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Comparison of Digital and Conventional Impression Systems in Dentistry

Dayanara Cecilia Burbano Pijal, Nahim Fernando Tito García, Leo Daniel Cabascango Perugachi

Universidad Regional Autónoma de Los Andes, Sede Ibarra, Ecuador.
Corresponding Author: Dayanara Cecilia Burbano Pijal
E-mail: dayanaraburbano@uniandes.edu.ec, nahimtg04@uniandes.edu.ec, leocp84@uniandes.edu.ec

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Abstract

Dental impressions are a tool widely used by the current dentist, they allow us to take a record, or impression of the patient's mouth, with the aim of carrying out a treatment plan, diagnosis or dental appliances, dental impressions could be classified into conventional or traditional technique and digital technique, the first is a technique used since approximately the end of the 18th century, today thanks to the advances in dentistry it has been possible to develop a technique that allows the dentist to interact with technology, we are talking about the technique digital, this is first used around 1970 by Dr. François Duret who is considered the father of modern dentistry. The digital technique consists of innovation through the use of tools such as an intraoral scanner that works by taking photographs to later indicate them in a three- dimensional way on a computer. In the present study the various advantages that can be observed in the different printing systems will be determined, for this purpose a review of various articles from sources such as PUD MED, EL SERVER, SCIELO, among others, where a significant future advantage is determined. for impressions by digital scanner, due to its speed, efficiency and detail, taking into account that its main disadvantage is its high cost, while on the conventional side the most complete material is vinylsiloxanether, giving better precision and detail than the scanner digital.

Keywords: Conventional printing; Digital printing; Printing technique; Precision

Introduction

Nowadays, thanks to the advancement of technology, dentistry has managed to develop techniques that make the work of dentists and dental technicians easier. One of the advances is dental impression, which is a fundamental part of dentistry, as it allows the creation and implementation of various dental treatments such as prostheses, crowns, fixed bridges, orthodontic appliances, in a precise and personalized way for each patient. Currently, there are two main methods for performing dental impressions: digital impression and conventional impression. In this article, we will discuss the differences between these two methods and explore their advantages and disadvantages in dentistry. A dental impression is a negative

reproduction of the details of the teeth and surrounding oral structures from which a positive reproduction is formed as a mold or model (1).

Among the printing techniques we have the conventional one, which has its origin in 1900, and the procedure is as follows, a soft paste is placed on the metal or plastic tray, it is introduced into the mouth and after a certain few minutes, (depending on the time instructions of the manufacturers), it is removed from the mouth and obtains an impression or record of the mouth in negative, They are made using printing materials that meet certain parameters such as biocompatibility, dimensional stability, cost-effectiveness, among others, mainly silicones, non-reversible hydrocolloids (alginate) or polyester. (2) With the dental impression it is possible to have a record of the teeth and the adjacent tissues (gum), then plaster is used, once the negative model of the patient's oral cavity is obtained, it must be filled with another material, plaster, which when performing a setting process will be able to positively reproduce the soft and hard tissues of the patient's mouth. It can be classified as follows. (3)

Type 1 (Plaster for impressions): it is currently in disuse as it is used to take impressions and there are products on the market that provide greater comfort to the patient. (4)

Type 2 (Plaster for models): it is characterized by being white, and the ratio is 100g of powder and 45ml of water, this makes it brittle compared to other stronger plaster, of this there are two kinds of normal setting that has a working time of 5-7 minutes and a setting time of 14 minutes, and a fast setting one whose working time is 2 to 4 minutes with a setting of 9 minutes. (4).

Type 3 (Stone plaster): this provides resistance to abrasion and is very hard, it can be used in orthodontic models and permanently since it is very resistant. An example in the water/powder ratio would be, 28ml per 100g, although its time and ratio depends on each manufacturer. (4)

Type IV (High Strength Stone Plaster): It is used for the production of dies due to its hardness, it is ideal for the manufacture of wax patterns for modeling and indirect restorations. (4)

Type V (High hardness and expansion stone plaster): tends to expand a lot to compensate for the contraction of the metal bases in fixed prostheses. (4)

Digital impression in dentistry uses intraoral scanning technology to create a three-dimensional image of the patient's teeth and gums. And this digital technique, this is used for the first time around the 1970s by Dr. François Duret who is considered the father of modern dentistry, and in 1983 he made a dental crown using the CAD system, computer aided design. This process is performed using an intraoral camera that scans the patient's mouth and creates a digital image in real-time. (8)

This digital image is processed in specialized software, depending on the manufacturer since each one uses a different software that allows the creation of a personalized tooth for the patient, this is accompanied by 3D printing technologies such as the use of resins for the creation of a physical model. (5)

Intraoral impressions allow the dentist to directly obtain the data of the prepared teeth, giving them greater precision and thus avoiding the clinical phase, the taking of the impression and the manufacture of the model, aspects that are sensitive to errors. Two benefits of intraoral digital impressions are the dimensional stability they exhibit over the long term and that they are not subject to the decontamination problems associated with indirect impression materials (3).

Materials and Methods

The search method was mainly through Scielo, MDPI, Quintessence Publishing, The Journal of Prosthetic Dentristry, Odovtos International Journal of Dental Sciences, PUDMED and

articles containing analog printing technique and digital printing technique in a time not exceeding 10 years old were related.

The study is of a nominal qualitative nature, since it evaluates two printing techniques, conventional and digital, the variables are independent and are defined as follows:

Conventional Printing

Digital Printing

Conventional printing is a technique in which it includes a tray and a paste that when introduced into the patient's mouth we obtain a negative record, after this we proceed to the emptying that is done with plaster and the positive record is obtained. (3D system compared to traditional techniques)

Digital impression: is a dental impression technique in which an intraoral scanner is used, which uses photographs to provide a 3D image of the patient's mouth.

Eligibility Criteria
Inclusion Criteria

- Printing Techniques
- Traditional or conventional printing techniques
- Digital Printing Techniques

Exclusion Criteria:

- Articles that include experimentation.
- Articles with undefined authors.

Results and Discussion

Digital Printing

Advantages and disadvantages of digital and conventional printing

Advantages	Disadvantages
72% of students prefer the digital technique as it is argued that it is easier to use, referring to the IOS system (10). Conventional printing has better accuracy than the full arcade Thus, polyvinylsiloxane is the material that best serves to maintain accuracy and stability for full-arc printing (10). With regard to impression taking in partial arches: from 1 to 4 teeth, it can be analyzed that the two techniques have a similarity in terms of precision (10). Communication with the laboratory is facilitated since the format used is virtual and, in this way, physical models will not have to be sent. (11)	The cost of tools in the digital technique is very high and this would present a difficulty when acquiring them. (11) It requires complex and expensive software systems that are compatible with the instruments. (12) Obtaining occlusion information is very complex and this reduces the possibility of performing complex prosthodontic treatments, compared to digital impressions. (14) The presence of blood, saliva, and plaque from the patient makes it difficult to take an image of the teeth in the digital technique. (13)

The digital impression technique has the ability to indicate to the patient the image of their teeth in real time. (12) The disinfection procedure is omitted, this is beneficial since it helps to avoid cross-contamination that occurs due to the count of bacteria in the case of presenting a physical printing model. (13) It does not require the use of various materials such as a bucket or other conventional materials. (8) La imagen digital se puede corregir, y su almacenamiento no es un problema por elhecho de que no ocupa espacio físico. (8)	If there is the presence of edentulous arcs, there is an inability to achieve precision in the image to be captured with the scanner. (10) The skill of the operator including that this technology is complex to learn and requires detailed information. (12) Physical storage would be a bit of an issue.

Conventional printing is a well-established and reliable method in dentistry. It's also a cheaper option compared to digital printing, at least initially. However, the accuracy of conventional prints can vary due to the deformation of the impression materials mainly in non-reversible hydrocolloids (alginate) and the possibility of human error during the impression taking process. Conventional impressions with vinylsiloxanoether material (VSE, VSES) showed the highest accuracy, while those using irreversible hydrocolloid (ALG) showed the lowest accuracy (2). This can be related to patient-related factors such as salivation and soft tissue resulting in an internal tear of the material. Addition silicone has the ability to record the most complex details, such as grooves and fissures on tooth surfaces, which is also determined by a higher price compared to alginate, and is especially useful for the manufacture of dentures and custom restorations. Addition silicone can be combined with transfer printing techniques, which allow accurate multi-model and full-arch prints to be obtained (6). In conventional dentistry, procedures and treatments are performed manually and require specific tools and materials for each task. Digital dentistry uses advanced technologies such as intraoral scanners and CAD/CAM systems to perform procedures more accurately and efficiently (7). Intraoral scanners eliminate the need to take molds with conventional materials, and CAD/CAM systems allow dental restorations to be fabricated in a single location.

short span. Digital systems also allow for better tracking and recording of patient information, which can help improve treatment planning (5).

The digital image is not affected by the deformation of the impression materials and is feasibly stored on a solid disk, without a doubt the most important advantage for the patient is that the oral scanner is less invasive, as the use of uncomfortable impression materials is not required. Finally, digital printing allows for greater efficiency in the production process, which can lead to a reduction in lead times (4). This is also related to the safety of the dental technician since having a digital impression does not involve direct manipulation, failing which there is no crossover of microorganisms and danger to it. Dental impressions are certainly contaminated with possibly pathogenic microorganisms when they come into contact with blood, saliva and bacterial plaque. (16). It is noted that in the case of conventional printing, greater accuracy ranges are found in polyvinylsiloxane, mainly in full-arch prints. Printing with polyvinylsiloxane showed a significantly better match to the custom full-arc reference model.

On the contrary, in the present study, the values obtained with PA were generally very similar to those obtained with digital scanners (5).

Conclusion

Digital printing techniques have numerous advantages over conventional methods, which often require a large number of steps and procedures as well as depend on a certain margin of error on the part of the person handling the material. However, despite these advantages, many dentists continue to use conventional techniques due to the initial cost and complexity of setting up a digital system, something that may be affected in the future as its use becomes more common, when the time comes it will be the standard for study in universities. It takes a certain level of training and knowledge in technology and software to properly handle these digital systems, which can result in a lengthy learning curve.

It is important to note that although digital printing offers many advantages, there are still some aspects that need improvement so that digital techniques can completely replace conventional methods. Ease of use and maintenance, in particular,

It is a key factor that needs to be improved to make digital systems more accessible and user-friendly for dental professionals. As technology continues to advance and more research is conducted, significant improvements in ease of use and maintenance are likely to be achieved, which will help drive the adoption of digital printing techniques in the dental industry.

Both conventional and digital printing techniques are efficient if you know how to use them. Since it was found that conventional printing can be very accurate and dimensionally stable depending on the materials used, such as the use of polyvinylsiloxane, to improve accuracy in full arch impressions, another example is the taking of impressions in partial arcs of 1 to 4 teeth, it could be considered that digital printing is very efficient since, The digital scanner would perform better than if it were used in a full arcade print, the employer's technique of this innovative tool also influences.

References

Abduo J, Elseyoufi M. Accuracy of intraoral scanners: A systematic review of influencing factors. Eur J Prosthodont Restor Dent [Internet]. 2018 [cited 2023 March 13]; 26(3):101–21. Available in: https://pubmed.ncbi.nlm.nih.gov/29989757/

Ahlholm P, Sipilä K, Vallittu P, Jakonen M, Kotiranta U. Digital versus conventional impressions in fixed prosthodontics: A review: Digital vs. Conventional impressions in fixed prosthodontics. J Prosthodont [Internet]. 2018; 27(1):35–41. Available in: http://dx.doi.org/10.1111/jopr.12527

Bi C, Wang X, Tian F, Qu Z, Zhao J. Comparison of accuracy between digital and conventional implant impressions: two- and three-dimensional evaluations. The Journal of Advanced Prosthodontics. 2022; 14(4):236.

Cicciù M, Fiorillo L, D'Amico C, Gambino D, Amantia EM, Laino L, et al.3D digital impression systems compared with traditional techniques in dentistry: A recent data systematic review. Materials (Basel) [Internet]. 2020 [cited 2023 March 13]; 13(8):1982. Available in: https://www.mdpi.com/1996-1944 /13/8/1982

CREATION OF A VIRTUAL MANUAL ON DENTAL IMPRESSIONS BASED ON DENTAL IMPRESSIONS MATERIALS PRINTOUTS AVAILABLE AT THE DENTAL CLINIC OF THE UNIVERSITY OF THE AMERICAS. QUITO: UDLA.

Ender A, Attin T, Mehl A. In vivo precision of conventional and digital methods of obtaining complete-arch dental impressions. The Journal of Prosthetic Dentistry. 2016 Mar; 115(3):313–20.

Fernández E, Rivero MG, Díaz-Yokens M, Padilla P. Traditional versus simplified impression methods for complete dentures: critical appraisal of evidence. Vital Dentistry [Internet]. 2021 [cited March 13, 2023]; (34):57–64. Available at: https://www.scielo.sa.cr/scielo.php?script=sci_arttext&pid=S1659-07752021000100057 &lang=en

Hardan L, Bourgi R, Cuevas-Suárez CE, Lukomska-Szymanska M, Cornejo-Ríos E, Tosco V, et al. Disinfection procedures and their effect on the microorganism colonization of dental impression materials: A systematic review and meta- analysis of in vitro studies. Bioengineering (Basel) [Internet]. 2022 [cited 2023 March 13]; 9(3):123. Available at: https://www.mdpi.com/2306-5354/9/3/123

Kihara H, Hatakeyama W, Komine F, Takafuji K, Takahashi T, Yokota J, et al. Accuracy and practicality of intraoral scanner in dentistry: A literature review. J Prosthodont Res [Internet]. 2020; 64(2):109–13. Available in: https://www.sciencedirect.com/science/article/pii/S1883195819302853

Malik J, Rodriguez J, Weisbloom M, Petridis H. Comparison of accuracy between a conventional and two digital intraoral impression techniques. Int J Prosthodont [Internet]. 2018; 31(2):107–13. Available in: http://dx.doi.org/10.11607/ijp.5643

Medina-Sotomayor P, Ordóñez P, Ortega G. Accuracy of Intraoral Digital Impression Systems in Restorative Dentistry: A Review of the Literature. Odovtos - International Journal of Dental Sciences. 2020 Apr 17; 205–16.

Ojeda Gutierrez F, Marquez Preciado R, Ramirez Gonzalez JH, Rojas Muñoz NAM, Martínez Martínez RE, Sánchez Robles PR, et al. Comparative study of three impression materials in their ability to reproduce the cervical margin of the preparation using the double thread and transfer coping techniques. Rev Odontol UNICID [Internet]. 2018 [cited 2023 March 13]; 30(2):157. Available in: https://pesquisa.bvsalud.org/portal/resource/pt/biblio-966165

Onbasi Y, Abu-Hossin S, Paulig M, Berger L, Wichmann M, Matta R-E. Trueness of full-arch dental models obtained by digital and conventional impression techniques: an in vivo study. Scientific Reports [Internet]. 2022 Dec 29 [cited 2023 Feb 5]; 12(1):22509. Available from: https://www.nature.com/articles/s41598-022-26983-5

Saleh A, Mathew M. A Comparison Between Conventional and Digital Dental Impression Techniques: A Review Article. Trends in Biomaterials & Artificial Organs [Internet]. 2022 Mar [cited 2023 Mar 13]; 36(2):107–10. Available from: https://search-ebscohost-com.bibliotecavirtual.udla.edu.ec/login.aspx?direct=true&db=a9h&AN=157970766&lang=en&site=eds-live

Yuzbasioglu E, Kurt H, Turunc R, Bilir H. Comparison of digital and conventional impression techniques: evaluation of patients' perception, treatment comfort, effectiveness and clinical outcomes. BMC Oral Health. 2014 Jan 30; 14(1).