

Digital Impressions in Dentistry

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ABSTRACT

Making impressions has always been an essential part of dentistry. Due to difficulties such as gagging, disagreeable taste, and many others, it was formal accomplished with traditional impression materials such as alginate, agar-agar, and elastomeric impressions. Digital impressions and digital scanners were among the latest methods. The entire way of taking classical impressions that includes a lot of stages like tray selection, material blending trying to load, tray placing, and withdrawal, has been excluded along the evolution of classical impressions, and the act of collecting smart impressions is much faster and uncomplicated. So, in order to learn more about the digital impression, this force was chosen. We have considered advantages and disadvantages of digitized impression techniques vs. conventional impression. The reliability of digitized impressions in restorative dentistry is determined by a number of factors. The accuracy of digital imprints in restorative dentistry may be influenced by the depth/angulations of the implants, the operator's skill, the intra-oral scanner employed, and environmental factors. The goal of this research was to see what factors could influence the reliability of digital imprints in restorative dentistry. In dentistry, Intra Oral Scanners (IOSs) are utilized to capture optical transmission impressions. The advancement of 3D technology, as well as the growing usage of IOSs in dental clinics, has required a review of the integrity of intra-oral digitized impressions. In dentistry, Intra Oral Scanners (IOSs) are utilized to capture optical transmission impressions. The advancement of 3D technology, as well as the growing usage of IOSs in dental clinics, has required a review of the integrity of intra-oral digitized impressions. The outcomes of the various IOS systems were found to be variable in the investigations. While the efficiency of IOS systems looks to be prospective and similar to traditional approaches, they are not without faults.

Key words: Efficiency, Restorative dentistry, Digitized impressions, Intra oral scanners, Reliability

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INTRODUCTION

Indirect fabrication's huge success advancement to full coverage gold, metal ceramic or all ceramic crowns has been facilitated by the introduction of accurate elastomeric impression material and dies stones for intracranial and extra coronal restoration like inlays and onlays.

With the arrival of computers and associated improvements, dentistry has progressed to new levels. Digital impressions particularly resulted in substantial advancements in impression production [1].

A traditional impression procedure has employed to record the tooth and adjacent soft tissue in the last

decades. However, there were several disadvantages, such as parametric variation in imprint materials, gypsum product enhancement, and so on, these necessitated remakes and it required energy and money [2,3]. In order to overcome these challenges, the field of dentistry developed the intraoral scanner [4].

Computerized impressions are cutting-edge feature that enable dentists to use lasers and other optical scanning technologies to make realistic, machine-generated recreation of soft tissues and hard tissue in the jaw. Without using classical impression materials, which some individual find disagreeable and unpleasant, digital technology collects clear and extremely precise impression information in micro minutes. Because traditional impression materials are eliminated, numerous patients find classical impressions as simpler and more comfortable treatment. The impression data is then transmitted to software and then they are used to create restorations, which may be done without the use of a stones model.

In the last few decades, digital devices have become increasingly common in dental practice. 'CAD/CAM' technology enabled the production of fixed prosthesis restorations using the workflow. Computerized impressions represent the first phase in the digital workflow, transferring the intra-oral state to a digital model. Because it is a vital step in correctly transporting the implant position, the correctness of this operation may influence the treatment outcome [5,6].

For chair-side prosthesis fabrication and digital impression plenty of ['CAD-CAM'] technologies are commercially available in the market [7-10]. Different IOSs become more popular as the number of companies that offer user-friendly, patient-pleasant [11,12] and time-efficient services grows [2,13].

Impressions, whether traditional or digitized, have been used to record an impression of one or more preparation teeth, including adjoining as well as opposing teeth, and also inter occlusal record relation [14]. As a result; the impression's consistency is a vital factor that indicates the overall result of the desired restoration. Besides the clinical and operational variations (velocity of use, particle requirement, and tips size), as well as the cost (buying and maintenance) of several equipment, the integrity of the information generated from scanning, which is described as "accuracy," is the most important factor to consider. Precision is made up of two fundamental components: "accuracy" plus "precision." The capacity of a measurement to match the real worth of measuring instruments is referred to as "trueness." Perfection is characterized as the capacity of a measurement to be continuously reproduced, or, as put it another way, the device's capacity to produce reproducible results while used on multiple assessment of the very same object [15].

Digital intraoral scanning has advantages including real-time visibility, easy reproducibility, precise recording of the relevant fields, without any requirement to sterilize and cleanse dental imprints along with impression trays, cast filling, no model damage, quick transmission [16-20]. This system selects full arch or quadrant scanning according to the teeth that were selected for restorations. The prepared teeth, the opposing teeth, and the relationship between them are scanned. In the presence of patient the scan is reviewed, and its accuracy is confirmed [14].

The several factors can influence the output and precision of computerized impressions; additional development of imaging devices, scanning procedures, and screening techniques are required to improve precise specificity of implant scan body visual acquisition. As the digital technology enabled in implant dentistry, lots of commercial brands developed ISBs with different geometries and designs (Figure 1) [21].

The ISBs consists of three different areas:

- The scan region (correlating to upper part)
- The body region (correlating to mid part)
- The base region (correlating to the most proximal region of the body that links to the implants)

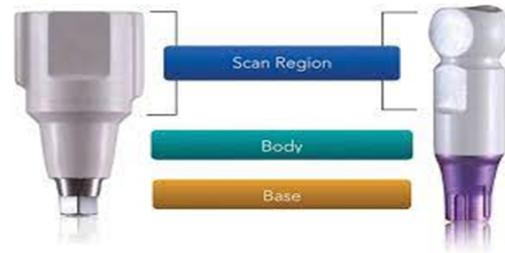


Figure 1: ISBs (intra oral scan body).

LITERATURE REVIEW

FIG-ISBs (Intra Oral Scan Body)

Therefore, the objective of the present review article is to understand the phase of the artwork of digitized impression in the dentistry, the factors to enhancing its accuracy, digital impression machines and the advantages and disadvantages of digital imprints over traditional techniques.

Digital impression system history and advancement

Models made out of impressions appeared around (18th century) [22,23]. Charles Stent 22 employed an imprint substance to design a device for the restoration of mouth abnormalities in 1856. For crowns, Sears 11 launched agar impressions material. ESPE introduced Impregum, the first polyether elastomeric material, in 1965 [24].

Condensation Silicone was invented; however it had dimensional inaccuracy as a disadvantage. Several obstacles were solved with the introduction of Polyvinyl Siloxane, including modulus of elasticity, dimensional correctness, tear strength, unpleasant odour, taste, and improved flow [24].

'CAD/CAM' has indeed utilized in the production of airplanes and vehicles since the 1960s. Francois Duret's thesis "Optical Impression" in the 1970s first used CAD/CAM in dentistry. Duret designed and patented CAD/CAM equipment in 1984, and he revealed fabrication of crown in four hours. In 1985, Mormann and Brandestini developed CEREC1, the first profit-driven classical impression system. CEREC1 used a 3-dimensional (3D) computerized scanner as well as a cutting tool to fabricate dental prosthesis in a single session using widely viable blocks of porcelain material. CEREC1 is a device that can produce porcelain inlays and onlays. Mormann is indeed a current licensee of Sirona Systems. CEREC 2, CEREC 3, and CEREC 3D became produced in 1994, 2000, and 2003, respectively [24-26].

Digital impression machines and technology

There are mainly eight systems available from six different organizations, with three basic systems now in use to create digital impressions, (Table 1) (Figures 2-4):

- Lava chair side oral scanner by 3 m
- CEREC AC by Sirona systems
- The CADENT ITERO systems

Table 1: The comparison between 3 scanner systems.

Features	3 M LAVA C.O.S	S. CEREC AC	CADENT ITERO
Visual Technique	Wave front sampling techniques (3D in motion)	LED/Laser collection	Parallel confocal/telecentric
Focal Depth	Extent from 5 mm to 15 mm	Extent from 5 mm to 15 mm	13.5 mm 1:1 exact focus
Powder Required	Yes	Yes/opti spray	No
Models	Added ingredient/SLA in blue resin. One solid model and one working model	Added ingredient/SLA; not tissue	Milled/Polyurethane. Soft tissue profile, Removable dies
Indications	Upto 4UB, and singles	All	All
Export for Digital Interface	LAVA	CEREC Connect	Major CAD front end systems-Dental wings, CEREC In-Lab, 3 Shape, Standard STL binary file.
Articulator	Articulated; Centric and lateral excursions	Hinge-Only	All directions, attachment system to whip mix full articulator for complex cases



Figure 2: 3 M LAVA chairside scanner with computer and handheld software.



Figure 4: CEREC AC system by sirona.

Impression taking method: As compared to traditional impression techniques, the method for recording the impression is quite simple. The following steps that must be followed-

- First, make sure that the system’s software is up to date and that hold with the camera is ready for scanning.
- Second, the prepared tooth must be dehydrated and separated, and the tissue retracted with a gingival cord. Retraction is necessary for taking digital impressions because the scanner may not be able to scan the profile margin if they are not visible. After the tooth has dried, it is lightly coated with titanium dioxide to give contrasting points for scanning, increase recording speed, and improve 3D picture recording.
- Third, a scanner, synonymous to an intraoral camera, is available to scan the images. The prepared tooth and its nearby teeth are scanned from various angles, and its neighbours are created in software. The patient is then instructed to seal their mouth in maximum interception while an image of the occlusion is taken.
- Fourth, the image data is then transferred to the suitable laboratory or milling machine in the office, together with the patient’s information for the prosthesis.



Figure 3: Cadentitero system.

Traditional vs. digital impressions

Conventional impression: Abutment-proper tray selection-recantation of gingiva-impression taking-sterilization-transporting lab equipment-cast filling-fabrication of restoration [27].

Digital impression: Abutment-recantation of gingiva-examines-digital transfer of impression to laboratory-classical design-fabrication of restoration [27].

The conventional impressions-advantages and disadvantages

The conventional impression, even while prevalent in most circumstances, has a number of drawbacks. Despite advancements in the quality of impression materials, the drawbacks have not been resolved, and yet there is no ideal impression material available in specialist market [28].

Many studies have found that numbers of dentist have forced variety of issues when it comes to creating the ideal impression, particularly when it comes to restorations. Problems such as fractures, bubbles, or poorly delimited preparation margins were discovered after examining the impression outside of the mouth cavity; in overall, there are a number of potential concerns with making dental impressions [28].

Other issues expressed by dentists include the fact that a variety of conventional impression materials can occupy space, have a difficult mixing method, or induce allergic reactions or reflux during the impression-taking process. Classical impression-taking may require various materials and, on sometimes, additional stages. From the time it is taken until the restoration is completed, an impression can deform or break under specific conditions. The lab or the dentist sometimes goes undetected by all of these mistakes. As a result, the steps must be repeated, costing time and money.

The Traditional impressions also have a number of benefits, they are:

- Most doctors are unwilling to learn innovative techniques because they are habituated to the traditional ones.
- The price ranges from very low to very high.
- The practitioner is knowledgeable and adopts the technique.
- Long history and familiar use.
- Precise and predictable.
- The equipment is minimal. The procedure is straightforward and simple to learn.
- The precision of silicone and polyether impressions are widely recognized.

The disadvantages of the traditional impression are

- Discomfort for the patients (for some, vomiting is accentuated)
- Taking a traditional impression leaves lots of "dust" remnants of material can be all over the cabinet, on

the gloves, on the ground, on the equipment, and so on.

- Model pouring is needed.
- Multiple steps required often 4 to 6 visits.
- More laborious technique
- Discrepancies in the model can be caused by errors produced by the integration of air bubbles.

Digital Impressions-Advantages and Disadvantages

Classical optical imprints increase productivity, creativity, and correctness by allowing practitioners to e-mail a digital imprint to the labs instead of sending a conventional impression or stone replica through ordinary mailing. Computerized impressions could also be utilized to manufacture identical dental restorations, minimizing the need for several office visits and speeding up treatment for patients [29].

The advantages of digital impression includes

- Less chair time.
- Patient and dental team will have more comfortable and stress-free experience.
- Using inserting impression materials and trays with in patient's mouth, digitized impressions by IOS reduces temporary pain [30].
- The screening of the participant's hard and soft tissues reduces chair side duration. Steps that take time, such as filling the casts, are omitted [31]
- Improve the impression quality for better fitting restorations.
- Reduce possibility of impression-taking errors.
- There's no need to buy spoons or imprint materials, and there's no need to store them.
- Air bubbles are not a concern with this procedure [28].
- The elimination of the "unclean" cabinet, as well as patient distress.
- The interaction between the physician and the patient has increased since the introduction of IOS, and the individual is much more integrated in the process and also has a significantly better treatment efficacy [30-36].

The disadvantages of digital impressions are

- The main drawback is lack of knowledge among dentists [28].
- The identification of deeply positioned gingival margins is a difficulty, and IOS scanning is especially problematic in cases of haemorrhage, as it might hide the prosthetic edges and cause the scan to be imprecise [1].
- IOS unable to of dislodging soft tissue edges or registering fluid tissue interactions.
- The machinery is complicated, though it has recently been considerably simplified, and mastering the skill requires training and experience.

- It's also not a well-known idea which everybody understands.
- The initial cost of the system is expensive, but after devaluation, becomes much less expensive than the traditional method.
- It needs long-term clinical trials.
- For senior clinicians who have less willingness and familiarity with internet and software, adapting the Learning Curve for IOS is tough.

DISCUSSION

This review article is elaborating us about uses of digital impression in dentistry. The entire way of taking classical impression has been excluded along the evolution of classical impressions, and the act of collecting smart impressions is much faster and uncomplicated. With the arrival of computers and associated improvements, dentistry has progressed to a new level. Digital impressions particularly resulted in substantial advancements in impression production. In the last decades, digital devices have become increasingly common in dental practise. 'CAD/CAM' technology enabled the production of fixed prosthesis restorations using the workflow. There are many systems available to create digital impressions. The method for recording digital impressions is quite simple as compared to traditional impression technique. It is a virtual scan that creates map of your teeth. This article will be elaborating us about advantages and disadvantages of digital impression over traditional impression taking technique in dentistry

CONCLUSION

Intra Oral Scanners (IOS) has several benefits over traditional imprint techniques: it enhances treatment and technician conveniences, minimizes the frequency of appointments, and increases the operator's practice capacity. In relation to traditional imprints, intraoral imaging devices can always be employed for diagnosis reasons with narrow screening with confidence. Computerized intraoral imprint techniques are still in the early stages of development. Digitized imprints appear to be such a precise process in restorative dentistry, according to studies. The results of the various intraoral scanners were found to be diverse with in investigations. Whereas the precision of IOS techniques looks to be prospective as well as similar to traditional approaches, these are not without drawbacks. Throughout the term, dentistry procedures will require use of such new methods and techniques. In the area of dental implant treatment, the digital technology for obtaining tooth imprints results to a quicker therapy as well as healing period.

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