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Original Research Article

Comparative evaluation of accuracy of post space scanned with three different techniques

Prasanna Pawar[1,*], Akanksha Katkade[1], Kishor M Mahale[1], Smita Khalikar[1], Vilas Rajguru[1]

[1] *Dept. of Prosthodontics, Government Dental College and Hospital, Aurangabad, Maharashtra, India*

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ABSTRACT

Aim: The aim of this in vitro study is to compare three different techniques of scanning post space at different depths.

Background: The important factor for success of treatment depends on endodontic treatment as well as by restoring it with prosthodontic treatment. The post is mainly used to retain and hold the core so that crown prosthesis can be given.

Materials and Methods: Fifteen freshly extracted single rooted teeth were selected and endodontically treated. Post space were created. Total Sample size taken was fifteen. There were three groups each with sample size of five. First group consist of Post space scanned with Omnicam intra oral scanner. Second group consist of Post space pattern scanned with InEos X5 Extraoral scanner. Third group consist of Post space impression made with Addition silicone, Poured and scanned with InEos X5 Extraoral scanner. Scanning files of all the three techniques were then converted to standard STL files. Diameter was measured at three different depths i.e., 3mm, 6mm & 9mm. Also, height & diameter was measured by 2 examiners to reduce bias.

Results: The intra oral scanner showed the best accuracy of diameter and as the depth increases the accuracy decreases.

Conclusion: Intraoral scanners showed the better accuracy and precision for scanning the post space as compared to extra oral scanner.

1. Introduction

The main aim of prosthodontist is to replace missing teeth, provide and maintain aesthetics and function to remaining teeth. Root canal treatment removes the pulp from tooth making tooth pulp less.[1–3] Thereby making the tooth non vital and significantly it leads to moisture loss from tooth. This makes to tooth brittle which so it becomes susceptible to fracture under any stress. To avoid such circumstances post procedures are recommended to reconstruct the tooth with inadequate coronal portion.[4] According to GPT 9- Post & core defined as a post with incorporated core; it provides retention and resistance for an artificial crown; it is also used as a platform for retentive attachment systems and non-retentive overdenture abutments.[5]

The long-term survival of post depends upon its fit and precision of impression.[6] Trueness & Precision both the elements comprises of Accuracy.[7] Various endodontic treatments such as incomplete root canal treatment, file breakage, instrument separation, ledge formation affects the survival of post to the post space preparation.[6]

In fabricating customized post restorations, silicone impression technique is used for fabrication procedures

* *Corresponding author*.
E-mail address: prasannapawar805@gmail.com (P. Pawar).

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conventionally.[8] Conventional impression materials are frequently used in general dental practice and have good properties, but they show some limitations in this respect.[9–12] To eliminate these disadvantages, intraoral digital systems have risen and are becoming popular day by day providing digital workflow.[13,14]

2. Aim

The aim of this in vitro study is to compare three different techniques of scanning post space at different depths. The first technique involves the Post space scanning with an intraoral scanner. The second technique involves scanning the impression of post space and third involves scanning the cast with extraoral scanner.

3. Materials and Methods

1. Fifteen Freshly extracted Single rooted teeth were selected and endodontically treated. Obturation was done with conventional methods.
2. Teeth were then embedded in acrylic models.
3. Post space were created of the length 9mm. A 4 no (1.30) peeso reamer was used up to 3 mm, 3 no (1.10) peeso reamer up to 6 mm & 2 no (0.90) peeso reamer up to 9mm.
4. Total Sample size taken was fifteen. There were three groups each with sample size of five.
5. First group consist of post space scanned with Omnicam intra oral scanner. Second group consist of Post space pattern scanned with InEos X5 Extraoral scanner. Third group consist of Post space impression made with Addition silicone, Poured and scanned with InEos X5 Extraoral scanner.
6. Scanning files of all the three techniques were then converted to standard STL files.
7. Files were opened in autodesk mesh mixer software where the length and diameter of post space measured.
8. Diameter was measured at three different depths i.e., 3mm,6mm & 9mm.
9. Also, height & diameter was measured by 2 examiners to reduce bias.

4. Result

One-way ANOVA and Tukey's post hoc test was used to know comparison. Group 1 showed mean height of 8.89 mm. Group 2 showed mean height of 8.4 mm. While group 3 showed mean height of 8.03 mm. So, the intraoral scanner showed the best accuracy in measuring the height.

1. Group 1 showed mean diameter of 1.3 mm at 3mm. Group 2 showed mean diameter of 1.27 mm at 3mm. Group 3 showed mean diameter of 1.24 mm at 3mm.
2. Group 1 showed mean diameter of 1.02 mm at 6mm. Group 2 showed mean diameter of 1 mm at 6mm. Group 3 showed mean diameter of 0.98 mm at 6mm.
3. Group 1 showed mean diameter of 0.795 mm at 9mm. Group 2 showed mean diameter of 0.763 mm at 9mm.Group 3 showed mean diameter of 0.711 mm at 9mm. So, the intra oral scanner showed the best accuracy of diameter and as the depth increases the accuracy decreases.

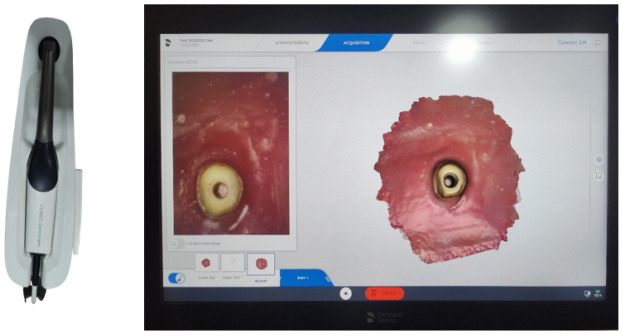


Fig. 1: Intraoral scanner dentsply CEREC omnicam

Fig. 2: Extraoral scanner

Table 1: Height & diameter of post spaceat different depths using three different scanning techniques examined by 2 examiners

	Height		Diameter					
			3 mm		6 mm		9 mm	
	E1	E2	E1	E2	E1	E2	E1	E2
Intra Oral								
1	8.91	8.89	1.31	1.32	1.01	1.02	0.80	0.81
2	8.92	8.93	1.30	1.29	1.05	1.03	0.79	0.78
3	8.88	8.87	1.28	1.30	1.00	1.01	0.79	0.80
4	8.90	8.91	1.33	1.30	1.04	1.03	0.81	0.82
5	8.85	8.88	1.30	1.31	1.02	1.05	0.78	0.77
Extra Oral								
1	8.40	8.43	1.29	1.28	0.99	0.98	0.76	0.73
2	8.45	8.41	1.28	1.28	1.00	1.01	0.77	0.76
3	8.42	8.29	1.30	1.29	0.98	0.99	0.77	0.75
4	8.39	8.36	1.27	1.25	1.02	1.00	0.75	0.77
5	8.44	8.45	1.29	1.26	1.01	1.02	0.78	0.79
CAST								
1	8.11	8.01	1.25	1.23	0.98	0.97	0.71	0.72
2	7.97	7.95	1.24	1.25	0.96	0.98	0.72	0.73
3	8.02	7.98	1.24	1.26	1.00	0.99	0.69	0.70
4	7.99	8.10	1.26	1.24	0.99	1.01	0.70	0.71
5	8.00	8.21	1.27	1.25	0.98	0.96	0.71	0.72

E1: Examiner 1, E2: Examiner 2

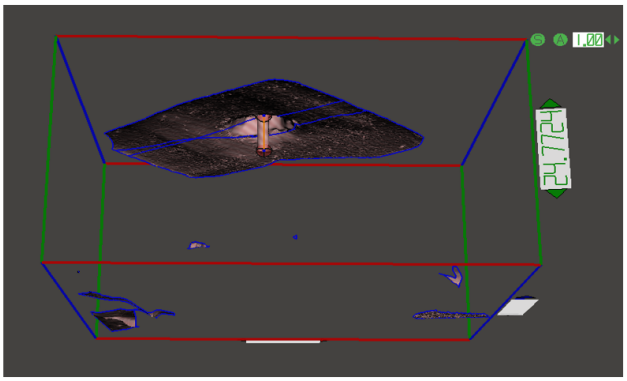
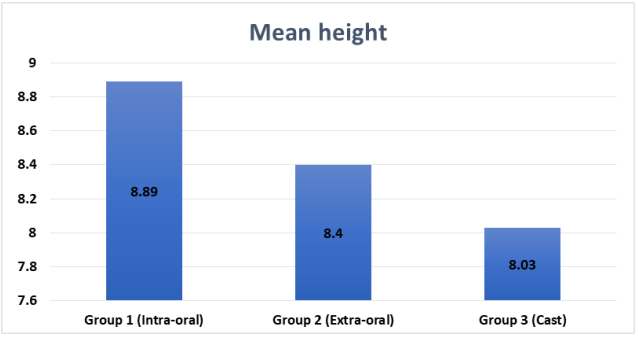
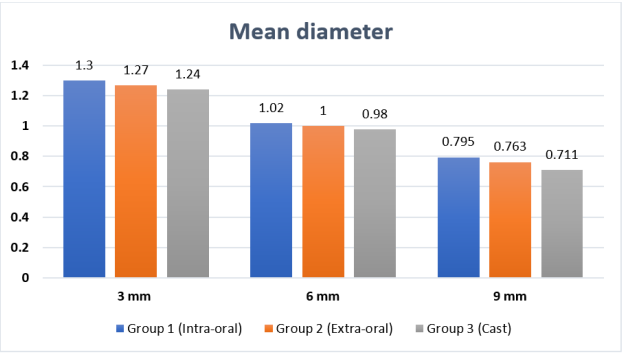


Fig. 3: Autodesk mesh mixer



Graph 1:



Graph 2:

5. Discussion

The aim of this study was to evaluate the accuracy of scanning post space using three different techniques at different depths. In this research the probability of creating the post scan with the use of three different scanning techniques have been examined. Advancements in scanners and different techniques will ultimately lead to the road for a more precise scans and more applications will allow for future research to assess their accuracy and precision.[7,15]

The use of computer-aided manufacturing and computer aided design is increasing for its applications in dentistry. CAD/CAM production systems provides variety of laboratory procedures and overcome the drawbacks of conventional methods. However, manufacturers can pay

enough attention for the development of CAD/CAM technology for milling of custom-made post and cores. The CAD-CAM design of post and cores allows precise planning of the clinical treatment and accurate fabrication of the post and core, thereby reducing treatment expenditure.

6. Limitations

This study has some limitations, as

1. It was conducted in vitro & did not mimic oral conditions.
2. The effects of temperature and humidity of the oral environments, saliva and blood, soft tissues, patient movement, oral cavity, and scanning laser angle of incidence were not considered.
3. At the same time, many items in oral cavity, such as implants (ceramics, metals & composite resin), dentin enamel, oral soft tissue and different materials and geometric shapes, also affect the accuracy of scanning.

But with the advent of technology these limitations can be overcome in future.

7. Conclusion

Intraoral scanners showed the better accuracy and precision for scanning the post space as compared to extra oral scanner. Also, greater depths of the post space preparation showed varying degrees of trueness. As the depth of post space increases, the precision and accuracy decreases. Intraoral scanners can be used to obtain post space impression data as an alternative to conventional silicone impression method. This system has good and reliable results in reading post space preparation.

8. Source of Funding

None.

9. Conflict of Interest

None.

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Author biography

Prasanna Pawar, PG Student

Akanksha Katkade, PG Student

Kishor M Mahale, Professor and HOD

Smita Khalikar, Professor

Vilas Rajguru, Associate Professor

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