

Evaluation of accuracy and reliability of the 3Shape TRIOS 4 intraoral scanner shade measurement tool compared to visual shade selection

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Introduction

A major challenge encountered by the restorative dentist and laboratory technician is the ability to accurately communicate and reproduce the parameters of tooth shade and characteristics [1]. Various methods are routinely used for shade selection, such as visual and instrumental. Instrumental methods include the use of a digital spectrophotometry device and, more recently, intraoral scanning systems such as the 3Shape TRIOS 4 [2, 3]. The objective of this study was to assess the accuracy and reliability of the 3Shape TRIOS 4 intraoral scanner's shade measurement tool when compared to the visual shade selection (VSS).

Hypothesis

Our hypothesis was that shade measurements obtained from the 3Shape TRIOS 4 would be equally reliable and comparable to visual shade selection (VSS).

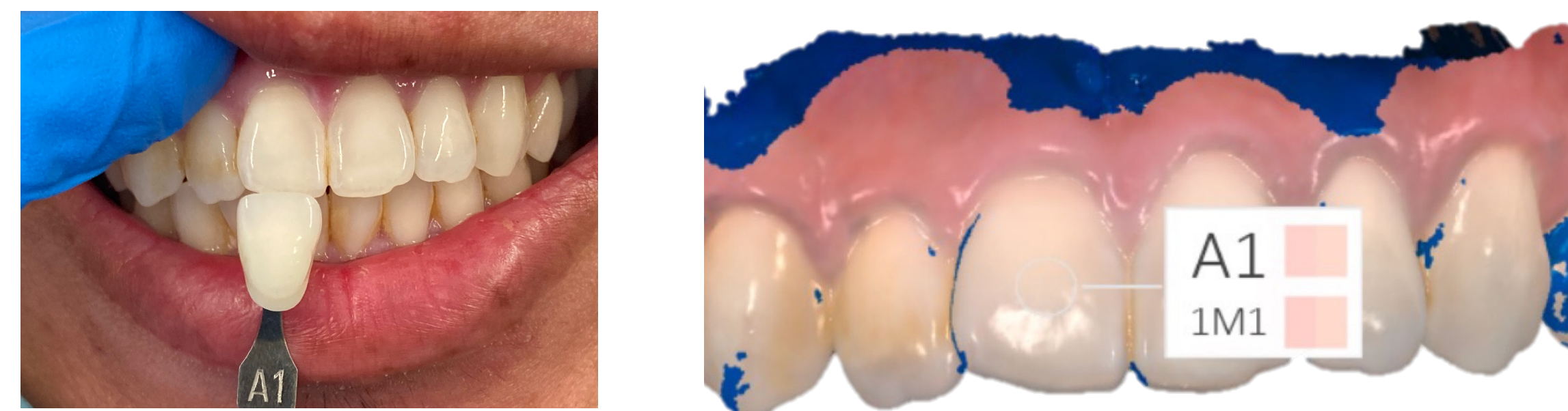
Methods

The participants of this study consisted of 10 male subjects aged 18-35 years. The subjects recruited were healthy with a history of no restorations or bleaching. The examiners included a master dental laboratory technician (Examiner 1) and a prosthodontics resident (Examiner 2). The shade of the right maxillary central incisor (#8) at the middle third was recorded at 3 timepoints (a, b, c). The calibrated examiners utilized a Vita Classical shade guide under a color temperature of 5,500K / CRI 90 Ra+ using a light correcting device (COCOLux®, Hass Corp) [4]. The 3Shape TRIOS 4 shade measurement tool was utilized to determine the shade from intraoral scans obtained at each timepoint. Accuracy was determined by comparing shade measurements from the scanner to the shade selected by Examiner 1. Reliability was determined by evaluating the degree of agreement across timepoints for each method of shade selection.

*The study was approved by the Institutional Review Board of Stony Brook University (IRB2021-00335).

Experimental Design

Shade of right maxillary central incisor was recorded by a master dental laboratory technician (Examiner 1), a prosthodontic resident (Examiner 2), and 3Shape TRIOS 4 at three timepoints in 10 patients.



Results

Accuracy of the intraoral scanner compared to VSS

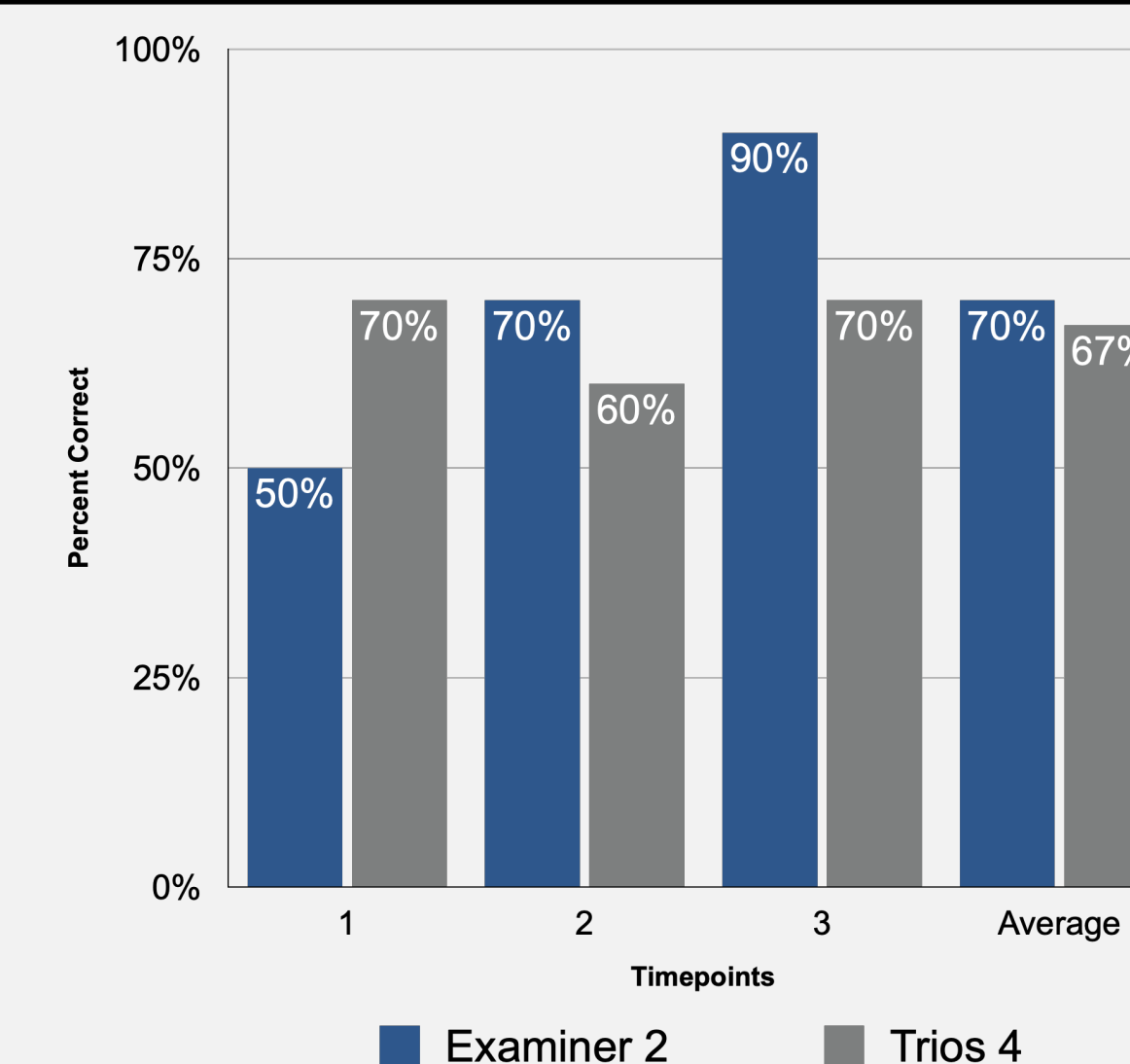


Figure 1

The accuracy of the 3Shape TRIOS 4 intraoral shade measurement and Examiner 2 VSS compared to Examiner 1 VSS.

Reliability of selection methods across timepoints

Kappa value	Degree of agreement
≤ 0	Poor
0 - 0.2	Slight
0.2 - 0.4	Fair
0.4 - 0.6	Moderate
0.6 - 0.8	Substantial
0.8 - 1	Almost perfect

Examiner 1	0.49627
Examiner 2	0.45565
TRIOS 4	0.54545



Figure 2

The reliability of VSS and TRIOS 4 scanner was assessed using Fleiss' kappa statistic. **TRIOS 4 had the highest reliability over the three time periods.**

Discussion

As visual shade selection is a subjective method of shade matching, it is influenced by factors such as operator gender, operator experience, eye fatigue, lighting conditions, and the shade guide itself [5]. The accuracy and reliability of shade determination methods are crucial for the esthetic success of a restoration. In this study, the accuracy was measured as how close the 3Shape TRIOS 4 intraoral scanner shade measurements were to that of the most experienced examiner using VSS. When the examiner was used as a control for VSS, the intraoral scanner shade measurements were comparable to that of a second calibrated examiner using VSS. In addition to accuracy, the reliability of the visual and instrumental methods across different time points was assessed. The Fleiss' kappa statistical test for multiple measurements was used to analyze the reliability of the methods [6]. The kappa test evaluated the agreement between the shades selected by the two examiners and the intraoral scanner. The 3Shape TRIOS 4 intraoral scanner shade measurement tool showed the highest kappa value, meaning that it had the highest reliability over the three timepoints when compared to VSS.

Conclusions

Based on the findings of this clinical study, the following conclusions can be drawn:

1. The accuracy of the shade measurement tool of the 3Shape TRIOS 4 intraoral scanner was comparable to that of VSS.
2. The reliability of the intraoral scanner across three different timepoints was highest, followed by VSS.
3. Intraoral scanners can be used to supplement shade selection due to their higher reliability and comparable accuracy [7, 8].

References

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