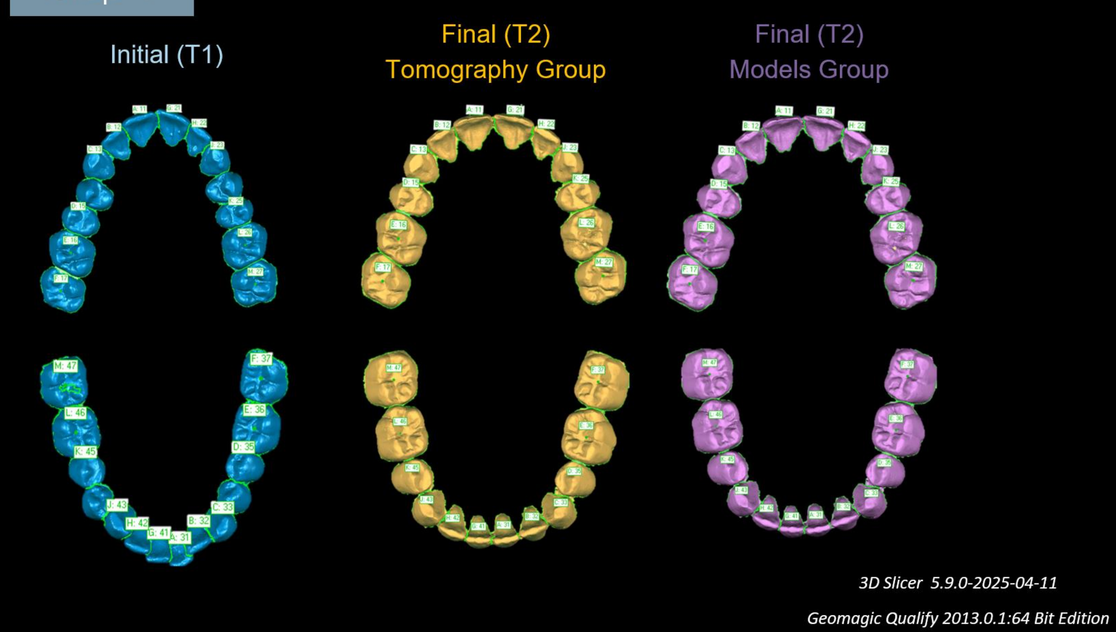


Step 3

Models Group

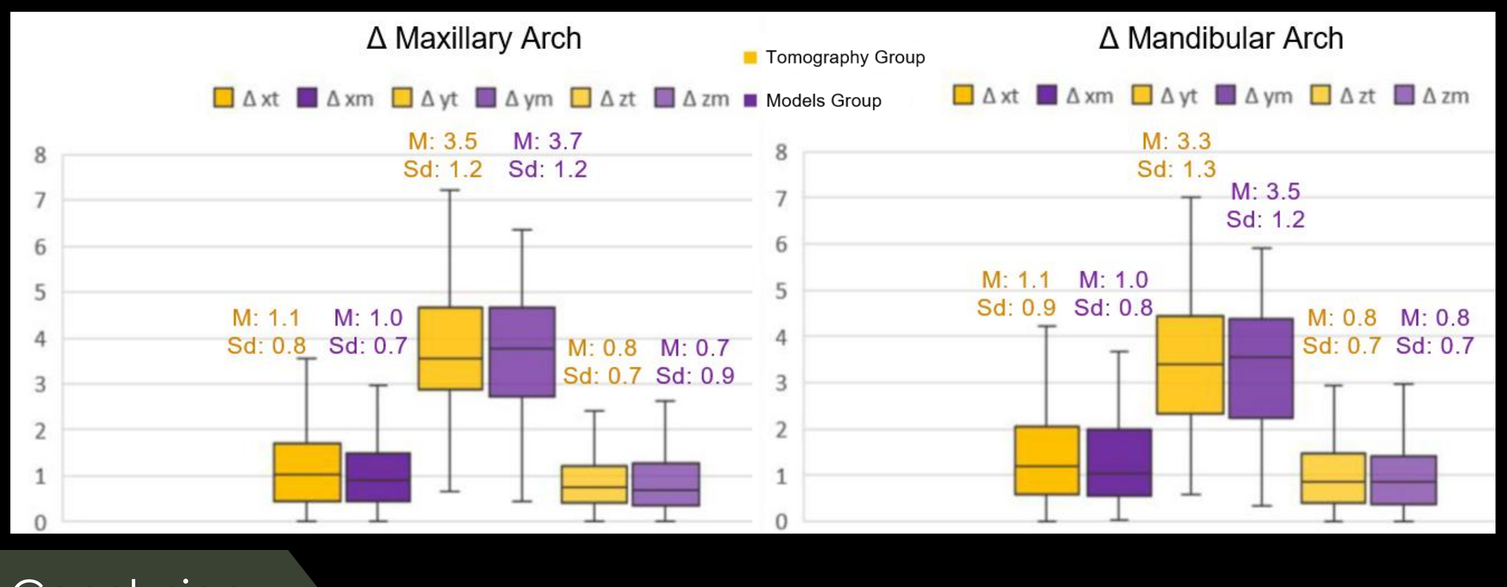


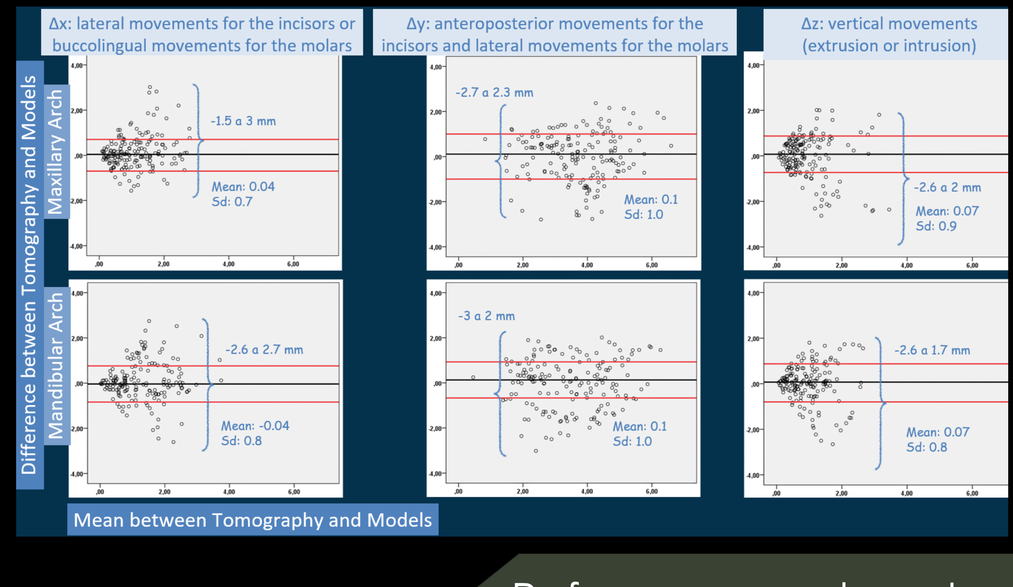
Step 4



Results

The two methods produced tooth displacement measurements of similar magnitude, with mean intermethod differences of 1 mm or less across all evaluated axes (x, y, and z). The Bland-Altman analysis indicated good agreement and intraexaminer reproducibility was evaluated in 50% of the sample after a 2-week interval showing excellent precision (ICC = 0.99).





Conclusion

- Digital model superimposition using palatal rugae for the maxillary arch and occlusion for the mandibular arch demonstrated good agreement with the standard CBCT-based method and excellent precision.
- These findings support its use as a valuable radiation-free tool for 3D assessment of orthodontic tooth movement, reducing the need for CBCT-based evaluation when imaging is not clinically justified.

References and contact

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