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Research Paper

Digital Impressions Versus Conventional Impressions In Prosthodontics: A Review Of Literature

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ABSTRACT
BACKGROUND:
The quality of the finished prosthesis is greatly influenced by the precision of the final/master impressions. In the conventional method, elastomeric impression materials are frequently utilized to indirectly fabricate prostheses by replicating anatomical components. However, because of many benefits, such as three-dimensional previsualization, cost-effectiveness and time savings, digital impressions are becoming more and more popular.
OBJECTIVE:
The purpose of this review was to evaluate conventional and digital impression techniques in prosthodontic practice with an emphasis on time efficiency, clinical results, accuracy and patient comfort.
METHOD:
An electronic literature search was conducted from 3 datasets: PubMed, ResearchGate and Google Scholar from 2010 to 2024. The search approach combined free text words, controlled vocabulary [Medical Subject Headings (MESH)] and a combination of both. The search yielded 20 articles from all datasets, excluding the articles found in more than one dataset.
CONCLUSION:
Digital impressions offer numerous benefits over conventional impression techniques, including increased operator and patient comfort, fewer visits and increased practice efficiency.
KEY WORDS:
Conventional impression, Digital impression, Prosthodontics, Prosthesis, Impression techniques

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I. INTRODUCTION AND BACKGROUND

According to the 10th edition of Glossary of Prosthodontic Terms (GPT), an impression is defined as "A negative replica/likeness or copy in reverse of the surface of an object; an imprint of the teeth and adjacent structures for use in dentistry".
Making impressions has always been an important part of dentistry.
The objectives of the dental impression are:
1. Retention: It refers to the denture's ability to withstand forces acting vertically. (Removal forces directed against the direction of denture insertion.)
2. Stability: Is the denture's potential to remain sturdy, steady and constant as well as its ability to withstand forces acting horizontally or laterally.
3. Support: is the ability of the denture to resist vertical and other forces in a direction towards the basal seat.
4. Preservation of residual alveolar ridge and soft tissues.
5. Aesthetics.
Intraoral impressions are of 2 types, primary and secondary/definite/final impression. Final/definitive impressions are essential to the prosthetic fabrication procedure. The accuracy of the impression greatly affects the quality of

the finished prosthesis [1]. Impression making is a crucial step in the fabrication of dental prosthesis. It creates a connection between the work of the dental technician and the dentist so that it may be precisely replicated in a clinical setting. A perfect impression procedure is necessary for precise casts, which in turn are necessary for precise fitting of the prostheses [2]. The planning of a prosthetic rehabilitation is impacted by a number of factors such as patient compliance, treatment costs, aesthetics and clinical preferences for the materials and preparation [3]. The keys to an effective long-term clinical outcome and patient satisfaction are the prosthesis' precision, mechanical stability and marginal adaptability, as well as an oral hygiene regimen. Plaque buildup from inaccurate margins raises the possibility of biological harm to the periodontium, whereas poor marginal adaptability can result in ceramic cracks and adversely compromise mechanical retention [3].

Analysing the range of information regarding the application of new technology is essential in the field of dentistry. This review was prompted by the desire to understand how developments in digital technology are transforming prosthodontic practice, particularly how digital impression techniques could speed up dental processes and enhance the treatment quality. The significant findings from several studies and articles contrasting digital and conventional impression procedures in dentistry are provided in this review of the literature.

Conventional impressions (CI)

Conventional Impression (CI) is still an extensively utilized method for reproducing intraoral structural architecture and transferring it to the dental lab for indirect prosthetic fabrication [1]. Previously, impressions were made using alginate, impression compound and agar-agar since many years ago, nowadays elastomeric impression materials, particularly polyvinyl siloxane and polyether have been utilized with great reliability in terms of impression accuracy [4]. If working procedures are followed correctly, conventional impression processes can produce reliable results without the need for specialized, expensive machinery. Several factors such as extended periods of storage, moisture, uncontrolled saliva flow during the process, undercuts, incompatibilities with other materials and material deformations can affect the impression's accuracy and as consequence, result in inaccurate and inappropriate prosthesis [2].

The accuracy of the impression depends on the material used, type of impression tray and most importantly the impression techniques and methods followed [5].

Some of the advantages of conventional impression are cost effectiveness, minimal equipment, simple and straightforward procedure, precision of silicone and polyether impressions are widely recognized [6]. Certain disadvantages of conventional impression include increased number of steps which in turn increases the number of appointments, discomfort, pain, cross-infection, gagging. Gag reflex is the most common drawback [7]. A high gag reflex may make it difficult to accept and administer dental treatments. Moreover, every stage of the procedure in conventional impression adds the possibility of material and/or human error [8,9]. As undercuts and angled implants need a greater force to remove from the mouth, they have also been shown to negatively impact conventional impressions [10,11]. This may also have a substantial effect on the treatment plan and treatment outcome.

Compared to conventional impressions, digital impressions are becoming more and more acceptable and widely used by clinicians.

Digital impressions (DI)

Prosthodontics has undergone a revolution,

thanks to the use of digital impressions for crown, bridge and denture fabrication, which offer a more accurate a nd efficient way to record intraoral data.

The first digital scanner for taking dental impressions was introduced in the 1980s. However, the technology didn't become more accessible until the early 2000s and economically feasible. Several companies' development engineers have advanced the technology and created more user-friendly, in-office scanners that create precisely fitted dental prosthesis [12]. The first intraoral scanner in the world, Mörmann created CEREC (Sirona Dental Co., GmbH, Bensheim, Germany) at Zurich University. It was first used only for the preparation of inlays and onlays.

Digital impression techniques that streamline production, lower costs and enhances patient comfort were the aim of the early advancements in computer-aided design and computer-aided manufacturing (CAD/CAM) technologies [2]. Over the past three decades, advancements in computer-aided design and manufacturing (CAD/CAM) techniques have significantly enhanced the quality of prosthesis that are manufactured in a laboratory or dental clinic [13,14]. Digital impressions provide speed, efficiency, flexibility to transfer digital images between the laboratory and the dental clinic, and the ability to save acquired information indefinitely [15]. With the digital impression procedure, an intraoral scanner is used to scan the teeth to create a virtual model that appears on a monitor. After the hypothetical model has been altered and its occlusion verified, it is uploaded online using the computer-aided manufacturing (CAM) process to create a working model. With the help of digital impressions, the risk of patient discomfort and cross-contamination are reduced, and the accurate raw data can be

sent to the laboratories and can be stored/saved permanently. However, certain disadvantages of the digital impression technique include requirement of a private software or program, intraoral scanner and a milling machine [16].

There are two different kinds of scanners: laboratory scanners and intraoral optical scanners. Laboratory scanners can be either mechanical or optical, and intraoral optical scanners can be either a video camera or a single image. The most popular intraoral digital impression scanning techniques accessible currently are TRIOS, iTero, CEREC, Lava C. O. S. System and E4D [4].

Advantages of digital impressions are less chair time, less discomfort to the patient, improved quality of the impression for better fitting prosthesis, possibility of impression-taking errors is reduced, etc. The main drawback of digital impression is lack of knowledge among dentists. Other disadvantages of include complicated machinery, mastering the skill of using the equipment's requires training and experience, economically expensive, requires long term clinical trials, etc [6].

Traditional and digital impressions are compared based on the main factors such as accuracy, operator preference and patient acceptance. The accuracy of both digital and conventional impressions can be evaluated using the precision of the impressions and the prosthesis.

1. Accuracy:

Trueness and precision are the two criteria used by the International Organization for Standardization (ISO) to assess the accuracy.

The measurement bias or systematic error between the reference and target objects is known as trueness. When the process is repeated, precision is the random error (reproducibility) between the objects [17].

2. Operator Preference:

It is assessed using factors including- operator perception, process difficulty and working time assessment. The workflow for the digital impression approach is quicker. The time needed to re-scan the digital imprint was far less, even in cases when a remake was necessary. In contrast to the conventional impression technique, which took more time, operators felt that the digital impressions made it easier and quicker to correct sections that were missing or unsatisfactory [4,18].

3. Patient Acceptance:

Criteria for evaluation of patient comfort include- anxiety, gag reflex, queasiness, pain, discomfort, trouble breathing, time perception, taste and their experience with the powdering method used for digital impressions. Because patients are more concerned with comfort and because digital impressions are less invasive, they have become more acceptable. Missing or inadequate parts can also be fixed by segmental rescanning. This improves the patient's satisfaction and reduces working time [4,18].

II. DISCUSSION AND CONCLUSION

The success and durability of prostheses are greatly influenced by the final impression. To create a precise clinical fit for the prosthesis, a variety of impression procedures have been used [1]. As the field of prosthetic dentistry advances, digital intraoral optical impressions and other digital applications are emerging as a viable substitute for the traditional approach [2]. Numerous studies have demonstrated that in terms of accuracy, digital impressions may match or even surpass the conventional impression techniques. But it is important to recognize and understand that digital impressions come with some restrictions and difficulties. The initial expense of purchasing the required hardware and software for digital impressions is one of the primary obstacles. Dentists must also go through a learning curve to become proficient with the new technologies. To guarantee precise and effective digital impressions, training, practice and experience are required [12].

It was concluded by Sachin K Chandran et. al., digital impressions were more accurate than traditional impressions, but there was no statistically significant difference. According to patient and operator preference surveys, the digital impression technique was more widely accepted and satisfied [1].

In a study conducted to compare marginal fit of cemented zirconia copings manufactured after digital impression with lava™ C.O.S and conventional impression technique by Rinet Dauti et. al., it was concluded that copings made from a digital impression using Lava™ C.O.S. exhibits marginal parameters that are similar to those made from a conventional impression using polyvinyl syloxane. The digital and conventional groups' mean marginal gap values fell within the range that is considered clinically acceptable [2].

Mohammad Abo Haoran and Yanikoglu N state that the inability to replicate digital impressions is one of the primary issues that must be addressed; nonetheless, intraoral digital impression prostheses have demonstrated good accuracy when compared to conventional impression prostheses. Furthermore, in terms of material savings and labour productivity, intraoral digital impressions provide a substantial benefit. With further developments, the intraoral digital impression technology will be utilized in dentistry more frequently [4].

It was concluded by Natasha Stavreva that the digital impression technique was shown to be more effective than the conventional impression technique based on the results of her systematic review. The conventional impression took longer to treat overall than the digital impression. It was acknowledged that the

digital impression technique was the more efficient and a preferred method when compared to the conventional impression technique. Compared to the conventional impression, digital impression offered greater treatment comfort when administered by a skilled dentist. Digital impressions are typically preferred by patients over conventional impression techniques [5].

Aakanksha Mahesh Dalal et. al., states that compared to conventional impression techniques, Intra Oral Scanners (IOS) offer a number of advantages, including improved treatment and technician convenience, fewer appointments and an increase in operator practice capacity [6].

Alessandro Mangano et. al., states that digital impression techniques were much more accepted by patients than traditional impression techniques and the intraoral scanner performed better in terms of comfort, gag reflex and breathing difficulty. Nonetheless, there were no appreciable variations between the two methods in terms of stress (measured by the State anxiety scale). Furthermore, digital impressions resulted to be slightly time consuming than alginate impressions, which resulted to be slightly faster [9].

Jaafar Abduo and Joseph E. A. Palamara state that the digital impressions, particularly the NSP (non-splinted) impression technique, generally have a tendency to produce more precise results than conventional impressions. The prevalence of different angles between implants had minimal effect on digital impressions, but it had a significant impact on the NSP impression technique. The TD produced the least accurate results out of all the iOS systems that were evaluated [13].

According to the study conducted by Thaise Ferreira Carvalho et. al., the results of the study indicate that in terms of clinical chair time, operator and patient preference and patient comfort, the digital impression techniques have surpassed traditional methods, but not in terms of fidelity, accuracy and detail reproduction. However, these technologies' exorbitant cost continues to prevent their implementation in clinical settings [15].

Mi-Jung Yun et. al., conducted a study to compare the fit of cast gold crowns fabricated from the digital and the conventional impression techniques and it was stated that there were greater gaps in the occlusal surface of the prostheses made using the digital impression technique [16].

Emir Yuzbasioglu et. al., evaluated patients' perception, treatment comfort, effectiveness and clinical outcomes by comparing conventional and digital impression techniques and concluded that, compared to the conventional impression technique, the digital impression technique proved more effective and efficient The conventional impression approach took longer to complete the entire treatment than the digital impression technique.

Digital impression technique was more widely accepted by the subjects/patients as the preferred and effective technique. When performed by an experienced operator/dentist, the digital impression's level of treatment comfort was greater than that of the conventional impression [18].

According to Sanjna Nayar and R. Mahadevan, with the removal of the common issues and drawbacks mentioned above, it is certain that intraoral digital scanning will become a normal practice in the majority of dental offices in the next years due to the substantial benefits of digital impressions. Furthermore, digital impressions have been shown to boost overall efficiency and decrease errors, returns and remakes. Additionally, the patient benefits from having a much better experience than conventional impression method. Lastly, it has been found that digital imprint manufacturing improves consistency and reduces chair time during insertion for laboratory products [19].

According to Nusima Mohamed et. al., making the claim that digital impressions are better than conventional methods is still controversial. Compared to the conventional technique, digital impressions have been shown to provide more comfort, better clinical results and less post-insertion adjustment. However, the conventional technique, especially for border molding, still yields good clinical results in terms of stability and retention [20].

CAD/CAM and digital impressions have revolutionized prosthodontics. Digital impressions and 3D imaging have been used in virtual treatment planning and simulation, which has improved the precision and predictability of denture fabrication. Digital impressions offer numerous benefits over conventional impression techniques, including increased operator and patient comfort, fewer visits and increased practice efficiency. Although digital impressions are promising in dental specialties like prosthodontics, orthodontics and implantology, there are still research gaps that need to be filled. These include long-term outcome evaluation, full-arch prosthesis, patient-specific factors, systemic error elimination, etc. Filling in these gaps will guarantee top-notch dental care and maximize the clinical use of digital impression techniques.

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