Doctoral Dissertation
Doctoral Program in Bioengineering and Medical-Surgical Sciences (37th Cycle)

Synthesis of PhD Thesis: Impact of intraoral scanners in prosthetic dentistry: research for clinical indications

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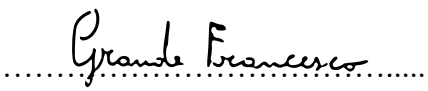

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Synthesis

The dissertation explores the evolving role of intraoral scanners (IOSs) in the field of prosthetic dentistry, with a particular focus on their application in implant-supported prosthodontics. The study investigates the accuracy, efficiency, and clinical implications of using IOS for digital scans in cases involving dental implants. A central aspect of the research examines the performance of various scan bodies (ISBs) —transfer devices that communicate the implant position to the digital workflow—and their compatibility with different scanning techniques and IOSs.

Starting with a literature review that identified the most critical factors in IOS scanning, a specific study on complete arch scanning was designed, standardizing all variables as much as possible except those under investigation. A rigorous methodological analysis was conducted to measure the accuracy of each system, and clinically significant results were highlighted. Here below, I provided in an abstract the synthesis of the thesis.

Purpose: This study aimed to evaluate the influence of three Implant Scan Bodies (ISBs), four intraoral scanners (IOSs), and two scan strategies on the trueness of complete-arch all-on-six implant scans.

Methods: A reference digital cast of an all-on-six maxillary rehabilitation was obtained using a coordinate measuring machine (CMM, Renishaw). Three ISBs (New Ancorvis AQ, One-shot, Elos PEEK), four IOSs (Trios 3POD, Medit i700, iTero, Primescan), and two scan strategies (Zig-Zag ZZ, One-shot OS) were tested. For each combination, 10 digital scans were performed by a single operator under controlled conditions (n=240). The ISB connection positions were compared to the STL reference file after best-fitting on three sphere-shaped markers in the

palatal vault. Trueness was assessed through 3D linear and angular deviations, interimplant distance discrepancies, and scanning time (alpha=0.05).

Results: ISB-AQ exhibited significantly higher trueness in 3D linear deviation compared to One-Shot and PEEK ($p<0.01$), with a mean deviation of 93±35 μm, while One-Shot and PEEK showed deviations of 110±58 μm and 121±60 μm, respectively. Among IOSs, Trios demonstrated the highest accuracy across all ISBs ($p<<0.01$), with a mean deviation of 85±40 μm, whereas Primescan had the lowest accuracy (135±37 μm). No statistically significant differences were found between scan strategies, except for Primescan, where OS performed better than ZZ ($p<0.01$). Regarding interimplant discrepancy, ISB-AQ (34±27 μm) and One-Shot (37±34 μm) had the highest accuracy, while PEEK exhibited the largest deviation (51±35 μm). Trios achieved the best interimplant accuracy across all ISBs ($p<0.05$).

For angular deviations, ISB-AQ performed significantly better than One-Shot and PEEK in both ML and AP angles across all IOSs and scanning strategies ($p<0.01$). Among IOSs, Primescan and Trios exhibited superior angular accuracy when used with ISB-PEEK, whereas Medit and iTero performed best with ISB-AQ. Scanning strategy did not influence angular deviations significantly, except for Primescan, where OS performed better ($p<0.01$).

Scanning times varied significantly among ISBs, IOSs, and strategies. ISB-One-Shot enabled the fastest scans ($p<<0.01$), while ISB-AQ had the longest scanning time (118±20 sec). Primescan demonstrated the shortest scanning time (72±22 sec), while Trios had the longest (115±24 sec). Zig-Zag scanning was generally faster than One-Shot, except for Medit with ISB-One-Shot ($p=0.053$).

Conclusions: ISB-AQ demonstrated superior trueness over One-Shot and PEEK. Trios consistently exhibited the highest accuracy among IOSs. The scanning strategy did not significantly influence accuracy except for Primescan, where OS performed better. ISB-One-Shot allowed the fastest scans, while Primescan was the most time-efficient IOS. These findings highlight the impact of ISB type and IOS selection on complete-arch implant scan accuracy.