Original Research Paper | Medical Science | Volume : 3 ¦ Issue : 7 ¦ July 2018 ¦ e-ISSN : 2456-5040

SMILE DESIGNING USING AN INTRAORAL SCANNER AND CAD/CAM

Dr. Deepika Chandhok [1], Dr. Grishmi Niswade [2], Dr. Jasmeet Chandhok [3]

[1] Reader, Department of Conservative dentistry and Endodontics, VSPM Dental College, Nagpur, India.
[2] Lecturer, Department of Periodontology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India.
[3] Reader, Department of Prosthodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India.

ABSTRACT

Intraoral scanners (IOS) are devices used for making optical or digital impressions in dentistry. These scanners can be used in various fields of dentistry such as Prosthodontics, Orthodontics, Implant surgery, endodontic dentistry etc. They have the advantages of reducing operative time for clinicians, enhancement of clinician patient communication and simpler clinical procedures. Recently, these advanced technologies are used more often than conventional techniques to overcome the hitches associated with conventional techniques. This article highlights the pros and cons of intraoral scanners with two case reports.

INTRODUCTION:

Intraoral scanners (IOS) create virtual 3 dimensional models of the intra oral cavity.[1] For an impression to be precise, the measurement obtained should match with the actual quantity being measured and the scanner must provide consistent results on repeated measurements. In addition to this, all the details of the hard and soft tissue structures present in the intra oral cavity should be detected. The scanners are composed of a handheld camera, computer and software. The device projects light on the area to be recorded which is obtained in the form of images or videos that are then compiled by the software. The digital format that is most commonly used is the open STL (Standard Tessellation Language).[2]

Advantages of optical impressions:

- Reduced patient discomfort and therefore increased acceptance by the patient.[3]
- Can be used in geriatric patients, patients with strong gag reflex, children or in patients who are not comfortable to impression materials and trays, in complex cases such as cases with multiple implants or severe undercuts.[4]
- Scanning can be repeated if the clinician is not satisfied.
- Reduced operative time for the clinician. The time required for obtaining optical impressions with an IOS is approximately 3-5 minutes which is similar to that of conventional impressions. However, the time required for pouring the impressions, making stone casts and sending the cast to the dental laboratory via courier or mail is saved with the use of intraoral scanners. The scanned images can be emailed to the dental technicians directly. If IOS is combined with CAD/CAM technology for delivering chair side restorations and prosthetic appliances, enormous amount of time is saved and treatment can be done with more accuracy and precision.[5]
- Simpler clinical procedures.
- Avoidance of the use of plaster casts.[6]
- Better communication with dental laboratory technicians and patients.[7] If the scanned images received by the technician are not proper, he/she can immediately notify the clinician and the impression can be repeated without any loss of time and a second appointment of the patient can be saved. IOS can be very powerful advertising and marketing tools. The patient feels more involved when their scan are shown and discussed with them. This has an overall positive impact on the treatment
- Optical impressions have the approximately the same accuracy for short span restorations such as single tooth restorations and fixed partial dentures when compared to conventional impression techniques.[8]

Disadvantages of optical impressions:

- Deep marginal lines of prepared teeth are difficult to detect with IOS.[9]
- Difficult to make scan while bleeding is present in the tissues
- Difficulty in learning the working of IOS.[10]
- Expensive costing of IOS machinery.[11]
- The accuracy of IOS is comparable to that of conventional impression techniques for long span restorations such as complete denture, implant supported complete denture

Indications:

- Guided implant surgery.[12]
- Resin inlays/onlays.[13]
- Zirconia copings.[14]
- Single tooth restorations.[15]
- Partial removable dentures.[16]
- Fixed partial dentures and framework.[17]
- Implant prosthesis.[18]
- Post and core.[19]
- Smile designing.[20]
- Obturators.[21]
- Diagnosis and treatment planning in orthodontics.[4]
- Aligners.[4]
- Custom made devices.[4]

Contraindications:

- Long span fixed partial dentures and implant prosthesis.[22]
- Complete removable prosthesis.[23]

CASE REPORT-1

The patient in this case was a 58 year old healthy male who came with a chief complaint of poor aesthetics and a conscious smile. The patient had no history of trauma. On examination, the mandibular and maxillary anteriors were crooked and had generalised spacing between them. Lower left lateral incisor and canine were root canal treated, had Grade I mobility and Grade I gingival recession.



Copyright© 2018, IEASRJ. This open-access article is published under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License which permits Share (copy and redistribute the material in any medium or format) and Adapt (remix, transform, and build upon the material) under the Attribution-NonCommercial terms.

Treatment Plan:
The patient was explained about the various treatment options available with their potential complications and benefits. The treatment plan included a 6 unit all ceramic fixed prosthesis in the mandible and a 4 unit all ceramic fixed prosthesis in the maxilla to restore the maxillary and manibular anteriors to form and function.

Procedure:
Using an intraoral scanner, a full arch scan of the maxilla and mandible and a scan of occlusion in centric relation was obtained with a Sirona CEREC Omnicam. A three dimensional digital record of the patient's dentition was made and submitted to the laboratory for the CAD/CAM restoration process. In the dental laboratory, a virtual scan of the teeth to be restored was made using electronic software. The custom made prosthesis was trial fitted in to the patient's oral cavity. The occlusion of the patient and the effect of the prosthesis on the adjacent soft tissues was evaluated. After minor adjustments, the final prosthesis was delivered.



Fig 1: Front view of the patient

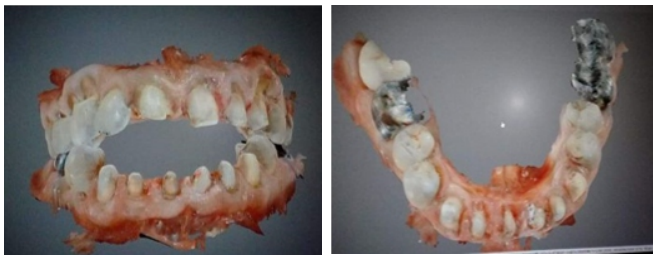


Fig 2: Scanned images of maxilla and mandible with IOS



Fig 3: Digital view showing the built up of teeth



Fig 4: Patient smile with prosthesis

The final prosthesis demonstrated optimal shade matching, mesio-distal width proportion and pontic tissue contact. The patient was satisfied with a pleasing smile.

CASE REPORT-2
A 62 year old female patient reported with chief complaint of receding gums in the lower anterior teeth and spacing present between the lower central incisors.



Fig 5: Front view of the patient



Fig 6: Patient smile with prosthesis

Treatment Plan:
The patient was explained about the various treatment options available with their potential complications and benefits. The treatment plan included a 4 unit all ceramic fixed prosthesis in the mandible to restore the manibular anteriors to form and function.

The final prosthesis demonstrated optimal shade matching, mesio-distal width proportion and pontic tissue contact. The patient was satisfied with the resulting aesthetics.

DISCUSSION:

Impression taking is the most crucial step in prosthesis fabrication since the accuracy of the impression leads to better retention and stability. Conventional impression techniques include functional impression technique, mucostatic impression technique and selective pressure technique. Intraoral scanners along with the use of CAD/CAM technology have been introduced in the last decade.

When compared with conventional techniques, optical impressions have comparable accuracy when short span restorations are considered.24 However, with long span restorations, conventional impression techniques are still considered ideal. Many studies have reported valuable precision (20-48 µm)and trueness (4-16µm) of impressions taken by IOS, both in vitro as well as in vivo.25 When IOS was used for full arch impressions for complete denture prosthesis fabrication, a distortion in the impressions have been reported by some studies. With respect to implants, distance and angulation errors are reported with multiple implant prosthesis.[26]

Digital impression techniques tend to have shorter operating times as compared to conventional techniques. Studies have shown that ceramic restorations with IOS have comparable or better interproximal contact point quality and occlusal point quality when compared to ceramic restorations with conventional techniques.[27] The chairside clinical time taken by the clinician to record the maxillomandibular relationships is also reduced which enhances the acceptance of IOS. The saved chairside time can be utilised to attend to other patients which ultimately increases the productivity of the clinician.[28]

A systematic review has reported that digital impressions provided better margins and internal fit of restorations when compared to conventional impressions.[29]

With respect to handling and learning, digital impression techniques are more efficient, comfortable, patient friendly and faster when compared to conventional impression techniques.[30]

Economically, with the use of IOS, cost of several laboratory procedures and materials involved in these laboratory procedures can be eliminated. However, the cost of the IOS, CAD/CAM software and training of the clinicians is quite high.[28]

CONCLUSION:

Optical impressions have many advantages over conventional impressions. The most important advantage being, an enhanced patient compliance and a reduced gag reflex. The stress and anxiety of the patient is automatically reduced which ultimately affects the treatment outcomes. In addition, the optical impressions are beneficial for the dental clinicians as well, as they reduce time required and simplify the clinical procedures with better communication with the technician and the patient.

When compared to conventional impressions, the optical impressions are equally accurate for short span bridges and restorations but not for long span restorations (6-8 elements). Ideally, the images produced by an IOS if opened with a CAD/CAM software have more benefits than an integrated proprietary system.

At last, in dentistry, there are wide applications of IOS ranging from orthodontics, prosthodontics and implantology. A concept of "Virtual patient" is on the verge of advancement whereby dentogingival information captured by IOS will be combined with bone information obtained with CBCT and information of the patient's face obtained with a face scanner. This can be used for surgical, prosthetic and orthodontic planning.

REFERENCES:

1. Ting-Shu S, Jian S. Intraoral Digital Impression Technique: A Review. J Prosthodont. 2015;24(4):313–21.
2. Raphaël Richert et al. Intraoral Scanner Technologies: A Review to Make a Successful Impression. Hindawi Journal of Healthcare Engineering Volume 2017, Article ID 8427595, 9 pages
3. Zimmermann M, Mehl A, Mörmann WH, Reich S. Intraoral scanning systems - a current overview. Int J Comput Dent. 2015;18(2):101–29.
4. Martin CB, Chalmers EV, McIntyre GT, Cochrane H, Mossey PA. Orthodontic scanners: what's available? J Orthod. 2015;42(2):136–43.
5. Goracci C, Franchi L, Vichi A, Ferrari M. Accuracy, reliability, and efficiency of intraoral scanners for full-arch impressions: a systematic review of the clinical evidence. Eur J Orthod. 2016;38(4):422–8.
6. Lee SJ, Gallucci GO. Digital vs. conventional implant impressions: efficiency outcomes. Clin Oral Implants Res. 2013;24(1):111–5.
7. Patzelt SB, Lamprinos C, Stampf S, Att W. The time efficiency of intraoral scanners: an in vitro comparative study. J Am Dent Assoc. 2014;145(6):542–51.
8. P. Ahlholm, K. Sipilä, P. Vallittu, M. Jakonen, and U. Kotiranta, "Digital versus conventional impressions in fixed prosthodontics: a review," Journal of Prosthodontics, pp. 1–7, 2016.
9. Lawson NC, Burgess JO. Clinicians reaping benefits of new concepts in impressioning. Compend Contin Educ Dent. 2015;36(2):152–3.
10. Lee SJ, Macarthur RX 4th, Gallucci GO. An evaluation of student and clinician perception of digital and conventional implant impressions. J Prosthet Dent 2013; 110 (5): 420–423
11. Aragón ML, Pontes LF, Bichara LM, Flores-Mir C, Normando D. Validity and reliability of intraoral scanners compared to conventional gypsum models measurements: a systematic review. Eur J Orthod. 2016;38(4):429–34.
12. Lanis A, Álvarez Del Canto O. The combination of digital surface scanners and cone beam computed tomography technology for guided implant surgery using 3Shape implant studio software: a case history report. Int J Prosthodont. 2015;28(2):169–78.
13. Karaokutan I, Yilmaz Savas T, Aykent F, Ozdere E. Color Stability of CAD/CAM Fabricated Inlays after Accelerated Artificial Aging. J Prosthodont. 2016;25(6): 472–7.
14. An S, Kim S, Choi H, Lee JH, Moon HS. Evaluating the marginal fit of zirconia copings with digital impressions with an intraoral digital scanner. J Prosthet Dent. 2014;112(5):1171–5.
15. Benic GI, Mühlemann S, Fehmer V, Hämmerle CH, Sailer I. Randomized controlled within-subject evaluation of digital and conventional workflows for the fabrication of lithium disilicate single crowns. Part I: digital versus conventional unilateral impressions. J Prosthet Dent. 2016;116(5):777–82.
16. Mansour M, Sanchez E, Machado C. The use of digital impressions to fabricate tooth-supported partial removable dental prostheses: a clinical report. J Prosthodont. 2016;25(6):495–7.
17. Shembesh M, Ali A, Finkelman M, Weber HP, Zandparsa R. An in vitro comparison of the marginal adaptation accuracy of CAD/CAM restorations using different impression systems. J Prosthodont 2016 Feb 8. doi: 10.1111/ jopr.12446.
18. Abdel-Azim T, Zandinejad A, Elathamna E, Lin W, Morton D. The influence of digital fabrication options on the accuracy of dental implant-based single units and complete-arch frameworks. Int J Oral Maxillofac Implants. 2014; 29(6):1281–8.
19. Lee JH. Accelerated techniques for a post and core and a crown restoration with intraoral digital scanners and CAD/CAM and rapid prototyping. J Prosthet Dent. 2014;112(5):1024–9.
20. Zimmermann M, Mehl A. Virtual smile design systems: a current review. Int J Comput Dent. 2015;18(4):303–17.
21. Londono J, Abreu A, Baker PS, Furness AR. Fabrication of a definitive obturator from a 3D cast with a chairside digital scanner for a patient with severe gag reflex: a clinical report. J Prosthet Dent. 2015;114(5):735–8
22. Ahlholm P, Sipilä K, Vallittu P, Jakonen M, Kotiranta U. Digital Versus Conventional Impressions in Fixed Prosthodontics: A Review. J Prosthodont 2016 Aug 2. doi: 10.1111/jopr.12527. [Epub ahead of print] Review.
23. Patzelt SB, Vonau S, Stampf S, Att W. Assessing the feasibility and accuracy of digitizing edentulous jaws. J Am Dent Assoc. 2013;144(8):914–20.
24. S. Ting-Shu and S. Jian, "Intraoral digital impression technique: a review," Journal of Prosthodontics, vol. 24, no. 4, pp. 313–321, 2015.
25. A. Ender, T. Attin, and A. Mehl, "In vivo precision of conventional and digital methods of obtaining complete-arch dental impressions," The Journal of Prosthetic Dentistry, vol. 115, no. 3, pp. 313–320, 2016.
26. . Giménez, M. Özcan, F. Martínez-Rus, and G. Pradíes, "Accuracy of a digital impression system based on active triangulation technology with blue light for implants: effect of clinically relevant parameters," Implant Dentistry, vol. 24, no. 5, pp. 498–504, 2015.
27. Syrek A, Reich G, Ranftl D, Klein C, Cerny B, Brodesser J (2010) Clinical evaluation of all-ceramic crowns fabricated from intraoral digital impressions based on the principle of active wavefront sampling. J Dent 38, 553-559.
28. George V. Duello. Intraoral Scanning for Single-Tooth Implant Prosthetics: Rationale for a Digital Protocol. COMPENDIUM January 2018; Volume 39, Number 1: 28-35.
29. Chochlidakis KM, Papaspyridakos P, Geminiani A, et al. Digital versus conventional impressions for fixed prosthodontics: A systematic review and meta-analysis. J Prosthet Dent. 2016;116(2):184-190.
30. L. Burhardt, C. Livas, W. Kerdijk, W. J. v. d. Meer, and Y. Ren, "Treatment comfort, time perception, and preference for conventional and digital impression techniques: a comparative study in young patients," American Journal of Orthodontics and Dentofacial Orthopedics, vol. 150, no. 2, pp. 261–267, 2016.