

Impact of Palatal Height and Scanning Strategy on the Accuracy of Maxillary Denture IOS Digitization

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Introduction:

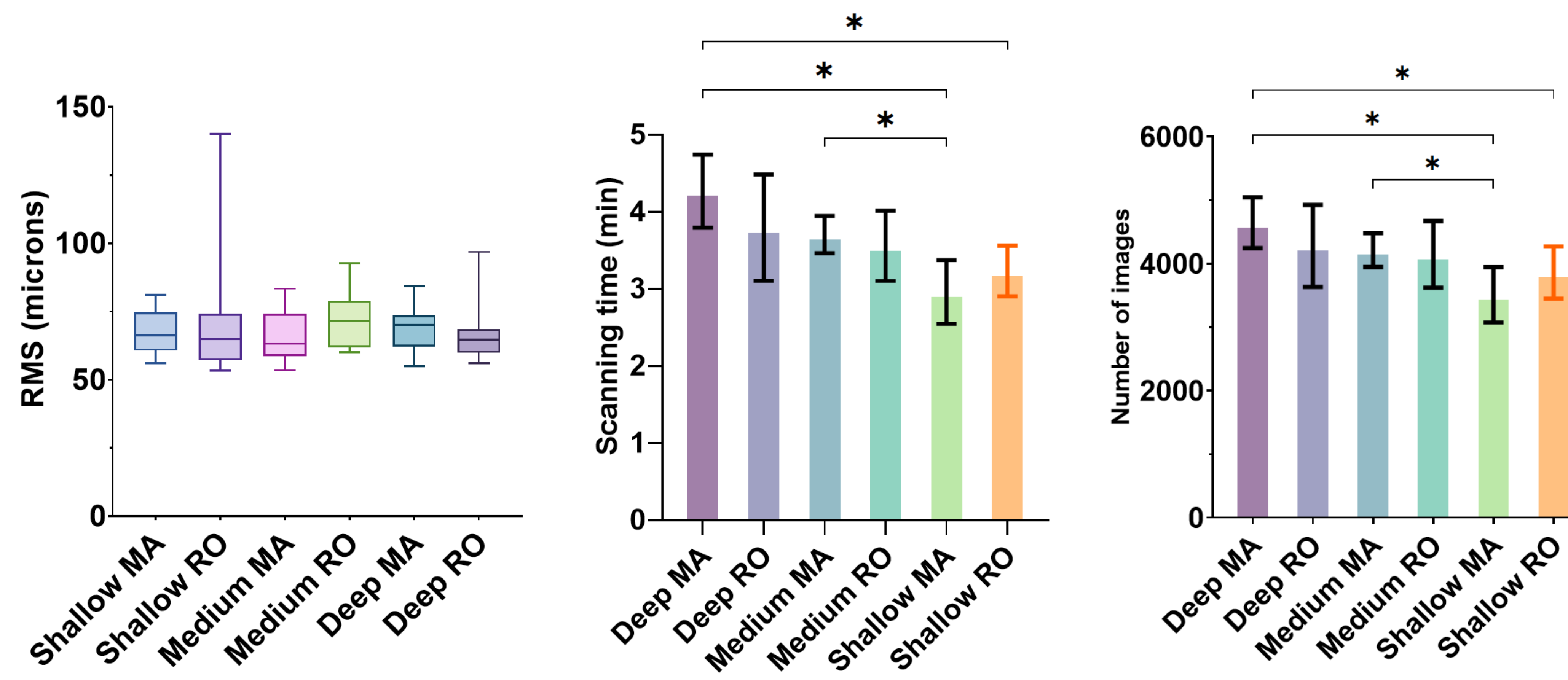
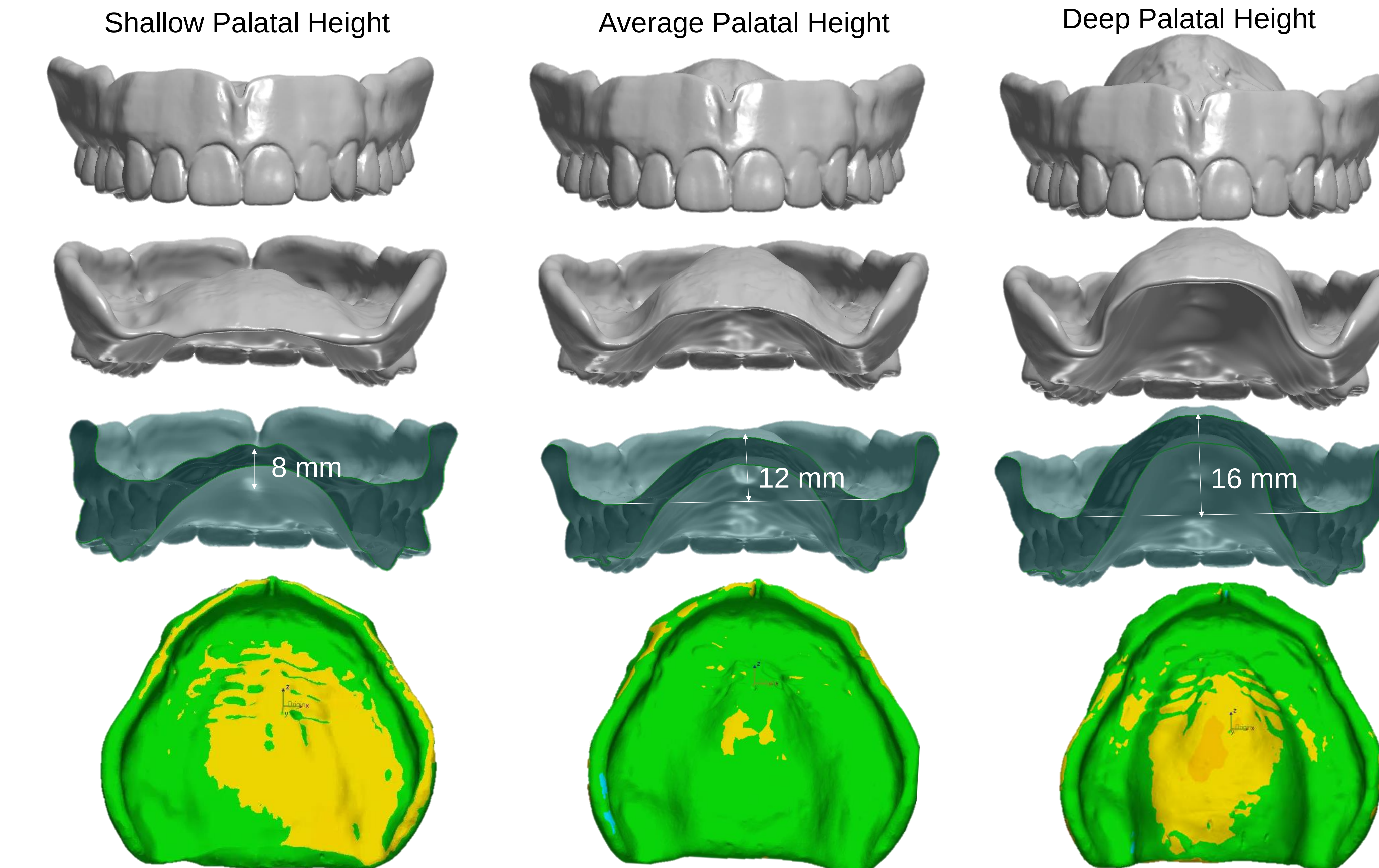
Different palatal anatomical configurations can often complicate the fabrication of complete denture prosthesis. Although intraoral scanning has been commonly used for complete denture duplication, some anatomical limitations, such as palatal configuration, may introduce errors. Previous studies have demonstrated that palatal configuration may have an effect on accuracy and speed of edentulous maxillary scans^{1,2}.

Purpose:

The aim of this study is to evaluate the impact of palatal height and scanning strategy on the accuracy, time, and number of images in maxillary denture digitization using an intraoral scanner.

Methodology:

- Three maxillary dentures were digitally designed based on Avci³ maxillary dentures with an average arch width and palatal height.
- shallow (8 mm), average (12 mm), and deep (16 mm).
- A laboratory scanner (3shape, E4) was used to obtain reference scans
- Test scans were performed using an intraoral scanner with two scanning patterns: manufacturer's (MA) and rolling (RO) (n=10/palatal configuration/pattern).
- Scanning time and the number of images were recorded.
- Test scans were superimposed onto the reference scan using 3D inspection software (Geomagic Control X) using overall best-fit alignment. Root mean square (RMS) values were calculated for accuracy analysis.
- A one-way ANOVA followed by Tukey post-hoc tests, analyzed trueness, precision, scanning time, and the number of images.
- Trueness was also assessed qualitatively using 3D color mapping.



Results:

Group	RMS Error (Mean ±SD) (Trueness ± Precision)	Scanning time (min.)	Numbers of 3D images
Shallow MA	67.60 ± 8.387	2.961 ± 0.41	3510 ± 435.8
Sallow RO	72.09 ± 25.17	3.23 ± 0.33	3862 ± 410
Medium MA	65.98 ± 9.43	3.70 ± 0.24	4215 ± 265
Medium RO	72.35 ± 10.25	3.56 ± 0.46	4148 ± 265
Deep MA	68.75 ± 8.70	4.27 ± 0.47	4646 ± 400
Deep RO	67.08 ± 11.53	3.80 ± 0.69	4280 ± 646

- RMS values showed no significant differences among the groups.
- Scanning time was significantly shorter for the shallow MA group compared to the medium and high MA groups (p<0.05).
- The number of images was significantly lower for the shallow palate compared to the medium and high palate groups (p<0.05).
- No significant differences were observed in scanning time or the number of images among dentures scanned with the RO pattern.

Conclusions:

It was hypothesized that the scan accuracy may be lower for the denture with the deep palatal height due to the higher geometric complexity which may lead to difficulty in digitizing the deep horizontal slopes. However, there was no significant difference in scan accuracy across the three palatal configurations. The shallow palate required the least scanning time and the fewest images.

References

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