

Affiliation

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Introduction

Photogrammetry has emerged as a transformative technology in implant dentistry, enhancing accuracy and efficiency in capturing implant positions, particularly for full-arch screw-retained restorations. Photogrammetry enables precise implant positioning by capturing simultaneous images of scanbodies, which can be seamlessly integrated with CAD/CAM systems for rapid prosthesis fabrication. This study evaluates the accuracy of photogrammetry in full-arch implant-supported restorations. Despite notable advantages, challenges remain in achieving standardized protocols, operator proficiency, and accurate data integration with intraoral scans.

Objective

This study included 30 patients that previously received implants for full arch restoration in the maxilla and/or mandible. All restorations were fabricated over multiunit abutments (S.I.N. Implant systems). After implant sites healed patients returned to follow-up. Temporary prosthesis were removed and the patients were scanned with Micronmapper (MM) and medit i600 intraoral scanner. The prosthesis was also scanned to compare fit with implant position. A verification jig was also obtained at time of scanning.

Methods



Figure 1

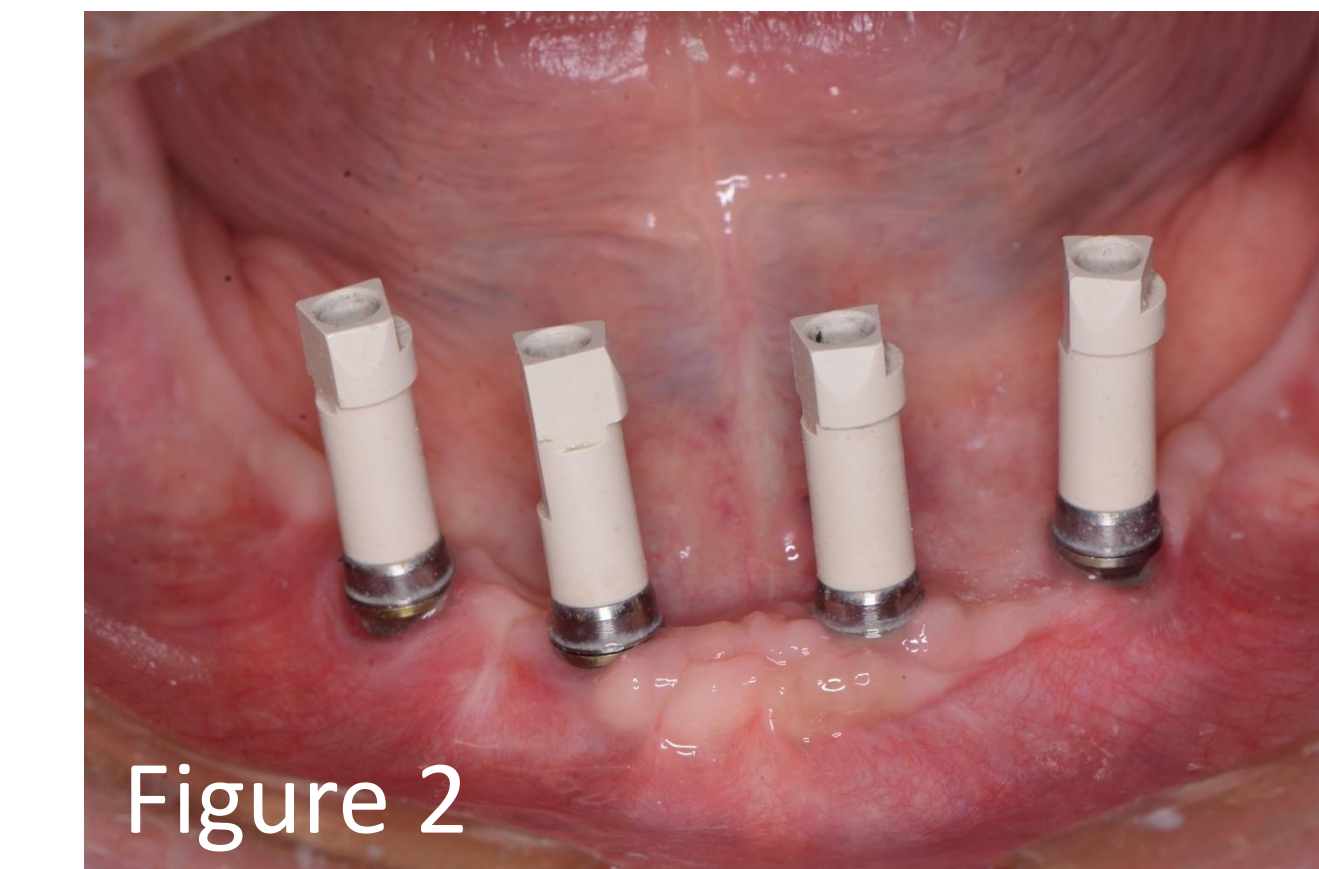


Figure 2

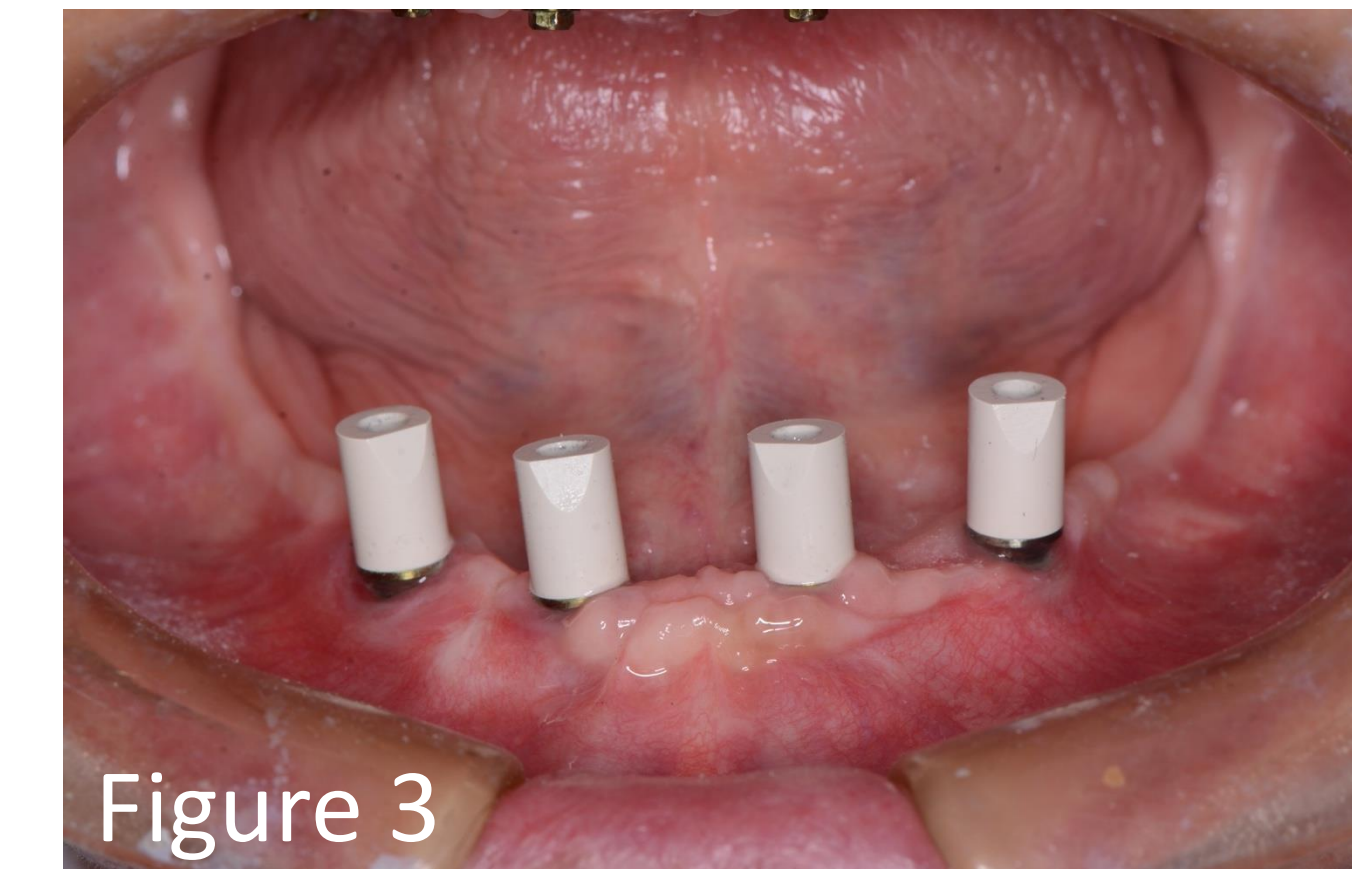


Figure 3

Intraoral scan of the tissue and scanbodies. Figures 1, 2, 3 and 5

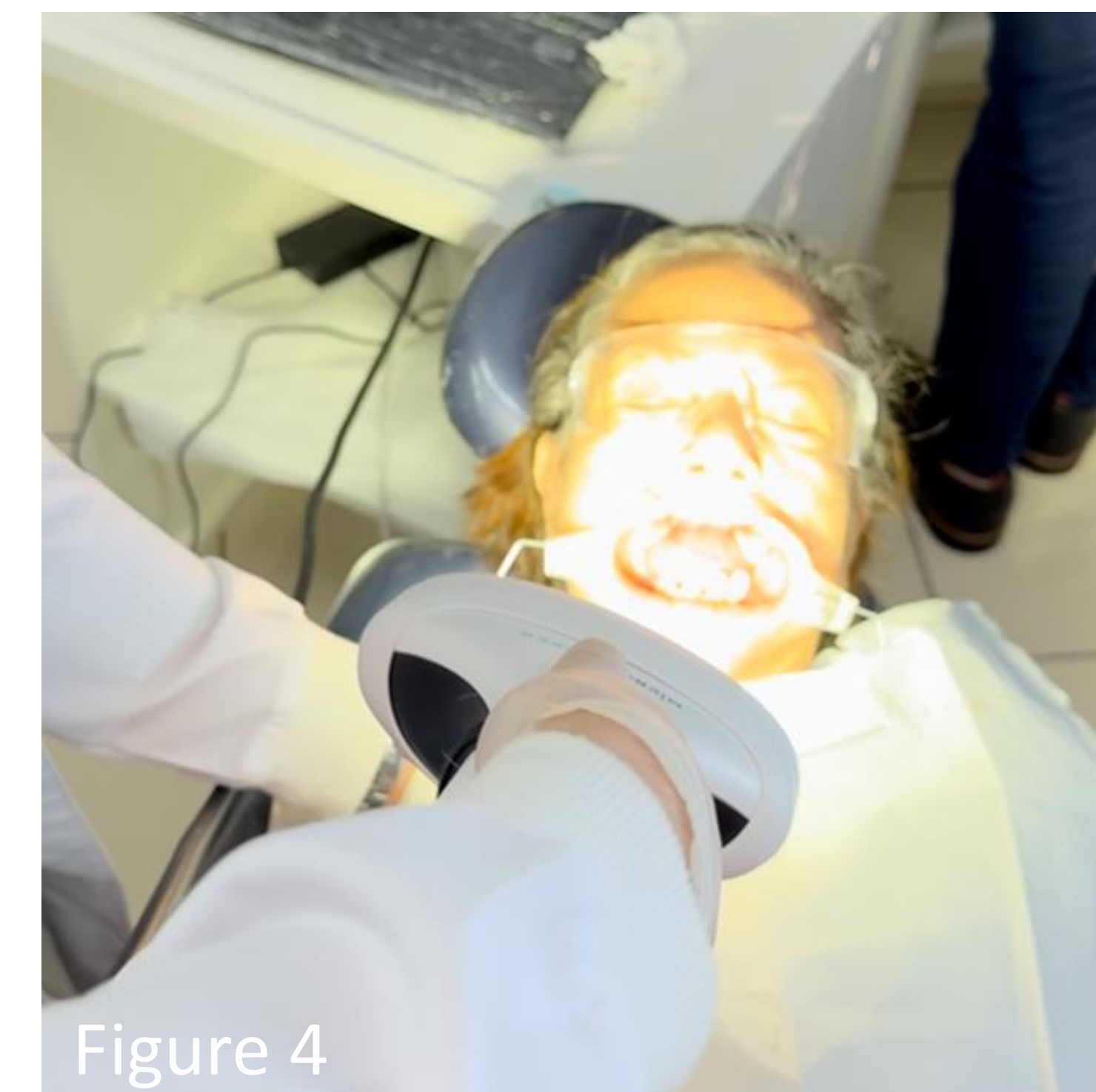


Figure 4



Figure 5



Figure 6

Photogrammetry to capture implant positions intraorally. Figures 4, 5 and 6

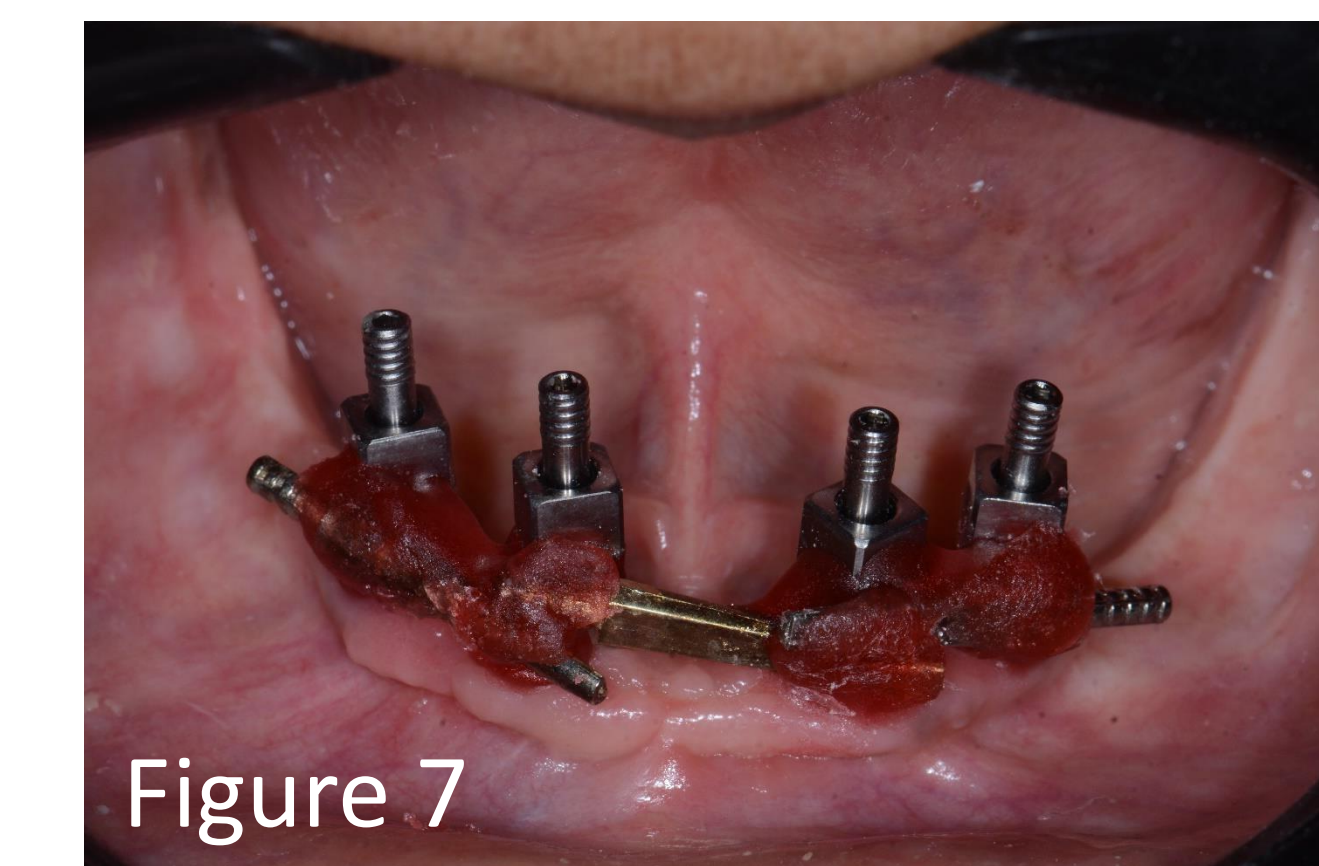


Figure 7



Figure 8

Fabrication of index and casts. Figures 7 and 8

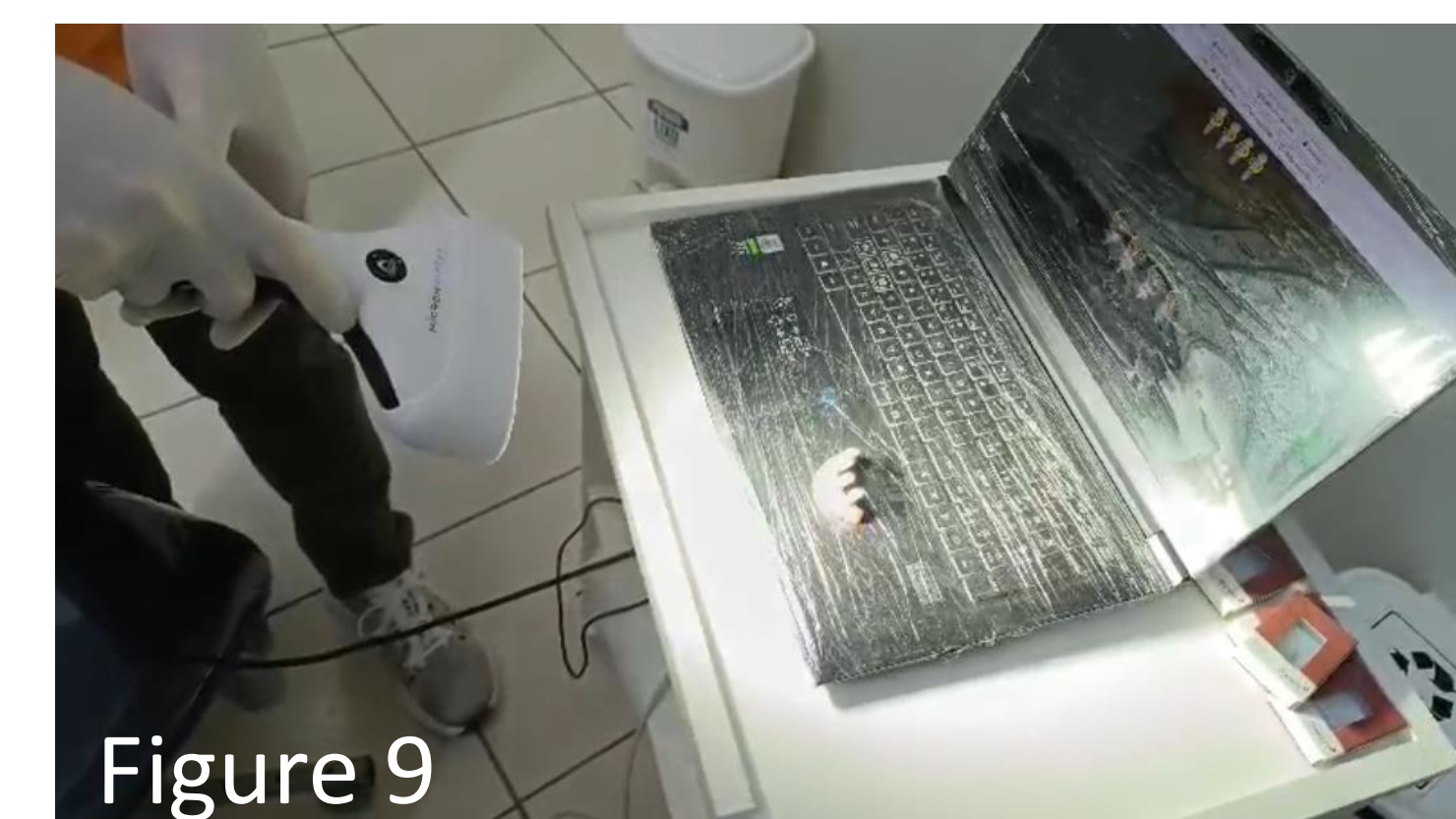


Figure 9



Figure 10

Photogrammetry to compare implant positions on temporary (Fit check). Figures 9 and 10

Results

All implants were osseointegrated. After prosthesis removal the scanbodies for MM were placed and patient was scanned. IO scanbodies were also used. Comparison between casts and MM showed a difference of $70.86\mu\text{m}$ (± 75.19) with a maximum variation of $100.76\mu\text{m}$ (Figure 11). When comparing MM and the index the difference was $66.42\mu\text{m}$ (± 70.54) with a maximum variation of $97.17\mu\text{m}$ (Figure 13). Two different types of scanbodies also presented different results (Figure 14 and 15). Design #1 difference was $107.75\mu\text{m}$ (± 115.06) with a maximum variation of $156.50\mu\text{m}$ (Figure 14) and Design #2 difference was $74.57\mu\text{m}$ (± 78.96) with a maximum variation of $107.04\mu\text{m}$ (Figure 15). Scanning the prosthesis showed higher values compared to MM ($97.69\mu\text{m}$ ($\pm 103.84\mu\text{m}$ - max $142.19\mu\text{m}$) (Figure 16). Clinically the situations were the values were above $150\mu\text{m}$ the fit of the temporary was considered not ideal and clinically noticeable.



Figure 11 - Cast

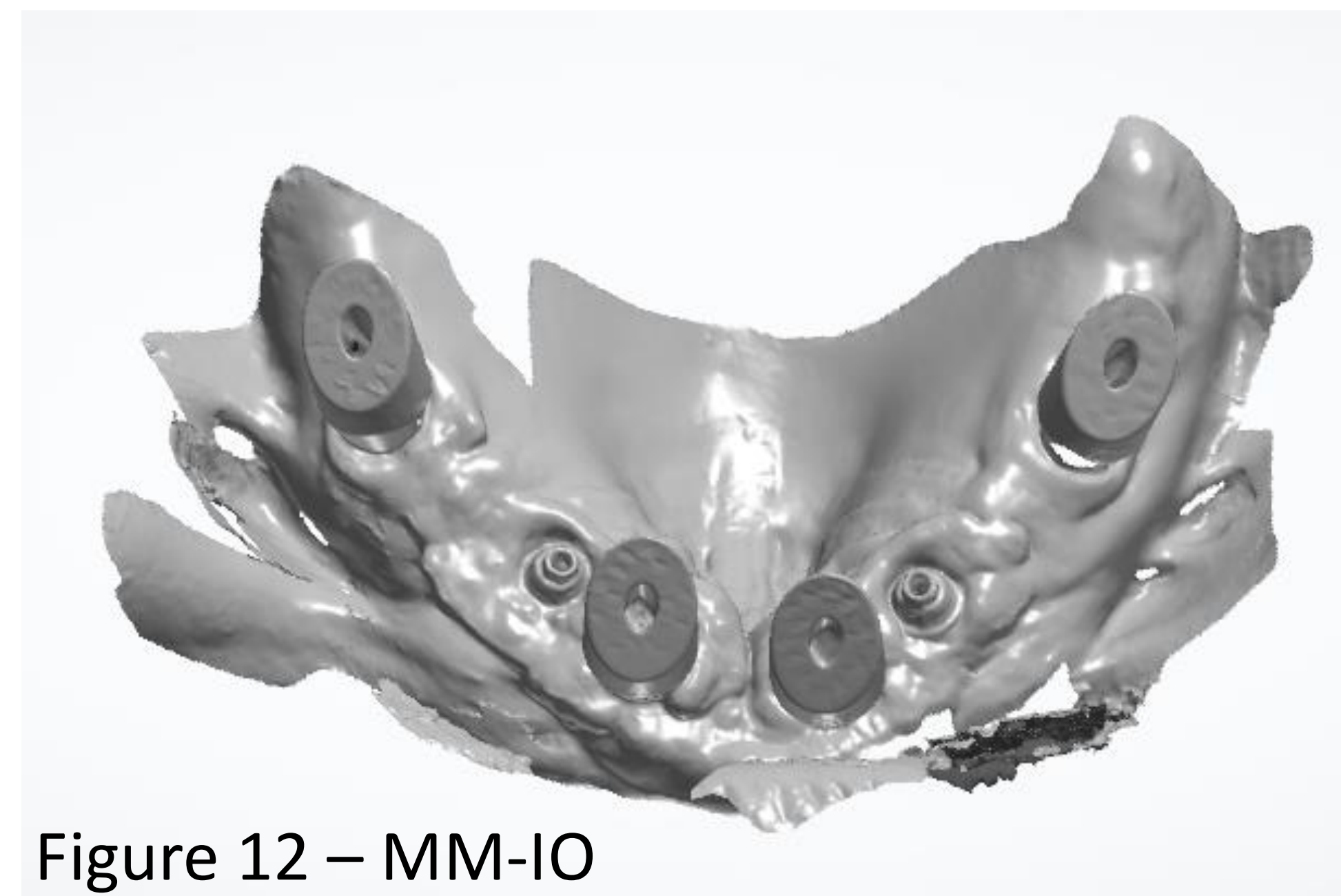


Figure 12 - MM-IO



Figure 13 - Index

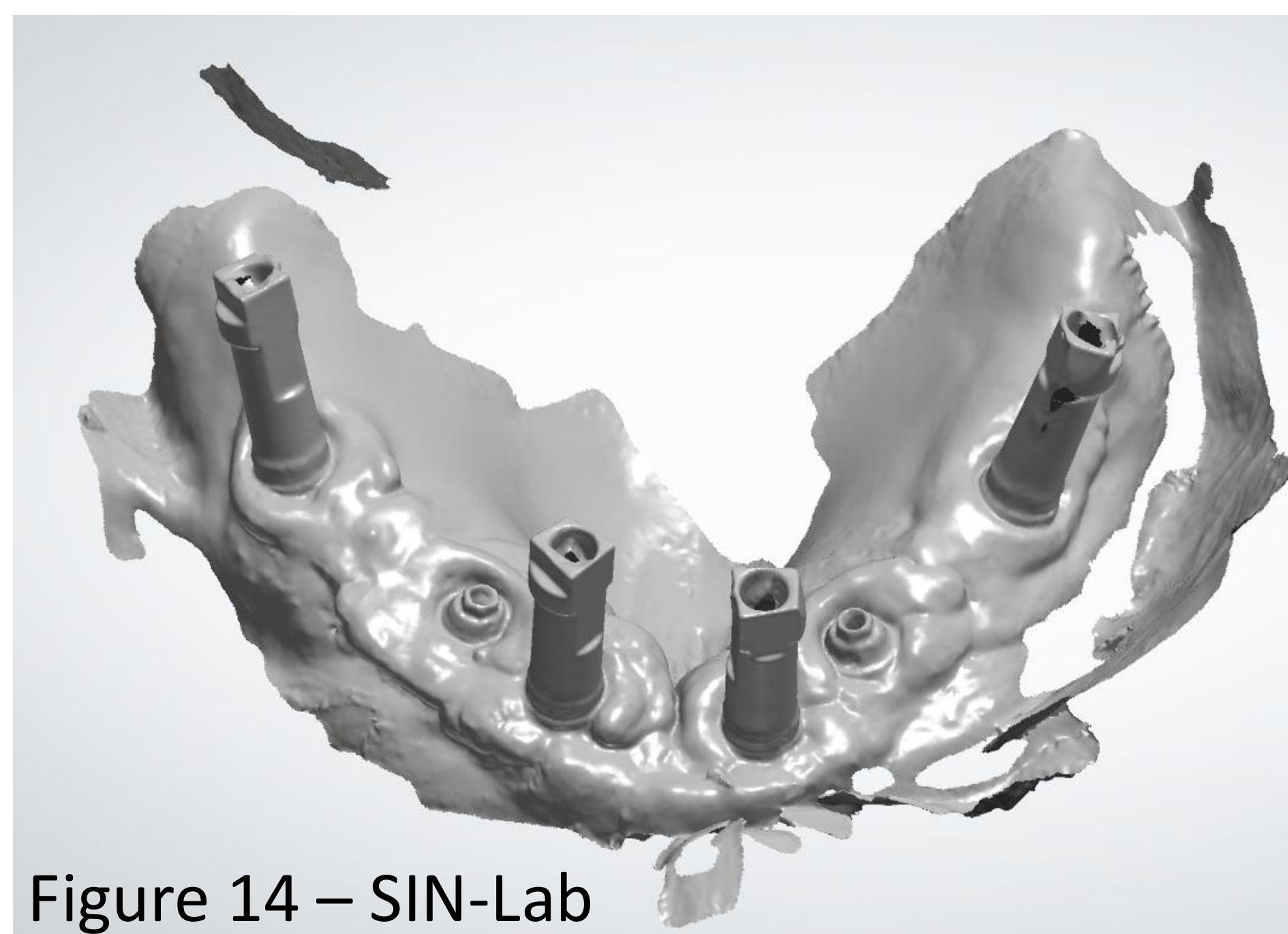


Figure 14 - SIN-Lab

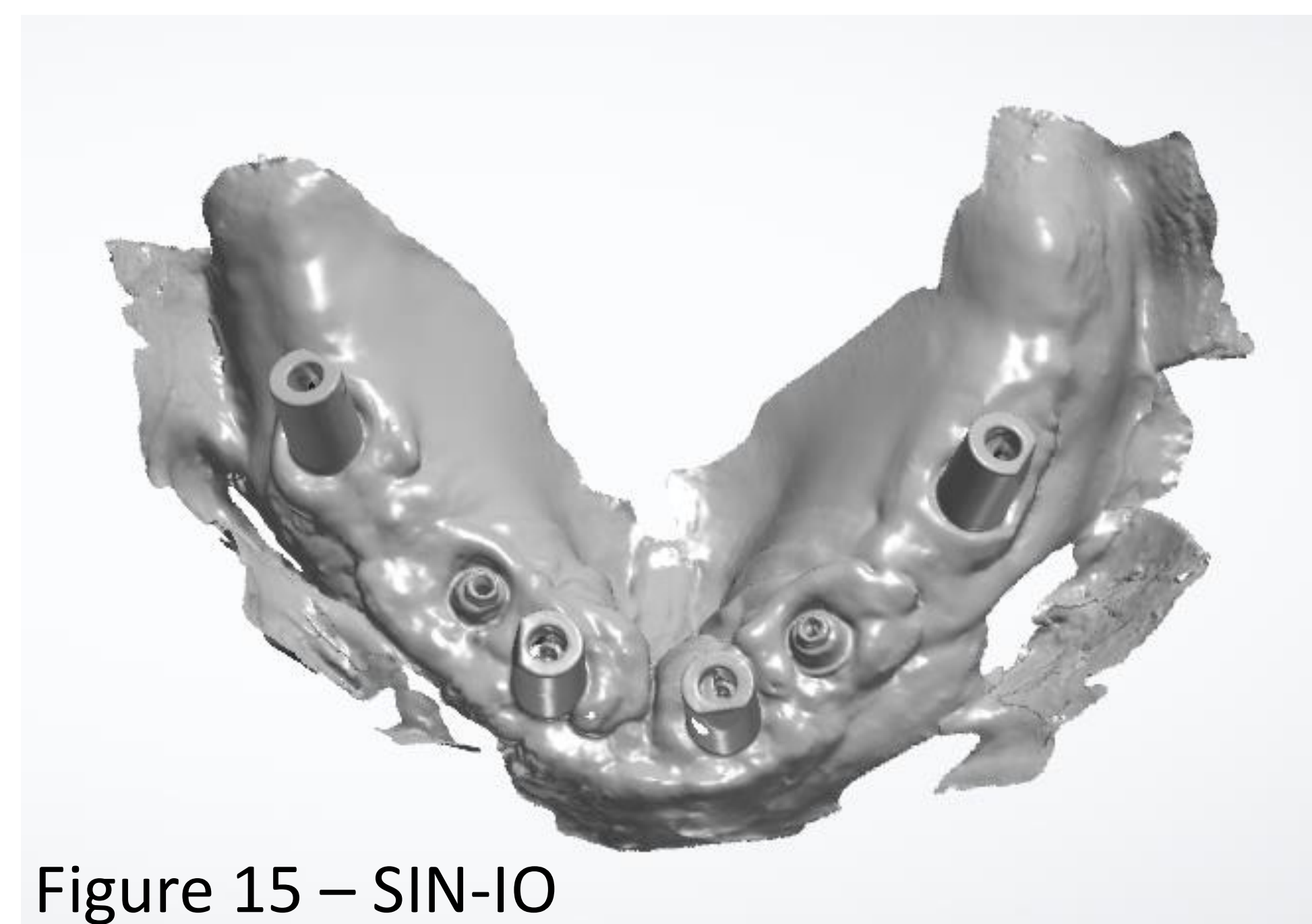


Figure 15 - SIN-IO

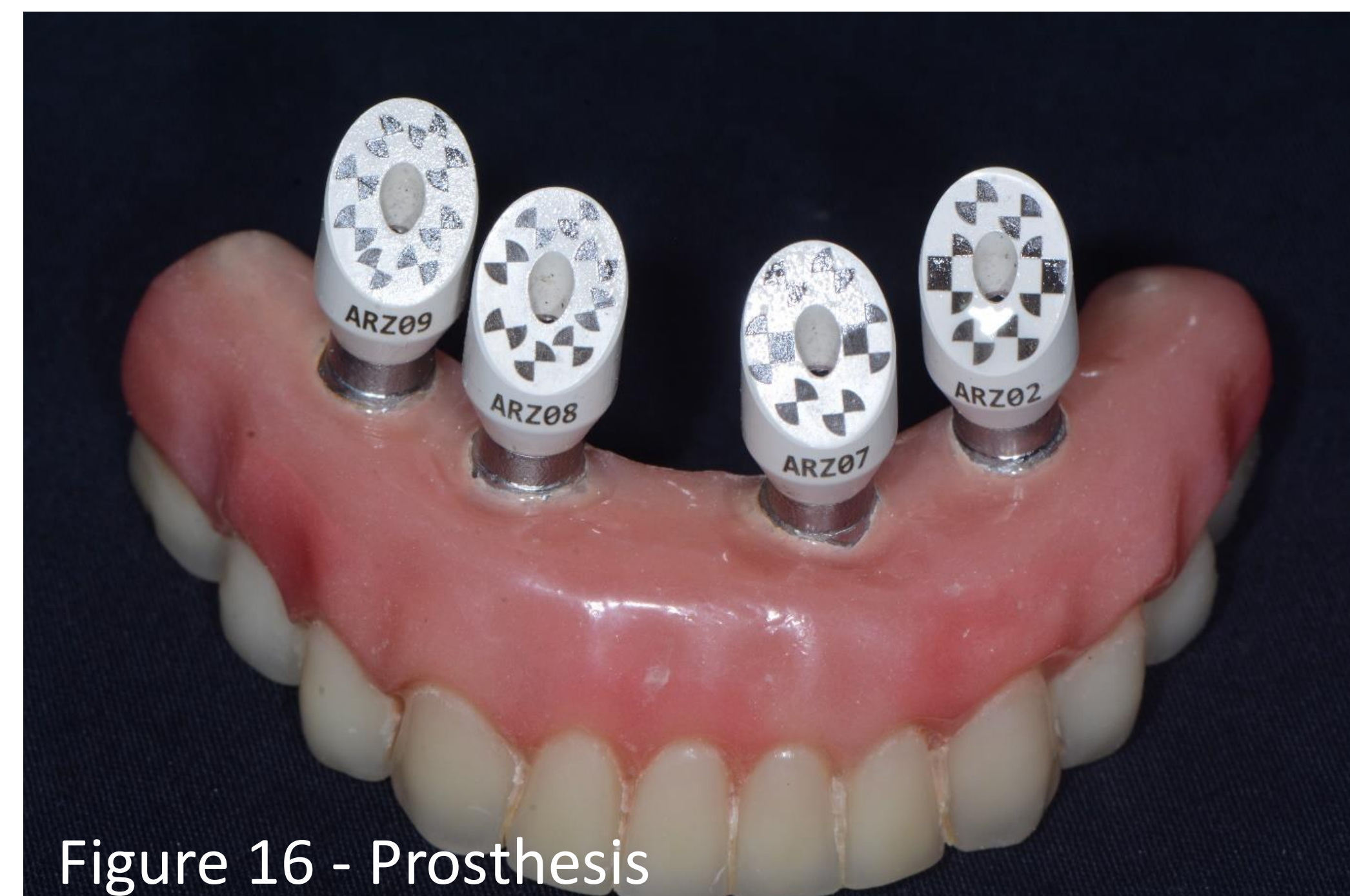
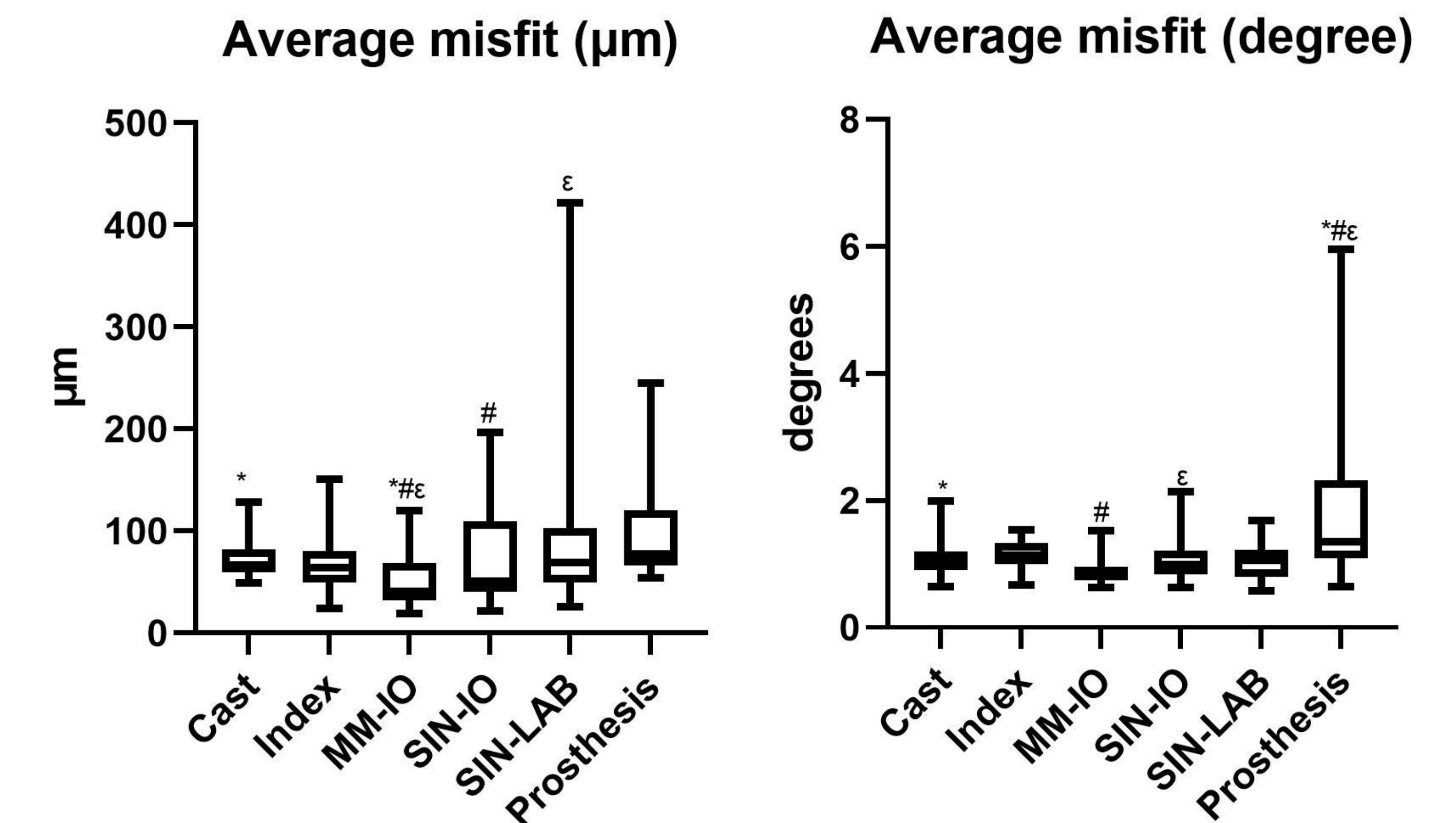


Figure 16 - Prosthesis



Conclusion

These results demonstrated accuracy of the photogrammetry system compared to a conventional cast. For the intraoral scanner, it was dependent on the shape of the scanbody used. This study also demonstrated some correlation between the values obtained in MM with clinically noticeable misfit of temporary prosthesis.