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THE EFFECT OF ANTERIOR SPAN LENGTH ON THE ACCURACY OF INTRAORAL SCANNER (AN IN-VITRO STUDY)

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and Omnia Nabil **

ABSTRACT

Purpose: This study aimed to evaluate the effect of anterior span length on the accuracy of the intraoral scanner.

Methodology: One typodont model represented two anterior bridge span lengths. One group had missing upper central incisors representing short-span length, and the other had missing upper central incisors and lateral incisors representing long-span. A laboratory scanner (inEos X5) obtained a scan to act as a reference for each group. For each group, five scans were obtained by the intraoral scanner (CEREC Primescan). The data set from the intraoral scans was superimposed on the reference scan using reverse engineering software to determine the trueness. Regarding precision measurement, the five scans taken by the intraoral scanner were superimposed on each other. Comparison between short and long-span edentulous areas was performed using Wilcoxon signed rank.

Results: There was no statistically significant difference between the different span lengths, the trueness of the long span (0.12 ± 0.107 mm) was insignificantly higher than the short span (0.082 ±0.04 mm) as P=0.22. Regarding precision, the long span (0.07 ± 0.07 mm) was insignificantly lower than the short span (0.082 ±0.04 mm) as P=0.57.

Conclusion: The intraoral scanner showed high trueness and precision in both long and short spans.

KEYWORDS: Intraoral scanner, Extraoral scanner, Span length, Trueness, Precision

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INTRODUCTION

The advent of digital workflows in dentistry has displaced the traditional process of dental care. Many procedures that were once performed traditionally are now replaced or assisted by digital methods. Impression-taking is considered a crucial step in prosthetic work for fabricating an accurate and well-fitted restoration. **Patzelt et al. (2014), Gjelvold et al. (2016), Diker & Tak (2020), and Fattouh et al. (2021).**

Computer-aided impression, Computer-aided design, and computer-aided manufacturing (CAI/CAD/CAM) are composed of three components: data capturing, designing components, and the manufacturing component. In the data-capturing stage, components like abutments and edentulous spans are captured using several technologies in a three-dimensional form. Digital impressions can be obtained either using intraoral scanners directly from the patient's mouth or by using an extraoral scanner to scan the gypsum model or the conventional impression indirectly. **Nulty A, (2021)**, **Borbola et al., (2023), Ahmed et al. (2024).**

Intraoral scanners have made it possible to record anatomical details directly from the patient's mouth, which saved a lot of time and made the impression-taking step more comfortable for the patient compared to the conventional technique due to the reduced gag reflex. In addition, errors such as expansion, shrinkage, improper tray selection, cross-infection, impression material separating from the tray, and issues with storage of the casts have been reduced. **Diker & Tak, (2020), Lim et al. (2021).**

Evaluating intraoral scanners' accuracy is a must to prove their reliance and their ability to replace the gold standard of obtaining physical impressions. Numerous studies confirmed that digital scanners produce impressions with the best accuracy in short-span or single prostheses. Nevertheless, increasing the span length was said to reduce the accuracy in comparison to the conventional impressions in the posterior area**. Patzelt et al., (2014) , Gjelvold et al., (2016), Elkhodary N, (2021); Fattouh et al., (2021), El-Sheikh et al., (2022)**.

Therefore, this study aimed to assess the effect of the anterior span length of missing maxillary teeth on the accuracy in terms of trueness and precision of the intraoral scanner. The null hypothesis proposed was that there would be no significant difference in the accuracy of the intraoral scanner in terms of trueness and precision between anterior span lengths.

MATERIALS AND METHODS

One Typodont dental model (Banna, Egypt) represented the maxilla with two different span lengths of anterior zirconia bridges**.** There were two groups: **group (SS)** to simulate the short span group with the two central incisors missing, and the abutments were the lateral incisors and canines, and **group (LS)** to simulate the long span group with the two central and two lateral incisors missing with the canines as the abutments. **(fig.1)**

For the Standardization of abutments preparation, a paralleling device (Nouvag AF 30 dental surveyor, Switzerland) **El-Sheikh et al., (2022)** with a straight handpiece and diamond stone with a 6-degree taper and a rounded tip, the typodont model was supported on the surveying table and the handpiece was used to reduce the teeth in the same path, the same preparation stone was used for all teeth. The space of the missing teeth was blocked out using pink wax. **Fattouh et al., (2021)**. The preparation was done according to the zirconia fixed partial dentures reduction principle, with an axial reduction of 1.5mm and a deep chamfer finish line (1mm) above the cervical line by 0.5mm **Elkhodary N, (2021); El-Sheikh et al., (2022).** However, the secondary plane preparation and the 2mm incisal reduction were performed free-hand by the same operator due to the inaccessible angle of the dental surveyor. All the teeth were glued to the dental model to preserve the position of each tooth in all the scans and to avoid any distortion of the wax in the area representing the edentulous span.

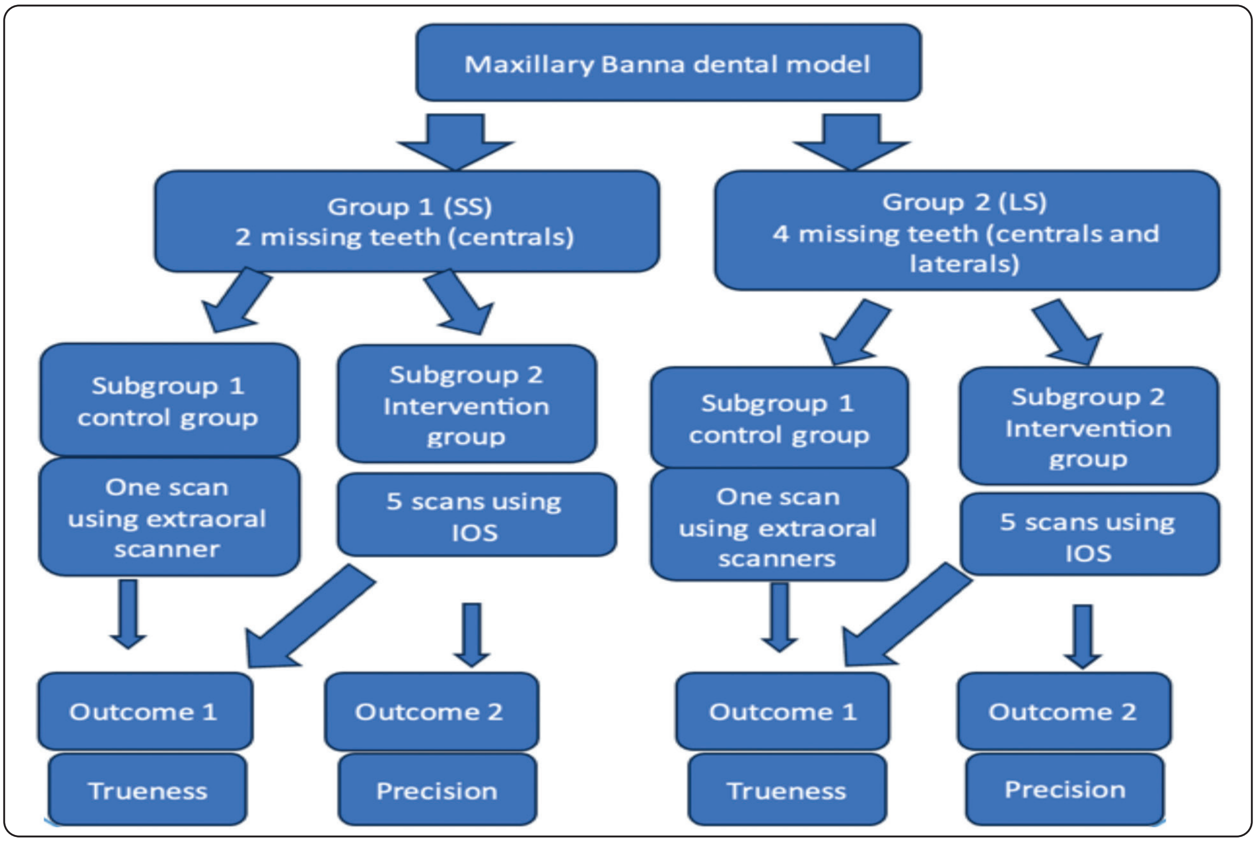

Fig. (1) Grouping

Digital Scanning of models

For each group, one reference scan was obtained with a desktop scanner (InEos X5) with CEREC inLab 2019 software, the STL files of the scans were exported **El-Sheikh et al., (2022)**. This was followed by using Cerec Primescan (version 5.0.1) to capture five intraoral scans. The scanning technique followed the recommendations, at a 2-3mm distance from the tooth's surface, continuously from the upper left second molar occlusal surface till the contralateral second molar, followed by scanning the lingual and interproximal surfaces ending with the facial surface of the teeth, the angulation of the scanning was between 45 to 90 degrees (**fig. 2**). When the scan started from the occlusal surface, it captured a little of the palatal and the buccal surfaces this allowed maintaining a frame for the mesh to align on, this was done by capturing the areas of interest of each surface. **Fattouh et al., (2021), Nulty A., (2021) An et al., (2022); El-Sheikh et al., (2022).**

The duration of the scan was between 2-4 minutes, at room temperature (23±2°C) and under normal light conditions (room light) **Fattouh et al., (2021)**, **El-Sheikh et al., (2022).** Virtual models obtained by the intraoral scanner of every group were exported as STL files.

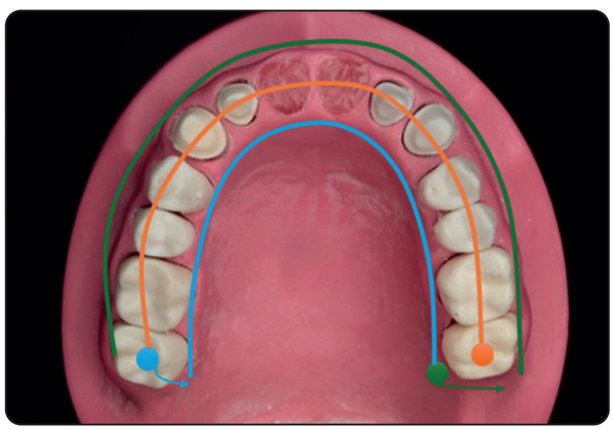

Fig. (2) The scanning path of the intraoral scanner

Accuracy Evaluation

The accuracy assessment of the optical scans was performed using reverse engineering software (Geomagic Control X2022 1.0, GOM GmbH, Germany) **Su & Sun, (2015), Fattouh et al., (2021), Dohiem et al., 2022 and El-Sheikh et al., (2022).**

For the trueness evaluation, the reference scan was the file of the extraoral scanner (InEos X5 files), and each of the five intraoral scans was superimposed on it. First, the Geomagic window allows both scans to be imported, and trimming of unnecessary data was done. The reference scan was selected as the STL file of the extraoral scan, which stays unmoving, and the moving scan was the STL file of the intraoral scanner, the initial alignment feature was applied to allow both models to be corrected to the proper position and by selecting the best-fit alignment tool allowed both scans to be in the least possible deviation within the same coordinate system. The reference scan can then be segmented to allow the selection of the area of interest, which was represented by the abutments and the edentulous span, to allow the application of the 3D comparison in this specific area. **(fig. 3)**. **Fattouh et al., (2021), Dohiem et al., (2022).**

In the 3-D space, between a sum of points, the square of the phase dissimilarity was computed after the scans were superimposed. The RMS (Root Mean Square), calculated as the difference between the reference data jaw scan and the measured data jaw scan, is determined by dividing the sum of the squares by the total number of points measured. A high RMS value indicates a substantial error, whereas a minor error or deviation is indicated by a low RMS value. The RMS deviation calculation was done in the software using the following equation.

$$RMS = \sqrt{\frac{\sum_{m=1}^{n}\left(x_{1,m} - x_{2,m}\right)^{2}}{n}}$$

Where X1,*m* is the reference model measurement, X2,*m* is the examined model measurement, and n indicates the sum of points measured.

A color map was created without a specific tolerance, featuring a maximum deviation range of 0.5 mm and a minimum deviation of -0.5 mm. Blue, yellow, and red colors indicate deviation values, with green representing zero deviation. Since deviation can occur in two opposing directions, the difference between the red and blue maps indicates direction **(fig. 4 and fig. 5)**. **Fattouh et al., (2021)**, **El-Sheikh et al., (2022)** Green represents areas of a perfect match, while red denotes a positive error (expansion), meaning that the scan is above the reference scan. Yellow indicates a less extreme positive error than red, and blue signifies a negative error (contraction), meaning that the scan is below the reference scan. These steps were repeated five times for each group, resulting in a total of 10 reports for trueness.

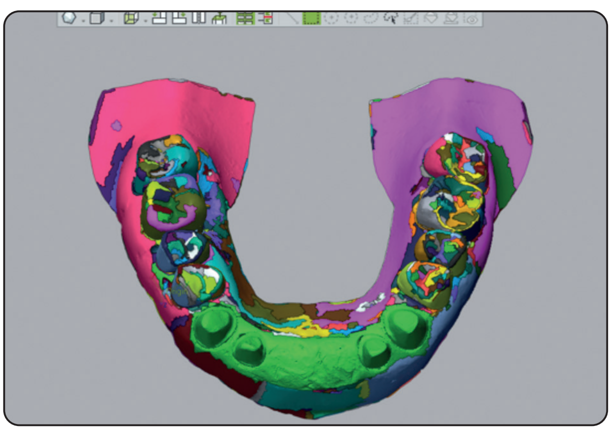

Fig. (3) 3D Segmentation of the reference scan into the area of interest (green color) and irrelevant data such as soft tissue and adjacent teeth

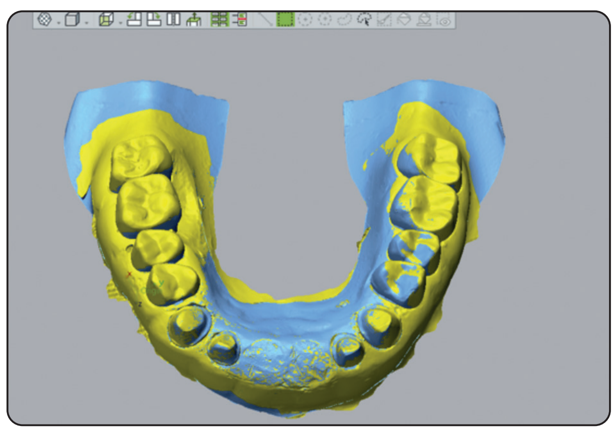

Fig. (4) Superimposition between the reference and measured data jaw scans using initial alignment, feature recognition, and best-fit alignment software tools

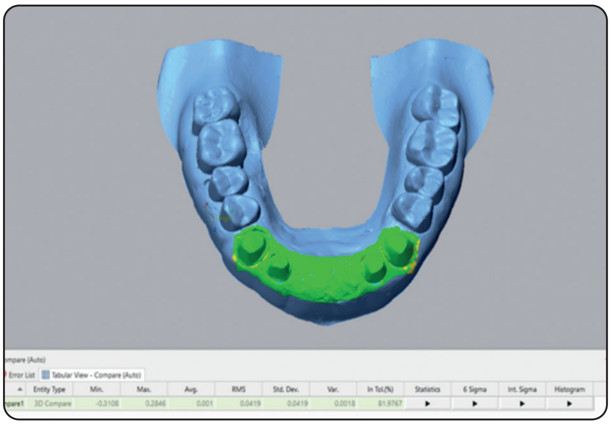

Fig. (5) 3D comparison limited only to the area of interest (prepared abutment and edentulous area) using the color map and Root mean square.

The calculation for the precision evaluation was performed within each group, using each scan in the respective subgroup as the reference scan. The remaining four scans were then superimposed on it to produce a total of ten reports per subgroup and twenty reports overall. From data alignment to report production, precision was assessed in a manner consistent with trueness.

Statistical analysis

The provided data was analyzed using the Shapiro-Wilk test and the Kolmogorov-Smirnov test for normality. The significance level (P-value) was found to be significant, with $P < 0.05$, indicating that the data followed a non-parametric distribution across all groups regarding trueness and precision for both short and long spans related to RMS, average – (negative), and average + (positive). As a result, a comparison between short and long spans was conducted using the Wilcoxon signed-rank test.

Trueness evaluation

Comparison of trueness between long-span and short-span edentulous areas revealed that the long span (0.12 ± 0.107 mm) was insignificantly higher than the short span (0.082 ±0.04 mm) as P=0.22, with (0.04 mm) difference between them. **(Table 1)**

Precision Evaluation

Comparison of precision between long-span and short-span edentulous areas revealed that long-span RMS (0.07 ± 0.07 mm) was insignificantly lower than short-span (0.082 ±0.04 mm) as P=0.57, with (0.0009 mm) difference between them. **(Table 2)**

TABLE (1) Descriptive results of trueness in both short and long spans regarding RMS, - average (AVG.) and + average (AVG.), comparison between them using Wilcoxon signed rank.

Trueness		**Descriptive**				**Paired Differences (Wilcoxon signed rank)**					**P value**
		Minimum (mm)	**Maximum (mm)**	**Mean (mm)**	**Standard Deviation (mm)**	**Mean (mm)**	**Std. Deviation (mm)**	**Std. Error Mean (mm)**	**95% Confidence Interval of the Difference**		
									Lower	**Upper**	
RMS	Long	0.0334	0.3128	0.1272	0.1076	0.0449	0.0729	0.0326	-0.0457	0.1354	0.22
	Short	0.0411	0.1444	0.0823	0.0435						
+AVG.	Long	0.0228	0.0299	0.0262	0.0029	0.0002	0.0044	0.0019	-0.0056	0.0052	0.71
	Short	0.0204	0.0299	0.0265	0.0036						
-AVG.	Long	-0.1706	-0.0189	-0.0697	0.0584	0.0203	0.0403	0.0180	-0.0703	0.0297	0.51
	Short	-0.0822	-0.0243	-0.0493	0.0255						

TABLE (2) Descriptive results of precision in both short and long spans regarding RMS, - average (AVG.) and + average (AVG.), comparison between them using Wilcoxon signed rank

Precision		Descriptive				Paired Differences					P value
		Minimum (mm)	Maximum (mm)	Mean (mm)	Standard Deviation (mm)	Mean (mm)	Std. Deviation (mm)	Std. Error Mean (mm)	95% Confidence Interval of the Difference		
									Lower	Upper	
RMS	Long	0.020	0.276	0.073	0.076	0.009	0.085	0.027	-0.070	0.052	0.570
	Short	0.025	0.155	0.082	0.044						
+AVG.	Long	0.011	0.020	0.015	0.003	0.013	0.038	0.012	-0.040	0.014	0.220
	Short	0.009	0.135	0.028	0.038						
-AVG.	Long	-0.124	-0.011	-0.034	0.033	0.005	0.039	0.012	-0.023	0.033	0.510
	Short	-0.078	-0.017	-0.039	0.020						

DISCUSSION

This study aimed to evaluate the accuracy concerning trueness and precision between the short span and the long span of missing anterior maxillary teeth.

An in vitro study was selected to control all the variables for standardization purposes and to avoid any errors associated with the intraoral environment like the presence of moisture in the in vivo conditions. **Ender et al., (2019), Rudolph et al. (2016), Pattamavilai & Ongthiemsak, (2022).**

A typodont model was used to overcome the issues with the reflection of the shiny surfaces. The anti-reflective powder was avoided because it can affect the values of trueness and precision. **Fattouh et al. (2021)**.

To assess the accuracy, the reference dataset was acquired from a scanner of high accuracy (inEos X5), so the intraoral scans can be superimposed on it, which was selected because of its high accuracy in full arch scans with its blue light and 5-axis scanning technology, which was verified by ISO 12836.2015. Literature confirms the accuracy of this scanner because it utilizes digital stripe blue structured light scanning technology, which is the principle for the constant scanning process, which reduces human error. **Patzelt et al., (2014)**, **Emir & Ayyıldız, (2019), Elkhodary N, (2021) and El-Sheikh et al., (2022).**

CEREC Primescan intraoral scanner was selected because of its high accuracy and its deep scanning capability of up to 20mm, this scanner also has the advantage of a large scanner head size which aids in reducing the amount of image stitching by increasing the field of view. With the advancement of artificial intelligence, up to 1,000,000 3D points were processed per second by the CEREC 5 software program. The use of powder is also not required by this scanner to reduce the effect of shiny surfaces on the accuracy of the scanner; this is also an advantage with patients. CEREC Primescan proved its high trueness in full arch scans and showed the lowest deviation in the anterior segment compared to other IOS. **Ender et al., (2019) Fattouh et al., (2021), Nulty A, (2021) and El-Sheikh et al., (2022).**

In this study, the preparation was done using a dental surveyor for standardization purposes with a straight handpiece and a dental stone with a 6-degree taper; the preparations followed the principle of zirconia preparation because it's the most used material for the construction of fixed partial denture in the anterior segment, and it has the strength to withstand long-span restorations. **El-Sheikh et al., (2022)**

Scanning protocol can affect the accuracy of the intraoral scanner. Continuous scanning starting from the occlusal surface of the posterior teeth with a horizontally held scanner yielded high accuracy **Oh et al., (2020).** The occlusal surface is a region of clearly defined morphology that would allow the best-fit algorithm to be used to stitch the subsequent photos, representing the optimal image overlap. **Moon et al. (2020), An et al., (2022), El-Sheikh et al., (2022).**

The 3D software (Geomagic) that applies reverse engineering was used in this study. It was selected because it measures the accuracy of freeform surfaces such as intraoral structures and teeth, the 3D surface comparison is preferred rather than the 2D linear method which requires surfaces to have sharp edges. **Su & Sun, (2015), Fattouh et al., (2021) and El-Sheikh et al., (2022)** confirmed the reliance and accuracy of this 3D analysis software.

The best-fit mathematical algorithm was recommended by ISO-12836. RMS values are the usual method of computation because it is considered more accurate than general arithmetic mean since it displays average error estimation values in both positive and negative directions. **Fattouh et al., (2021) and El-Sheikh et al., (2022).**

The null hypothesis of this study which stated that the accuracy of the intraoral scanner will not be affected by the anterior span length, with regards to trueness and precision was accepted. The results of this study showed no statistical difference between the long-span and short-span scans between the intraoral and extraoral scanners concerning trueness and precision. The RMS value of the long span was insignificantly higher than that of the short span. Regarding precision, the RMS value of the long span was insignificantly lower than the short span.

These results showed that the anterior span length did not affect the accuracy of the intraoral scanner, the new advanced technology and improved software with the large size of the scanner head (greater field of view) could have attributed to the results obtained.

The results agreed with **Gao et al., (2022)** who showed in their study that intraoral scanners had an increased accuracy in recording the anterior segment of the maxilla and showed higher deviation in the posterior teeth compared to impression and cast scanning of the completely prepared arch. Correspondingly, **Majeed-Saidan et al., (2023)** tested different partially edentulous areas, and they found the best trueness when the edentulous span was in the anterior segment, the missing anterior teeth were the four incisors, and the canines (Kennedy Class IV) compared to the posterior edentulous span like Kennedy Class II or I.

Regarding the results of the precision in this study **Alfaraj et al., (2024)**, proved that the precision of the intraoral scanner was noted to be higher in the anterior segment and unilateral distal distortion posteriorly was observed. They revealed that intraoral scanners' precision was not affected by the different span lengths posteriorly when testing partially edentulous spans for removable partial dentures.

The results were opposed to **Elkhodary N, (2021),** who explained that the long span length in the posterior maxilla with the first and second premolar missing showed significantly higher RMS value and less trueness when compared to short span bridge with only the second premolar missing. **Fattouh et al., (2021)** also explained that longer span lengths in posterior mandible with a five-unit and four-unit posterior bridge resulted in significantly less trueness and precision compared to three-unit bridges.

The difference in the results obtained from this study may be due to **Elkhodary N, (2021)** using a different method to measure the accuracy (the linear method was utilized) and used a different tested scanner (Medit). The dissimilarity to **Fattouh et al., (2021)** may be due to the different tested arch (the mandibular arch) and the different positions in the arch (posterior not anterior).

Similarly, **El-Sheikh et al., (2022)** compared the accuracy of a long-span anterior edentulous area with missing four incisors to the long-span posterior group (lower first molar and lower second premolar) and the short-span posterior group (missing lower first molar) and they concluded that the long span anterior edentulous area had significantly lower trueness and precision using the intraoral scanner. **Alfaraj et al., (2024)** showed that CEREC Primescan showed significantly lower trueness when edentulous spans increased in the posterior mandible when they tested different edentulous spans for removable partial dentures.

The variance in the results in accuracy compared to this study may be attributed to **El-Sheikh et al., (2022)** using powder when scanning the typodont model and different study design, and the inconsistency with **Alfaraj et al., (2024)** may have been due to the different material used to simulate the edentulous area, scanned areas with larger span length for removable partial dentures and different position in the arch (posterior mandible).

The limitations encountered were that the study was an in vitro study which does not replicate clinical conditions like in vivo. Also, the refractive index of teeth cannot be simulated by a typodont model.

Intraoral scanning is considered an uprising promising technology for both short and long spans. Delivering an accurate scan for different clinical situations is the key to producing restorations in a complete digital workflow, saving the efforts of the dentist, the patient, and the technician. Thus, research has to expand to include different span lengths in vivo to validate the use of intraoral scanners in all clinical situations.

CONCLUSION

Within the limitations of this study, the following conclusions can be deduced:

- Recording of the long-span and short-span edentulous areas in the anterior segment can be performed using an intraoral scanner with high trueness.
- The increased anterior span length did not affect the precision of the intraoral scanner in full arch scans.

RECOMMENDATIONS

- Further studies can be performed using other intraoral and extraoral scanners, the restoration manufacturing can also be done to assess the accuracy of the restoration.
- Clinical studies can be performed to assess the effect of the arch shape, different scanned materials like enamel or other restorative materials, and also the soft tissue of the edentulous span.

Conflict of interest

The authors declare no conflict of interest

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REFERENCES

- An, H., Langas, E.E. and Gill, A.S., 2024. Effect of scanning speed, scanning pattern, and tip size on the accuracy of intraoral digital scans. The Journal of prosthetic dentistry, 131(6), pp.1160-1167.
- Ahmed, S., Hawsah, A., Rustom, R., Alamri, A., Althomairy, S., Alenezi, M., Shaker, S., Alrawsaa, F., Althumairy, A. and Alteraigi, A., 2024. Digital Impressions

Versus Conventional Impressions in Prosthodontics: A Systematic Review. Cureus, 16(1).

- Alfaraj, A., Khanlar, L.N., Lin, W.S. and Zandinejad, A., 2024. Exploring the impact of the extent of the partially edentulous area on the accuracy of two intraoral scanners. The Journal of Prosthetic Dentistry, 131(1), pp.163-171.
- Borbola, D., Berkei, G., Simon, B., Romanszky, L., Sersli, G., DeFee, M., Renne, W., Mangano, F. and Vag, J., 2023. In vitro comparison of five desktop scanners and an industrial scanner in the evaluation of an intraoral scanner accuracy. Journal of dentistry, 129, p.104391.
- Diker, B. and Tak, Ö., 2020. Comparing the accuracy of six intraoral scanners on prepared teeth and effect of scanning sequence. The journal of advanced prosthodontics, 12(5), p.299 –306.
- Dohiem, M.M., Abdelaziz, M.S., Abdalla, M.F. and Fawzy, A.M., 2022. Digital assessment of the accuracy of implant impression techniques in free end saddle partially edentulous patients. A controlled clinical trial. BMC Oral Health, 22(1), p.486-495.
- Emir, F. and Ayyıldız, S., 2019. Evaluation of the trueness and precision of eight extraoral laboratory scanners with a complete-arch model: a three-dimensional analysis. journal of prosthodontic research, 63(4), pp.434-439.
- Ender, A., Zimmermann, M. and Mehl, A., 2019. Accuracy of complete-and partial-arch impressions of actual intraoral scanning systems in vitro. International journal of computerized dentistry, 22(1), pp.11-19.
- Elkhodary, N., 2021. Effect of span length on the trueness of an intraoral scanner.(An in-vitro study). Egyptian Dental Journal, 67(3), pp.2605-2612.
- El-Sheikh, N., Sherif, R. and Kamel, M., 2022. Accuracy of Conventional and Digital Impressions at Different Span Lengths of Missing Teeth (comparative in vitro study).. Egyptian Dental Journal, 68(4), pp.3835-3848.
- Fattouh, M., Kenawi, L.M.M. and Fattouh, H., 2021. Effect of posterior span length on the trueness and precision of 3 intraoral digital scanners: A comparative 3-dimensional in vitro study. Imaging Science in Dentistry, 51(4), p.399-407.
- Gjelvold, B., Chrcanovic, B.R., Korduner, E.K., Collin-Bagewitz, I. and Kisch, J., 2016. Intraoral digital impression technique compared to conventional impression technique. A randomized clinical trial. Journal of Prosthodontics, 25(4), pp.282-287.
- Gao, H., Liu, X., Liu, M., Yang, X. and Tan, J., 2022. Accuracy of three digital scanning methods for complete-arch tooth preparation: An in vitro comparison. The Journal of Prosthetic Dentistry, 128(5), pp.1001-1008.
- Lim, J.H., Mangal, U., Nam, N.E., Choi, S.H., Shim, J.S. and Kim, J.E., 2021. A comparison of accuracy of different dental restorative materials between intraoral scanning and conventional impression-taking: An in vitro study. Materials, 14(8), p.2060-2073.
- Majeed-Saidan, A., Dutra, V., Levon, J.A., Chu, T.M.G., Morton, D., Alfaraj, A. and Lin, W.S., 2023. The trueness of scans using one intraoral scanner in different partially edentulous conditions. Journal of Prosthodontics, 32(7), pp.588-593.
- Moon, Y.G. and Lee, K.M., 2020. Comparison of the accuracy of intraoral scans between complete-arch scan and quadrant scan. Progress in Orthodontics, 21, pp.1-6.
- Nulty, A.B., 2021. A comparison of full arch trueness and precision of nine intra-oral digital scanners and four lab digital scanners. Dentistry journal, 9(7), p.75-88.
- Oh, K.C., Park, J.M. and Moon, H.S., 2020. Effects of scanning strategy and scanner type on the accuracy of intraoral scans: a new approach for assessing the accuracy of scanned data. Journal of Prosthodontics, 29(6), pp.518-523.
- Patzelt, S.B., Emmanouilidi, A., Stampf, S., Strub, J.R. and Att, W., 2014. Accuracy of full-arch scans using intraoral scanners. Clinical oral investigations, 18, pp.1687-1694.
- Su, T.S. and Sun, J., 2015. Comparison of repeatability between intraoral digital scanner and extraoral digital scanner: An in-vitro study. Journal of prosthodontic research, 59(4), pp.236-242.