Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 100

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Evaluation of finish line precision recorded with two digital impression methods in teeth prepared to receive all ceramic complete veneer crowns

[1]Deepika Madala, [2]Krishna Kishore Kadiyala, [3]Haragopal Surapaneni, [4]Kavya Sai Sree Uttaradi, [5]Nayeema Sultana, [6]Sugandhi Pidaparthi

[1,5,6]Post Graduate, [2]Professor And Head of The Department, Department of Prosthodontics and Crown& Bridge, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India;
[3]Reader, [4]Senior Lecturer, Department of Prosthodontics, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India

ABSTRACT:
Aim: To evaluate the precision of digital impression methods in recording the finish line margins in tooth prepared to receive all ceramic complete veneer crowns. **Objective:** To evaluate precision of digital impression made with intraoral digital scanner in recording the shoulder finish lines prepared in teeth receiving all ceramic complete veneer crowns. To evaluate precision of digital impression made with extra oral digital scanner in recording the shoulder finish lines prepared in teeth receiving all ceramic complete veneer crowns. **Methodology:** Tooth preparation was done by using shofu #102R, #SF210, SF101 burs to create a uniform reduction of 2 mm and to obtain equigingival finish line.Gingival retraction was done using cord packer (Fischer's Ultrapak Packer) and retraction cord (medi-pak 000)impregnated with haemostatic agent (retra gel). Digital impressions were made with TRIOS 3 shape intra oral scanner for 3 times and STL files were obtained.Conventional impression was made with putty and light body polyvinyl siloxane impression material (zhermack hydrorise) using stock tray(perforated stainless steel).Cast was poured using type IV gypsum product (zodenta) and scanned with lab scanner (rainbow scanner prime) for 3 times and STL files were obtained. Precision of intraoral scanner and lab scanner were determined by superimposing 3 STL files obtained from intraoral scanner and lab scanner respectively using GEOmagic inspect software. **Result:** Laboratory scanner demonstrated higher precision compared to intraoral scanner with a mean difference of 1.53 µm. This difference between the groups was statistically significant indicating that the intraoral and laboratory scanners have comparable precision in evaluating the finish lines of teeth prepared to receive all ceramic complete veneer crowns. **Conclusion:** Laboratory scanner demonstrated higher precision compared to intraoral scanner with a mean difference of 1.53 µm. This difference between the groups was statistically significant indicating that the intraoral and laboratory scanners have comparable precision inevaluating the finish lines of teeth prepared to receive all ceramic complete veneer crowns.

Keywords: Intra oral scanner, Laboratory scanner, Finishline, Precision

Received: 08 March, 2023 Accepted: 12 April, 2023

Corresponding author: Deepika Madala, Post Graduate, Department of Prosthodontics and Crown& Bridge, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India

This article may be cited as: Madala D, Kadiyala KK, Surapaneni H, Uttaradi KSS, Sultana N, Pidaparthi S. Evaluation of finish line precision recorded with two digital impression methods in teeth prepared to receive all ceramic complete veneer crowns. J Adv Med Dent Scie Res 2023;11(5):143-147.

INTRODUCTION

Making a dental impression is a crucial step in restorative dentistry. They transfer the intraoral condition to an extra oral cast for fabrication of restoration. Traditional impression techniques have been utilised to record the threedimensional geometry of dental tissues since the seventeenth century. The gypsum cast that results from taking an impression using an elastomeric impression substance with either a stock tray or a custom tray was the gold standard. However, the expansion, shrinkage, and distortion of the impression on the gypsum model cannot be prevented by the use of trays and impression materials. Digital impressions made with intraoral and extraoral scanners can improve the accuracy of dental restorations because they remove issues caused byconventional impression-making and gypsum model.

Dr. Duret introduced the concept of CAD/CAM, or computer-aided design and manufacture, to dentistry for the first time in 1973. Digital impression making is the first step in the manufacturing of a CAD/CAM dental prosthesis. Three-dimensional (3D) data of the anatomical structures are recorded using optical cameras. Digital data acquisition has several advantages, including better treatment planning, greater efficiency, simplerdata storage, repeatability, treatment documentation, cost and time efficiency, and improved lab-dental office communication.[1]

There are two ways to create digital impressions: directly with an intraoral scanner, which eliminates the need for conventional impressions and casts and creates a 3D virtual model; or with an extraoral laboratory scanner, which involves scanning dental impressions or gypsum casts to create a 3D model, after which the restoration is designed on a computer using specialised software.

The accuracy of the scan created by an intraoral scanner is impacted by saliva and a lack of available space inside the mouth. The accuracy of the plaster model will be damaged by non-standard operation during the taking of the impression and deformation of clinical material, which in turn impacts the accuracy of the 3D model data provided by an additional oral scanner and the quality of prosthesis. Both digital impression methods involving intraoral and extraoral scanners must be precise for a prosthesis to fit properly. An accurate dental impression is one that is "true" and "precise" in nature. To assess trueness, a reference dataset and a test dataset are compared. To determineprecision," numerous datasets from the same object using the same scanner are compared.

The current study's objective is to compare the intraoral scanning system's "precision" and its ability to produce an accurate digital impression to an extraoral scanner.

AIM

To evaluate the precision of digital impression methods in recording the finish line margins in tooth prepared to receive all ceramic complete veneer crowns.

METHOD

Tooth preparation was done by using shofu #102R, #SF210, SF101 burs to create a uniform reduction of 2 mm and to obtain equigingival finish line. Gingival retraction was done using cord packer (Fischer's UltrapakPacker) and retraction cord (medi-pak 000)impregnated with haemostatic agent (retra gel). Digital impressions were made with TRIOS 3 shape intra oral scanner for 3 times and STL files were obtained.Conventional impression was made with putty and light body polyvinyl siloxane impression material (zhermack hydrorise) using stock tray(perforated stainless steel).Cast was poured using type IV gypsum product (zodenta) and scanned with lab scanner (rainbow scanner prime) for 3 times and STL files were obtained.Precision of intraoral scanner and lab scanner were determined by superimposing 3 STL files obtained from intraoral scanner and lab scanner respectively using GEO magic inspect software.

FIGURE 1:INTRA ORAL SCANNER

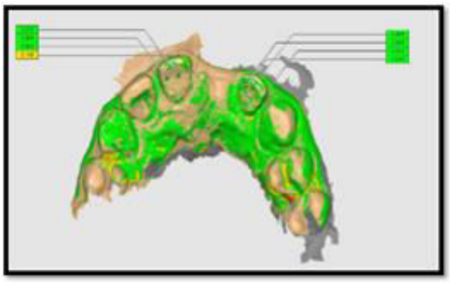

FIGURE – 2:TRIOS SCANS SUPERIMPOSITION

FIGURE - 3 RAINBOW PRIME LAB SCANNER

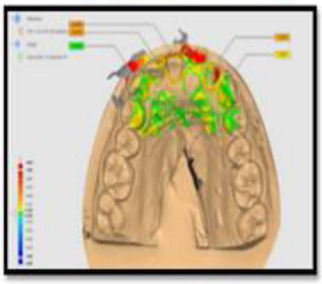

FIGURE-4: RAINBOW PRIME SCAN SUPERIMPOSITION

RESULT

It presents the descriptive statistics for finish line discrepency (µm) in the intraoral scanner group. The mean finish line discrepancy (µm) was 75.41±18.61µm. The minimum and maximum values documented in the intraoral scanner group were 23 and 95, respectively. Table1 shows a box plot depicting the distribution of finish line discrepancy (µm) in the intraoral scanner group. descriptive statistics for finish line discrepancy (µm) in the laboratory scanner group. The mean finish line discrepancy (µm) was 73.88±22.84µm. The minimum and maximum values documented in the laboratory scanner group were 18 and 99, respectively. Table 2 presents a box plot showing the distribution of finish line discrepancy (µm) in the laboratory scanner group.

Table 1: Descriptive statistics for finish line discrepancy(µm) in the intraoral scanner group

Parameter	Statistic
Mean	75.41
Standard deviation	18.615
Standard error	4.515
95% confidence interval	65.84 – 84.98
Minimum	23
Maximum	95
Range	72

Table 2: Descriptive statistics for finish line discrepancy (µm) in the laboratory scanner group

Parameter	Statistic
Mean	73.88
Standard deviation	22.847
Standard errorz	5.541
95% confidence interval	62.14 – 85.63
Minimum	18
Maximum	99
Range	81

DISCUSSION

Since 18th century conventional impression techniques are used to register the 3 dimensional geometry of dental tissues for the fabrication of definitive restorations. Accurate impressions are necessary for construction of any dental prosthesis[1].Until the mid-19th century waxes were the only impression materials used in dentistry. Later charles stent developed thermoplastic modeling compound in 1857 and the drawback of this material was rigidity and could not reproduce undercut areas. To overcome these problems impression materials like agar and alginate which remain elastic even after setting were introduced . Due to the drawbacks of alginate and agar, such as their dimensional instability and poor tear strength, elastomeric (also known as rubber-based) impression materials were developed[2].The first elastomeric impression material to be introduced was Polysulfide with high tear resistance and enhanced elastic properties and it has improved dimensional stability over hydrocolloid but it was proved to be unpopular owing to its unpleasant sulfide odor ,long setting time , compromised dimensional stability due to release of by products and discoloration. Disadvantages of polysulfide have been overcome by condensation silicone but, its dimensional stability is less than that ofpolysulfide due to its by products and extremely hydrophobic nature. Polyethers were created with their enhanced hydrophilicity, no volatile by product is formed and thus the resulting dimensional stability is excellent. Polyether has certain disadvantages like the stiffness of the set material causes problems when a stone cast is separated from the impression. Later addition silicone was introduced as a dental impression material in the 1970s also known as Polyvinyl Siloxane. These materials were more flexible and less likely to distort plastically when removed. Volumetric changes in the impression materials, the wrong choice of impression tray, the separation of material from the tray, tears or voids with the impression materials or cast, tray to tooth contact, temperature sensitivity, time constraints, inaccurate pouring, and the expansion of dental stone all seem error-prone, so the process calls for the assistance of a top-notch dental laboratory. The intraoral scanner (impression with ios) was created for dental practise to address these issues. The use of the iOS device in dental offices occurred at the same time that cad/cam (computer- aided design and manufacture) technology in dentistry was developing. Ios and cad/cam currently give simpler treatment planning, case acceptance, communication with laboratories, storage requirements, and shortened treatment periods. There have been more optical ios developed during the past ten years, and because they are based on various technologies, the choice made may have an effect on how they are used in therapeutic settings.With the debut of computer-aided design/computer-aided manufacturing (cad/cam) by Dr. Francois Duret in France in 1973, digital dentistry began to advance. The chairside economical restoration of aesthetic ceramics (cerec®) system, later developed by Sinora Dental Systems, was a prototype device for digital impressions. The cerec system turned out to be a cutting-edge tool for the cad/cam dentistry sector. Cerec1 was introduced in 1986 by Prof. Dr. Werner Moermann. The first technology was replaced in 1994, 2000, and 2003, respectively, by the cerec 2, cerec 3, and eventually the cerec 3d system. The lavaTM chairside oral scanner (c.o.s.) was developed by bronte's technologies in Lexington, Massachusetts, and was granted a patent by 3m espe in October 2006. (st. Paul, mn). Cadent released the itero digital impression system for use in offices in 2006. In October 2012, 3M espe created the true definition intra oral scanner.A computer, software, and a portable camera make up the medical device IOS. The three-dimensional geometry of an object is intended to be precisely captured by IOS. The most widely used digital formats were eitherclosed STL-like or open STL (the standard tessellation language).The currently available intraoral scanning systems are divided into groups based on attributes including their mode of operation, light source, necessity to remove shiny surfaces, operating system, and output file formats.

CONCLUSION

Within the limitations of the present study the following conclusions are drawn:

1. Laboratory scanner demonstrated higher precision compared to intraoral scanner with a mean difference of 1.53 µm.
2. This difference between the groups was statistically significant indicating that the intraoral and laboratory scanners have comparable precision inevaluating the finish lines of teeth prepared to receive all ceramic complete veneer crowns.

REFERENCE

1. Sason GK, Mistry G, Tabassum R, Shetty O. A comparative evaluation of intraoral and extraoral digital impressions: An in vivo study. The Journal of the Indian Prosthodontic Society. 2018 Apr;18(2):108.
2. Baheti MJ, Soni UN, Gharat NV, Mahagaonkar P, Khokhani R, Dash S. Intra-oral scanners: a new eye in dentistry. Austin Journal of Orthopedics & Rheumatology. 2015;2(3):1023.
3. Ender A, Mehl A. Accuracy of complete-arch dental impressions: a new method of measuring trueness and precision. The Journal of prosthetic dentistry. 2013 Feb 1;109(2):121-8.
4. Flügge TV, Schlager S, Nelson K, Nahles S, Metzger MC. Precision of intraoral digital dental impressions with iTero and extraoral digitization with the iTero and a model scanner. American journal of orthodontics and dentofacial orthopedics. 2013 Sep 1;144(3):471-8.
5. Su TS, Sun J. Comparison of repeatability between intraoral digital scanner and extraoral digital scanner: An in-vitro study. Journal of prosthodontic research. 2015 Oct 25;59(4):236-42.
6. Jeong ID, Lee JJ, Jeon JH, Kim JH, Kim HY, Kim WC. Accuracy of complete-arch model using an intraoral video scanner: An in vitro study. The Journal of prosthetic dentistry. 2016 Jun 1;115(6):755-9.
7. Güth JF, Runkel C, Beuer F, Stimmelmayr M, Edelhoff D, Keul C. Accuracy of five intraoral scanners compared to indirect digitalization. Clinical oral investigations. 2017 Jun;21(5):1445-55.
8. Su TS, Sun J. Comparison of marginal and internal fit of 3-unit ceramic fixed dental prostheses made with either a conventional or digital impression. The Journal of prosthetic dentistry. 2016 Sep 1;116(3):362- 7.
9. Uhm SH, Kim JH, Jiang HB, Woo CW, Chang M, Kim KN, Bae JM, OhS. Evaluation of the accuracy and precision of four intraoral scanners with 70% reduced inlay and four-unit bridge models of international standard. Dental Materials Journal. 2017 Jan 30;36(1):27-34.
10. Bosniac P, Rehmann P, Wöstmann B. Comparison of an indirect impression scanning system and two direct intraoral scanning systems in vivo. Clinical oral investigations. 2019 May;23(5):2421-7.
11. Nedelcu R, Olsson P, Nyström I, Rydén J, Thor A. Accuracy and precision of 3 intraoral scanners and accuracy of conventional impressions: A novel in vivo analysis method. Journal of dentistry. 2018 Feb 1;69:110-8.
12. Nedelcu R, Olsson P, Nyström I, Thor A. Finish line distinctness and accuracy in 7 intraoral scanners versus conventional impression: an in vitro descriptive comparison. BMC oral health. 2018 Dec;18(1):1-1.
13. Park GH, Son K, Lee KB. Feasibility of using an intraoral scanner for a complete-arch digital scan. The Journal of prosthetic dentistry. 2019 May 1;121(5):803-10.
14. Suzuki S, Katsuta Y, Ueda K, Watanabe F. Marginal and internal fit of three-unit zirconia fixed dental prostheses: Effects of prosthesis design, cement space,

and zirconia type. Journal of Prosthodontic Research. 2020;64(4):460-7.
15. Zhongpeng Y, Tianmin X, Ruoping J. Deviations in palatal region between indirect and direct digital models: an in vivo study. BMC Oral Health. 2019 Dec;19(1):1-2.