

EFFECT OF DIFFERENT INTRA-ORAL SCANNERS AND PHOTOGRAMMETRY SYSTEMS ON THE ACCURACY OF FULL-ARCH SCANS FOR FIXED IMPLANT-RETAINED RESTORATIONS

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INTRODUCTION

New intraoral scanners are introduced almost every year, incorporating advanced technologies that enhance accuracy for various applications. These systems are now widely utilized in the restoration of dental implants, including full-arch fixed screw-retained restorations.

OBJECTIVE

The objective of this study was to evaluate and compare the accuracy of full-arch digital implant impressions obtained using seven currently available digital impression systems.

METHODS

A reference maxillary model with six implants and multi-unit abutments was used for this study. The digital impression systems assessed included **Dentsply Sirona Primescan**, **3Shape Trios4**, **3Shape Trios5**, **Medit i700**, **Medit i900**, and **Micronmapper**. Each group was scanned ten times and a dental lab scanner (**E4**, **3Shape**) was used as the reference. All scans were exported as STL files, and an implant bar was designed in 3Shape Dental System software.

The 3D position for each implant was extracted from digital bar designs and saved in a .CSV format, which included implant implant positions and rotations. This process was automated using a Python script in Blender software. The data were then analyzed using the Evalumap software (Claronav Dental). For each group, both 3D deviation and angular deviation were calculated.

Accuracy was measured in terms of **trueness** (comparison between test and reference) and **precision** (consistency of repeated measurements). The Shapiro-Wilk test indicated that the data were not normally distributed. Therefore, the Kruskal-Wallis test, followed by the Mann-Whitney test, was used for statistical analysis, with significance set at $p = .05$.

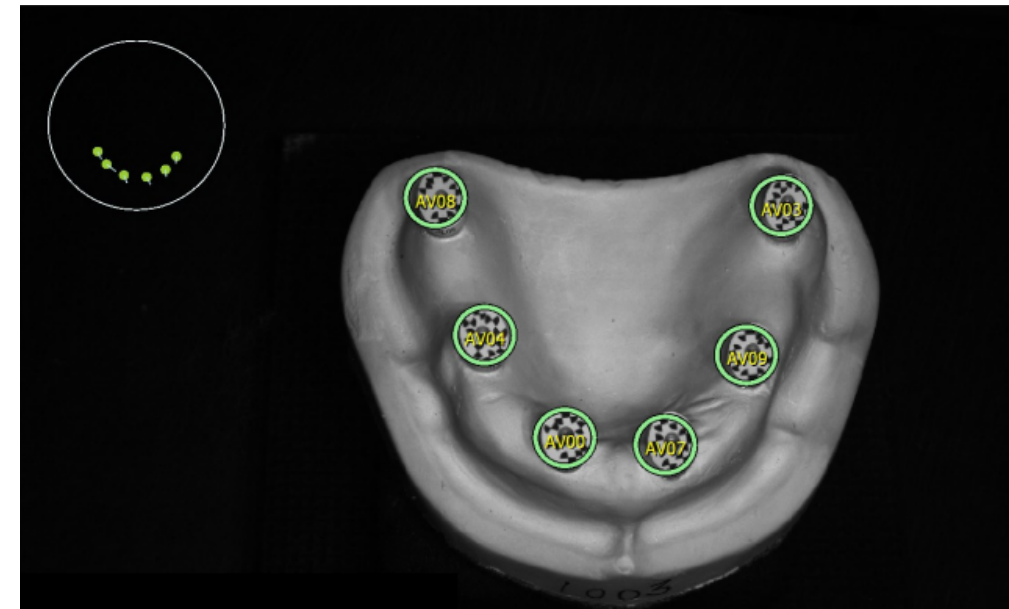


Fig 1. MicroMapper photogrammetry software at the time scan bodies are registered in the implant position.

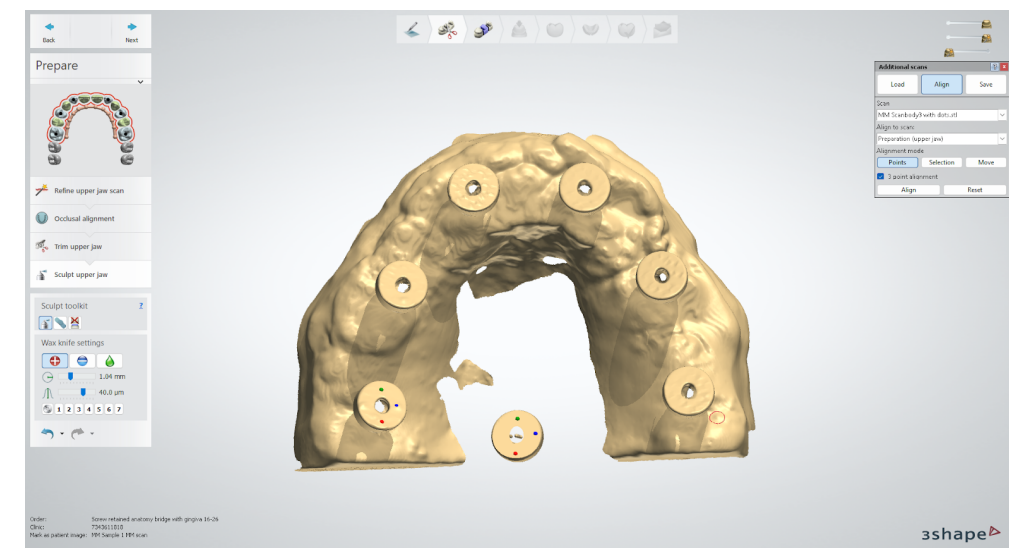


Fig 2. 3Shape software at the time aligns scan bodies in arch-scanned.

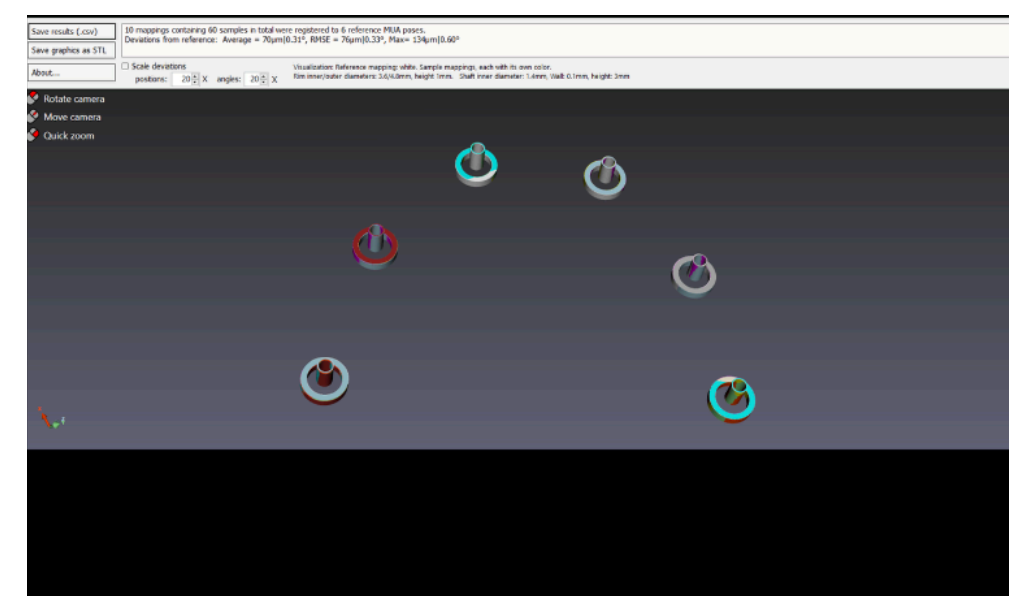


Fig 3. Evalumap software measures distance and angular deviations.

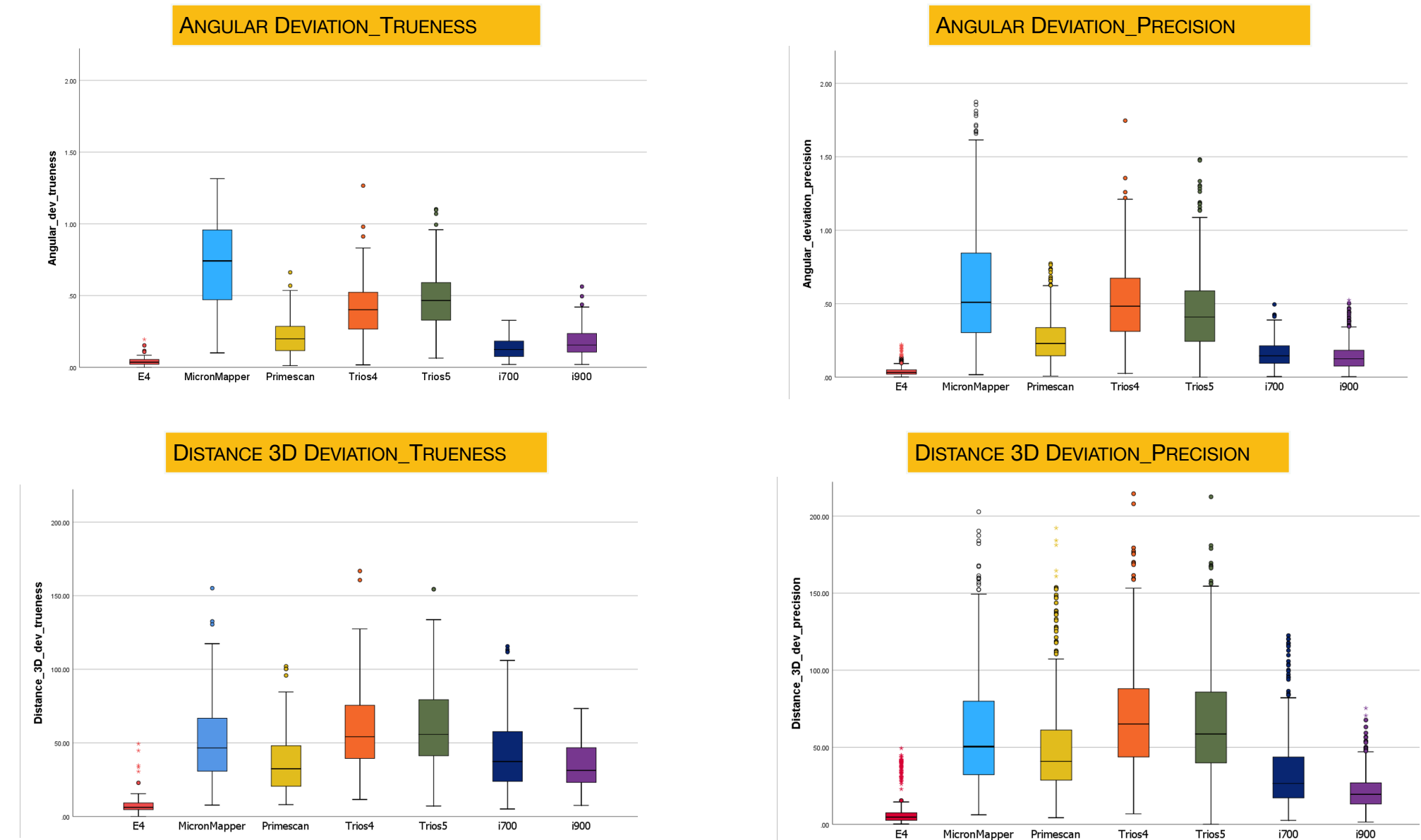


Fig 4. The graphs display the 3D deviation and angular deviation for both precision and trueness across different intraoral scanners and the photogrammetry system.

RESULTS

The study identified significant differences in scanning accuracy among the scanners and photogrammetry system ($p < 0.001$). Among all the scanners, the Medit i900 demonstrated the lowest angular and 3D deviations for both precision and trueness. This system features a larger field of view, which may contribute to reduced scanning time and improved capture of the scanned area. The photogrammetry system also produced accurate results, comparable to those of the desktop scanner.

CONCLUSION

Different intraoral scanner influenced the accuracy of digital impressions in completely edentulous arch. Further research is needed to evaluate how varying levels of accuracy affect the precision of these intra-oral scanners for full arch implant restorations.