

The accuracy of different digital scanners in occlusal contacts assessment: a comparative study

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Objectives

This study aimed to compare the accuracy of clinical data obtained from three digital scanners to that of conventional articulating papers. This study also assessed overall patient comfort and preference associated with each digital device during scanning procedures.

Introduction

Correcting occlusal discrepancies is crucial in comprehensive dental treatments, and articulating paper has served as the gold standard in this process for decades.¹ Furthermore, conventional methods of analyzing occlusion with articulating paper are standard in everyday dental treatment. Although articulating paper is a reliable source for assessing occlusion, variables such as saliva and paper thickness may influence the occlusal analysis.² In contrast, digital methods offer the advantage of more objective interpretations of occlusal records.³

Previous studies compared the accuracy of T-scan, a digital occlusal analysis device, to the CEREC Omnicam when assessing occlusal contacts. One study found the T-scan system more sensitive to determining occlusion, while the CEREC was more efficient in tight contact areas.⁴ A recent innovation, Modjaw, utilizes 4D technology as a digital articulator to facilitate dynamic occlusal analyses.



Modjaw



CEREC



T-Scan

Materials and Methods

A total of 23 participants, ranging between 20 to 50 years old, were recruited for this study (UNC IRB 24-0269). Participants missing first and second molars were excluded.

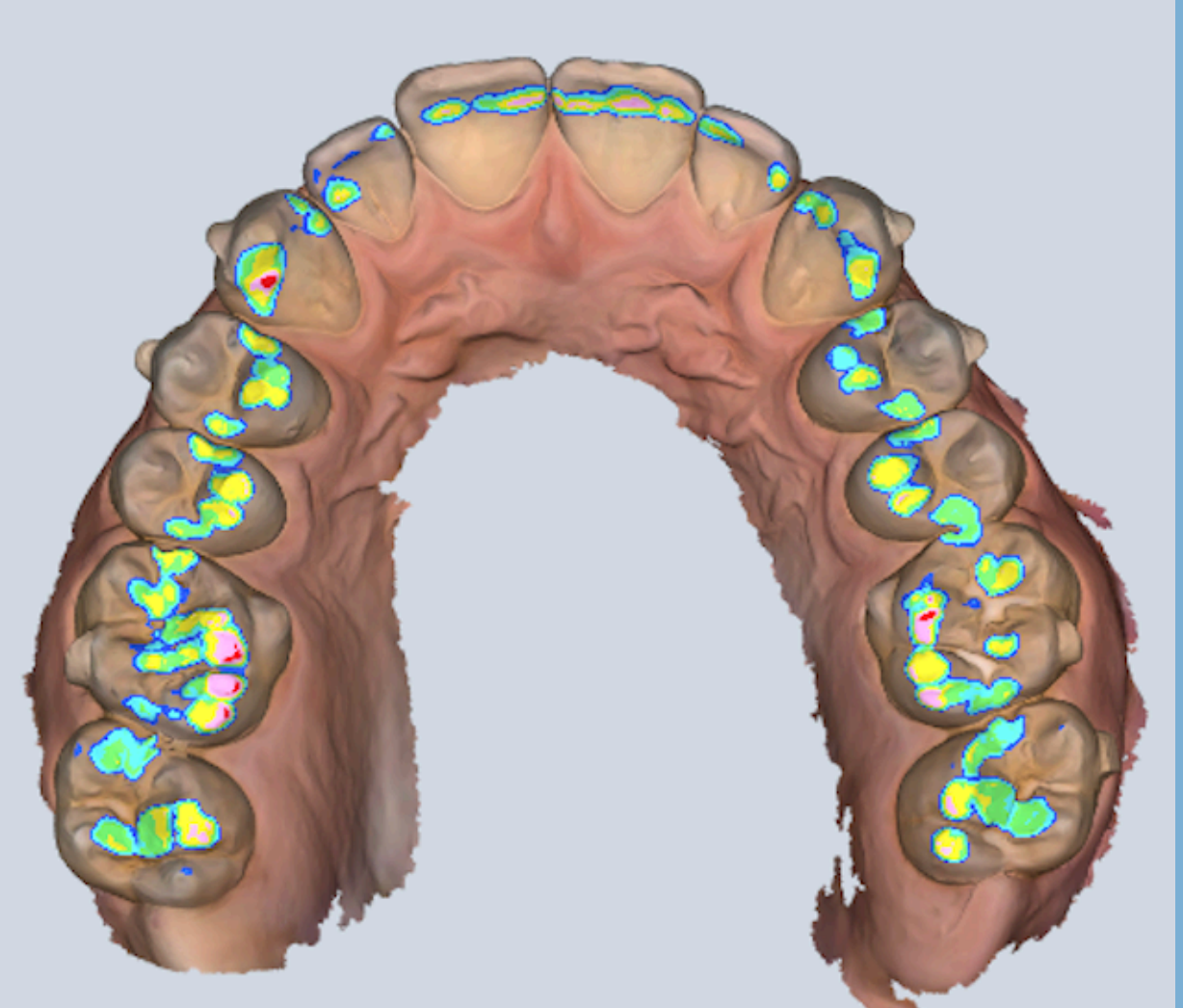
Participants first occluded on 88 µm and 21 µm articulating paper, and images of their maxillary and mandibular occlusal surfaces were captured. They were then scanned with the T-scan (T-Scan software version 9, TekScan, USA) and asked to perform four movements: bite and clench, protrusion, right laterotrusion, and left laterotrusion. Participants were then scanned with the CEREC Primescan (Dentsply Sirona, USA) to capture maxillary, mandibular, and bilateral bite registration scans. To gather Modjaw data, a Trios 4 scanner (3Shape, Copenhagen, Denmark) was used to obtain maxillary and mandibular intraoral scans, which were then transferred into Modjaw's computer system. Using Modjaw's software (Tech In Motion, MedTech, France), participants were asked to perform five recorded movements: open-close, protrusion, right laterotrusion, left laterotrusion, and chewing. Participants then completed a questionnaire examining any prior occlusal evaluations, visual understanding of each device, and comfort during the scanning procedures.

All records were exported in JPEG format and analyzed using an imaging processing software (Adobe Photoshop). All intraoral scan records contained a color-coded occlusal analysis that was taken during each participant's maximal intercuspal position. The number of occlusal contacts (50 µm and above) per arch was calculated for each group and statistically analyzed using a repeated measures analysis of variance (ANOVA) and Šídák's multiple comparisons test ($\alpha=.05$). Occlusal contacts on all second molars were excluded from the data analysis.

Articulating Paper Analysis



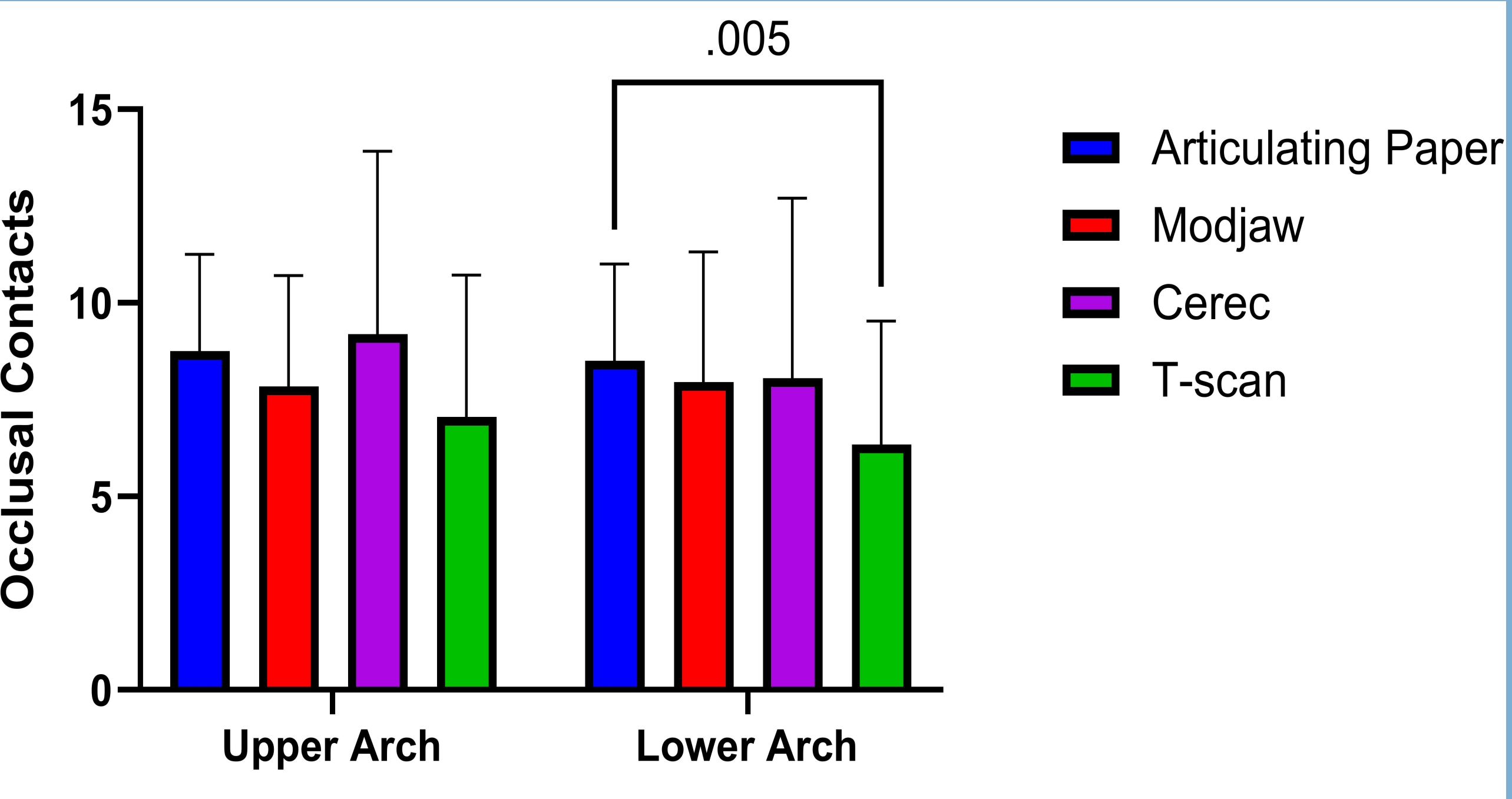
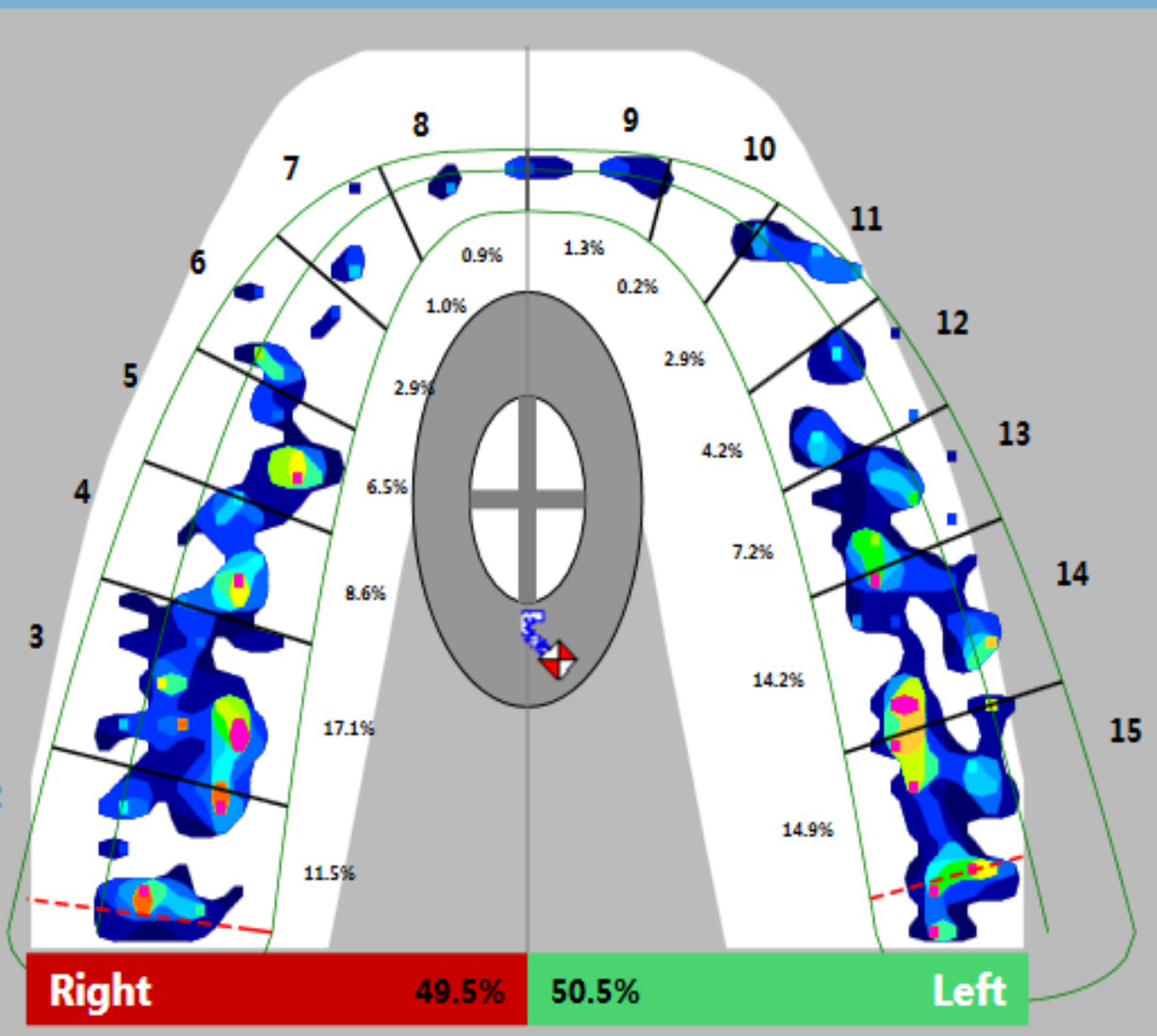
Modjaw Analysis



CEREC Analysis



T-scan Analysis



Results

The mean occlusal contacts recorded on the maxillary arch ranged between 21.35 and 15.1; on the mandibular arch, the mean ranged between 19.35 and 13.75. Differences between both arches were not statistically significant, regardless of the record-taking method. The articulating paper showed significantly more occlusal contacts than the T-scan for the lower arch ($P=.005$). 52.2% of participants felt most comfortable with the T-scan, while 47.8% felt least comfortable with the Primescan. 56.5% of participants found Modjaw visually easier to comprehend than both T-scan and Primescan when their occlusal contact assessment was displayed. 78.3% of participants reported a general dentist had never analyzed their occlusion using a digital device.

Conclusions

The CEREC Primescan and Modjaw scanners demonstrated comparable occlusal contact recordings to the articulating paper, whereas the T-scan had suboptimal number of contacts. The color scale features on each device allows for an objective analysis of different contact pressure levels. Questionnaire results indicated that participants favored the T-scan and Modjaw over the Primescan. However, a limitation of this study was the variability in occlusal analysis values across each digital device.

References

