

IMPRESSION TECHNIQUES IN COMPLETE DENTURE PATIENTS: A REVIEW

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ABSTRACT

This literature review aims to create a comprehensive review of both traditional and new techniques and materials used in dental impression and their principal characteristics, specifically for patients that need a complete denture. This review will represent an opportunity to compile the vast information for professionals to get a general idea of all the procedures that can be used, its advantages and disadvantages, as well as the acceptance they have among professionals and patients. In addition to this, this literature review will offer future perspectives for the development of new techniques and the adaptation of new technologies and materials.

Key words: Complete denture impressions, dental impression materials, digital dental impressions, conventional dental impression techniques, new dental impression techniques.

Introduction

A dental impression is a useful tool for dental procedures. It can be defined as a negative imprint or positive digital image used to cast or print a replica of a denture structure ¹. These impressions are usually applied for dental restoration or prosthesis ^{2,3}. Over the years, many impression techniques have been developed, but the success of these impressions can be determined by the type of material used, the patient's needs, and the techniques used ⁴. This makes it crucial for professionals to understand the existence of all these multiple options to choose the best option for each case ⁵. In addition, new technologies and materials are surging ⁶. This represents a new challenge for the professionals, especially when a complete denture is needed because the patients are in a situation where basic needs such as eating become difficult. This becomes of great interest as prospective studies calcite an increase in the number of edentulous patients from 33.6 million in 1991 to almost 38 million by 2020 ⁷, whereas the importance to address this topic and the possible contribution the present review could represent for the dentistry community.

Materials and Methods

Design and search strategy

To perform the literature review, the PRISMA statements were considered for a systematic review ⁸. An n= 4,454 was identified through database searching (including NCBI, ResearchGate, and ScienceDirect), a total of n= 3,228 was obtained after eliminating duplicates. After a quick review of the topics considering the titles and abstracts obtained through EndNote, 77 reviews were screened. From this

article selection, 46 were fully considered for eligibility. For a final selection, 26 research papers were excluded using the criterion proposed for a final number of 17 articles that will be thoroughly reviewed for the present review paper. The searching engines used were ScienceDirect, ResearchGate, and NCBI, engines specialized in science-related topics. Google was also used as a general searching engine; the research papers obtained though it were selected based on the credibility and reliability of the origin Journal. The terms introduced on the searching engines, both general and specialized, were "impression techniques", "dental impression techniques", "complete dental impression", and "conventional impression techniques". In all specialized searching engines, filters were applied to narrow down the search to the research papers published from 2015 to 2020.

Screening process and inclusion criteria

A program known as Covidence was used to eliminate duplicates. To analyze the titles and abstracts of each paper, the specialized searching engines offered the option to download abstracts in addition to cites. For this, Endnote was used to subtract, organize, and analyze the research papers selected. For the inclusion criteria, a year of publication not older than 5 years was considered. Additionally, no letters to the editor, protocols, conference, and discussion papers were selected. Other criteria included the selection of research papers in English only. Finally, addressing the topic of interest for this review, other inclusion criteria included the addition of research papers with topics such as conventional and new impression techniques, the perception of students and patients considering the variety of techniques, material related to these techniques, and future perspectives for impression

techniques and materials. Considering all these topics, the articles were organized according to subtopics to make more straightforward the process of summarization and homogenization of the content.

Results

Conventional techniques

Many impression techniques have been developed over the years. In general, these techniques can be grouped into mucostatic, mucocompressive, selective pressure, functional,

and neutral zone impressions¹; however, other classifications can be considered. Considering these different procedures, Alqattan et al. conducted research to address the techniques that were currently used in Saudi Arabia in an aim to find the most common materials and techniques used (2016). They used surveys to assess the frequency of complete denture impression, the techniques for primary impression materials, and the materials. The outcomes of the investigation made visible the commonly used of alginate for preliminary impressions and acrylic tray for the final one⁴. Alginate, the most common material for dental impressions, can be located in that position due to its many advantages such as hydrophilicity, ability to record finer details, elastic recovery, and its low price⁹. Regarding the techniques, Alqattan et al. observed the primary use of selective pressure technique and mucocompressive technique with a low percentage of mucositis technique (2016). The most commonly used technique, selective pressure, is characterized by the distribution of pressure over the areas that can support it better, avoiding the weaker ones¹⁰. This characteristic provides a safe form to create impressions for dental professionals. Additionally, Jayaraman addressed the use of selective pressure as the preferred option for the patients (2018). Therefore, the technique also proved to be comfortable for patients.

As Jayaraman assessed, the patient's opinion is crucial for an impression to be accepted. For the complete dentures, one of the standard techniques includes the use of two impressions, one considered the primary one (generally performed on alginate) and the final one (performed on silicone). Considering this and the opinion of the patients, the author Jo et al. presented a survey to evaluate how efficient it was to keep the protocol of making a primary and final impression against a simplification (2015)¹¹. In their outcomes, they concluded that the conventional techniques with two steps were more accepted by the patients¹¹. Once again, this conclusion makes us think that conventional

techniques and conventional materials such as alginate are valid and therefore, their everyday use is justified by both professionals and patients. However, the negative outcome for this two-step technique could be its cost compared to the simplified version. To address this issue, Miyayasu et al. conducted a comparison between the costs generated by the use of two steps conventional technique against the simplified one for a complete denture (2018)¹². As expected, the outcome of this research located the simplified method as the lower cost option as it avoids the use of silicones and limits only to the use of alginate, an already low-cost material¹². Even though this is important, the professionals must assess the efficiency and the patient's response above the costs.

To further address the efficiency of conventional techniques, Jung et al. presented research comparing a conventional method with two novel impression techniques. In the comparison performed, the conventional method proved to be at the same level as a novel tray and a digital impression method regarding efficiency¹³. This finding is relevant as it explains why the use of conventional methods is so widespread all over the world and continues even with the presence of new technologies. An additional benefit of conventional techniques is that it can be used for patients with extensive bleeding, contrary to a digital scanner that cannot detect image due to the blood interference¹⁴. Finally, in an additional study where digital and conventional techniques were compared it was proven that conventional methods are more accurate in comparison to digital ones when assessing complete dentures¹⁵. As observed, conventional techniques still have a lot to offer to patients, and it is probable that they will remain for much more time.

By observing the information presented, another form to categorize the diverse techniques that dentistry has developed over the years is possible, by the materials used. To highlight this possibility, Punj offers an extensive review of the materials and the techniques linked to them (2017)¹⁶. For entirely edentulous clinical scenarios where the patient needs a fast complete denture, he indicates the use of PVS or polyether and the linked techniques known as splinted impression copings and open tray technique¹⁶. Additionally, and, as expected, the use of alginate in combination with selective pressure technique is also suggested by Punj et al. These observations, once again, are consequent with the literature presented up to this point and the frequent use of selective pressure and alginate. By analyzing the data obtained from the articles reviewed, it is easy to notice that conventional techniques remain used in many different places up to this day for diverse reasons. The most notable

ones are the low cost of the materials involves. However, these techniques need to be improved as many of them present some deviations and uncomfortable scenarios for the patients with the necessity of second appointments or techniques that are difficult to tolerate.

Modern techniques

Even though the use of conventional techniques for impression is still primarily used, the raising of new technologies and materials have opened the options, and this has been noticed by the patients. In a study conducted by Maria et al., a group of patients was treated with conventional impression techniques and with the digital impression (2019) ¹⁷. When their opinions were asked, the majority declared that they preferred the digital impression technique because it was more comfortable when performed, there was no possibility of allergic reactions due to conventional materials or swallowing the impression materials ¹⁷. Following this same research field, Burhardt et al. tested the perception and preferences for impression techniques in a group of thirty-eight individuals (2016) ¹⁸. As expected, this research located the use of alginate high in the scale of discomfort with patients reporting gag reflex and difficulty to breathe against a 51% favoring digital impressions ¹⁸. The patient's comfortability was also addressed by a group of students in another research ¹⁹. As observed, the patients themselves are now addressing the advantages modern techniques are bringing to the table, parameters such as low cost, accessibility, shorter chair times, and comfortability are being assessed and valued over conventional techniques.

Another critical advantage the newest procedures provide is the capacity to avoid trimming procedures that can lead to distortions on the duplicates, a disadvantage present on the rock, alginate, and tray conventional materials. Addressing this problematic, Ammoun & Bencharit provided a view of a digital technique that combines a desktop scanner and open-source software to generate a file that can then be used to create duplicates offering the possibility to save it for future uses (2020). As observed in Figure 1, the model can be applied for both superior and inferior complete dentures ²⁰. The principal advantage of this technique is the accuracy it provides to the duplication, the accessibility to it, and the possibility to save the information provided by the scanning, all this in addition to the approbation of the patients themselves.

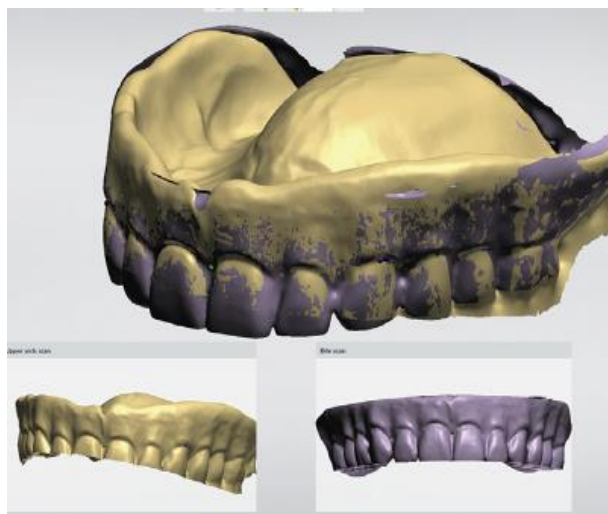


Figure 1. Scan example ²⁰

Unfortunately, with the apparition of new techniques, new clinical challenges appear. Alqarni et al. addressed this issue with the use of computer-aided design and computer-aided manufacturing (CAD-CAM) technology for the creation of complete dentures (2019). From their point of view, they assessed the difficulty linked to capturing maxillomandibular records due to an excessive loss of alveolar ridge height ²¹. However, considering the many advantages, this technique provides, adaptations are proposed to eliminate these complications. For example, Alqarni et al. proposed a combination of conventional mandibular record with the computational record (2019). This example offers an exciting vision of how both new and conventional techniques can be combined to achieve a better impression that adapts to the patient's necessities. Regarding the solutions for possible problems with CAD-CAM technology, Fang et al. proposed the use of intraoral scanners to avoid the possible deviation of conventional techniques, making it a direct digital impression (2018). They explored the clinical case of a 60 years old man, at the end of the procedure the CAD-CAM technology was able to avoid the frequent use of stone models ⁷. In addition to this, other authors have proved the efficiency of intraoral scanners for complete dental impressions ²². This is a significant advance as it translates into less deviation and, therefore, more accurate, complete dentures that, contrary to Alqarni's response, do not depend on the use of conventional techniques.

Wu et al. presented a research paper focused on comprehending the reach of alternative digital technologies that have been used to fabricate removable partial dentures (2020) ²³. They addressed how this kind of impression techniques represent an advance as they eliminate the

interoperator variability and increase the precision when compared with conventional methods ²³. This kind of technology applied to complete denture procedures have the potential to reduce chair time and clinical appointments, achieving a faster solution for them. However, the recent application of these technologies has a negative side because even though they represent new possibilities, its rapid rise represents a challenge for students as they do not receive education on these new techniques. Regarding this issue, Schott et al. published a research paper to measure the knowledge thirty-one dental students had about digital impressions in orthodontics (2019). Unfortunately, the conclusions made evident the lack of preparation they had, as 97% had no previous experience performing digital impressions ¹⁹. This makes evident the necessity for dentistry schools to highlight the importance of these new emerging techniques and offer their student the option to access them to generate a change in the community.

The use of digital technologies is not the only advancements achieved in modern techniques for impressions. As stated in the conventional techniques, materials are an essential form to determine techniques; therefore, the development of new materials will have, as a consequence, the creation of new techniques. To address this, Sivaranjani published a research paper on a new technique using thermoplastic stock trays (2018). The material presented represents the shorting of conventional techniques with only one appointment necessary to obtain the impressions ²⁴. This not only represents a time improvement, but a more comfortable option for the patients. As observed in Figures 2 and 3, the size of this thermal material is significantly smaller than conventional alginate. Therefore, the patient will have a more comfortable experience. As observed, the creation of new technologies and innovative materials have a direct impact on the development of new techniques. It is critical for the dentistry community to be aware of these rapid changes as they represent a door to new and more accurate treatments and tools.



Figure 2. Alginate Impression



Figure 3. Thermoplastic stock trays ²⁴

Discussion

In summary, the use of impression techniques is crucial for the assessment of various treatments in dentistry. Over the years, the techniques to achieve these impressions have taken different pathways as a response to different diseases and treatments. However, they can be classified according to different parameters considering the assessment for a complete denture that wants to be addressed in this review paper. The first form to categorize them is considering the pressure applied to the impression. In this fashion, the most common impression is the selective pressure in which pressure is put on the areas that are stronger; this makes sense as it will impress the areas needed to be assessed, and at the same time, it represents less pain or discomfort for the patient. The second form to classify these impressions is by considering if there is a primary and final impression, meaning if the process consists of two steps or simplification of it. According to patients and professional observations, two-step impressions are superior. This makes sense as the alginate process can be upgraded with the silicone final step, even if this represents a higher cost. Finally, the materials for impressions also determine the techniques that can be used; for selective pressure, the material linked is alginate, a low cost, and accessible material.

Even though these conventional techniques have proven to be effective, the rise of new technologies is changing the view and offering innovative solutions. The principal modern techniques can be classified on digital impression techniques and techniques derived from the development of new materials. In the case of digital impressions, these represent a more accurate form to obtain impressions and less uncomfortable experience for the patients; this can be observed in the use of alginate, the most popular conventional technique that is continuously reported as an unpleasant experience for patients themselves. The intraoral scanners offer a more direct and secure form to obtain the impressions wanted. Additionally, by digitally impressing, other advantages are addressed, such as the possibility to save the data for future uses and the save in materials and instrumentation. The same occurs with the new material techniques; it shortens the time the patient has to spend on the dentistry and is less uncomfortable. However, the complexity of these technologies and the fast advancements make it difficult for professionals to keep updated.

In conclusion, the current review makes visible the necessity for professionals to keep updated. Both conventional and modern techniques offer different advantages and challenges and are dependent on various factors such as the budget, the materials, the patient's scenario, and the professional's skills. For every case is necessary to address different points to select the correct technique. Additionally, it is essential for the patients and students to actively participate by offering feedback to these different techniques so the professionals can create new adaptations and even the use of combined techniques to fulfill the patient's necessities. Even though conventional techniques are still widely used is highly possible that they will be slowly replaced by new materials and modern techniques.

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