

## Revolutionizing Dental Restorations: The Impact of Digital Impressions on Conventional Techniques and Modern Implant Dentistry

Dr. Sudharsan Mohana Sundaram<sup>1</sup>, Dr. V. Vidyashree Nandini<sup>2\*</sup>

<sup>1</sup>Intern, Department of Prosthodontics, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Kattankulathur Campus, Chengalpattu District, Tamilnadu, India

<sup>2</sup>Professor and Head of Department, Department of Prosthodontics, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Kattankulathur Campus, Chengalpattu District, Tamilnadu, India

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\*Corresponding author: Dr. V. Vidyashree Nandini

Professor and Head of Department, Department of Prosthodontics, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Kattankulathur Campus, Chengalpattu District, Tamilnadu, India

### Abstract

### Original Research Article

Impression techniques in dentistry are fundamental for creating precise molds of a patient's oral structures and crucial for fabricating dental restorations such as crowns, bridges, and dentures. This review explores both conventional and digital techniques, highlighting the growing prominence of digital impressions. Digital methods, which utilize intraoral scanners and CAD/CAM systems, offer enhanced precision, patient comfort, and efficiency compared to traditional methods. They are particularly beneficial for implant procedures and complex restorations. While conventional techniques remain widely used due to their cost-effectiveness and versatility, digital impressions are revolutionizing modern dentistry by streamlining workflows, improving accuracy, and facilitating better clinical outcomes. In summary, digital impressions simplify the process, and accuracy, increase patient comfort, and result in improved clinical outcomes in implant dentistry. They play a vital role in contemporary implant procedures, covering everything from initial planning to the final restoration.

**Keywords:** Prosthodontics, Dental Implants, Digital Impression, Conventional Impression, Modern Future.

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## INTRODUCTION

In dentistry, impression techniques are essential for creating accurate molds of a patient's teeth, gums, and oral structures (Wismeijer D *et al.*, 2014). These impressions are used for fabricating various dental restorations such as crowns, bridges, dentures, and orthodontic appliances. Different impression techniques and materials are depending on the clinical situation (Srinivasan M *et al.*, 2019). Conventional and digital impression techniques are now used rapidly in the dentistry field. Each method has specific indications and advantages based on the clinical requirements and the restorative procedure being planned (Azar B *et al.*, 2018). The choice of technique depends on the level of accuracy needed, the comfort of the patient, and the type of restoration being fabricated.

A conventional impression involves using a tray to deliver and hold the impression material inside the mouth, where it supports the material as it captures the shape of the oral structures (Gherlone EF *et al.*, 2016). A digital impression utilizes an intraoral scanner for direct

scanning of oral structures, capturing them as 3D data, which is then converted into polygonal information to create a digital image. Alternatively, an extraoral scanner may be used for indirect scanning, where patterns are digitized outside the mouth [Yoshimasa Takeuchi *et al.*, 2018]. The success of the procedure depends on the skill and experience of the operator using the scanner, as well as the condition of the area being scanned, which must be free of obstructions like blood, saliva, or soft tissues (Seelbach P *et al.*, 2013).



**Fig. 1:** shows using of a digital scanner to take a digital impression and create and place a crown or full-coverage restoration

Digital impressions are becoming increasingly favored due to their precision, speed, and patient comfort (Dawood A. *et al.*, 2015). Digital impressions are designed to deliver precise scans of partially edentulous dental arches, including hypermobile teeth, without causing any tooth movement, as the system operates without direct contact (Hayama H *et al.*, 2018). Digital impressions have been shown to achieve accurate RPD fittings, particularly in Kennedy Class III or IV cases with limited mucosal support. While digital impressions demonstrate greater trueness than conventional impressions, they may have slightly lower precision (Hayama H *et al.*, 2018). This method allows for evaluating the effectiveness of digital impressions taken with an intraoral scanner (IOS) in accurately capturing the morphology of partially edentulous dental arches, including areas with hypermobile teeth (Ender A. *et al.*, 2019). Our review works to show proof of how the digital impression technique will provide results for the future generation of dentistry.

## MATERIALS AND METHODS

### Conventional/Traditional Impression

Tray selection and preparation involve choosing the appropriate tray and material, such as alginate, polyvinyl siloxane (PVS), or polyether. The selected material is mixed, often using auto-mix systems for PVS or polyether (Lee SJ *et al.*, 2013). Impressions are then taken by loading the tray, inserting it into the patient's mouth, allowing it to set, and providing necessary patient instructions. After setting, the impression is carefully removed, ensuring it remains intact. It is inspected for defects, bubbles, or distortions, and all critical areas are checked to ensure they have been accurately captured. The impression is disinfected to prevent cross-contamination (Ender A. *et al.*, 2013). A model is created by pouring dental stone or plaster into the impression. Once hardened, the model is trimmed and finished. The impression or model is then sent to a dental lab to fabricate prosthetics, dentures, crowns, or other restorations. While digital impression systems are gaining popularity in modern dentistry, conventional methods remain widely used due to their versatility and cost-effectiveness (Sachin KC *et al.*, 2019).

### Digital Impression

The process begins with an initial scan, where a digital scanner captures the oral environment, including the implant site and surrounding teeth (Mangano FG *et al.*, 2014). Using Computer Aided Design (CAD) technology, the scan is utilized to design custom implant abutments and the final restoration. After the implant is placed, a final scan is performed to create the restoration (Yuzbasioglu E *et al.*, 2014). The prosthetic, whether it's a crown, bridge, or denture, is then fabricated using CAD/Computer Aided Manufacturing (CAM) technology and fitted onto the implant. In many cases, instability and discomfort can be avoided through direct data capturing, offering a more efficient and

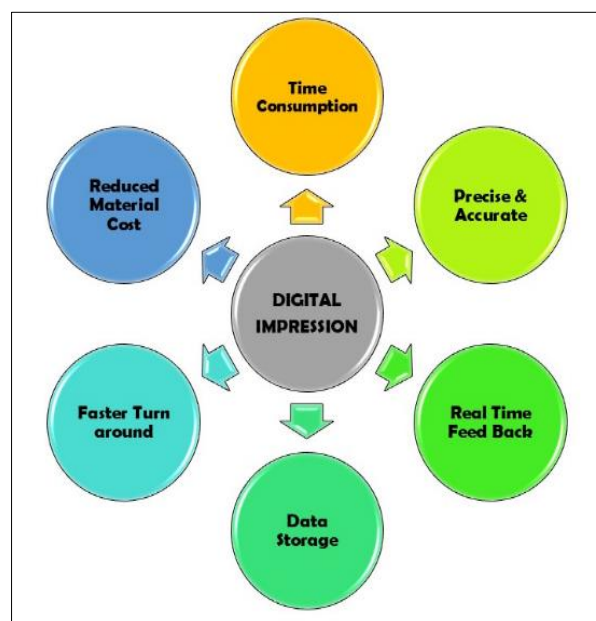
straightforward pathway to dental CAD/CAM systems. (Guth JF *et al.*, 2013). In summary, digital impressions streamline the workflow, enhance precision, improve patient comfort, and lead to better clinical outcomes in implant dentistry (Sachin KC *et al.*, 2019). They are a crucial component of modern implant treatments, from planning to final restoration.

## Pros and Cons of Impression Techniques in Dentistry

### ❖ Conventional Impression Techniques

Conventional impressions are widely used and well-established, offering cost-effectiveness, high accuracy when done correctly, and versatility without requiring digital skills. However, the drawbacks include patient discomfort, a higher risk of errors, longer procedure times, and the need for multiple appointments. Additionally, the material may experience dimensional changes, such as slight shrinkage or expansion over time, which can impact accuracy, particularly in complex implant cases.

### ❖ Digital Impression Techniques



**Fig. 2: shows the advantages of the digital impression technique in implants.**

Digital impressions offer enhanced patient comfort, and precise capture of fine details, and eliminate the risk of material distortion found in conventional methods (Mangano F *et al.*, 2017). They also speed up the treatment process, reduce material costs, provide real-time feedback for immediate corrections, and allow for easy data storage, making previous scans readily accessible for comparison or future planning (Ahlholm P *et al.*, 2018). However, the downsides include a higher initial cost compared to traditional techniques, potential scanner limitations in capturing intricate details as accurately as conventional impressions, and technical issues with the software that can delay treatment (Patel N *et al.*, 2010).

### Importance of Digital Impression in Implant

Digital impressions seamlessly integrate with CAD/CAM systems, enabling the direct fabrication of custom abutments and crowns. They offer consistent, repeatable results, which are harder to achieve with traditional methods, ensuring high-quality outcomes for each patient. Additionally, 3D modeling and simulations help dentists identify potential challenges in advance, allowing for better treatment planning and more predictable surgical outcomes. Digital impressions can be stored long-term and retrieved easily for future reference, unlike traditional molds that may degrade over time (Revilla-Leon M. *et al.*, 2019). They allow for easy duplication without needing new impressions, facilitating future adjustments or implant restorations. Additionally, they enhance aesthetics by enabling restorations to be more precisely tailored to the patient's natural teeth, improving both appearance and satisfaction (Gjelvold B *et al.*, 2016). Digital impressions are also environmentally friendly, reducing the need for physical materials like trays and alginate, thereby minimizing waste (Revilla-Leon M. *et al.*, 2019). Their use in dental implants increases accuracy, efficiency, patient comfort, and overall outcomes (Mangano F *et al.*, 2017). By streamlining workflows and improving communication with labs, digital impressions contribute to the success and predictability of implant procedures.

### Applications of Digital Impression in Dentistry

Digital impression techniques have broad applications in modern dentistry and prosthetics. In implantology, they are widely used to design crowns, bridges, and prosthetic restorations with precision. In orthodontics, they are employed to create aligners (like Invisalign), retainers, and treatment planning, reducing the reliance on traditional molds (Grunheid T *et al.*, 2014). In restorative dentistry, digital impressions streamline the production of crowns, inlays, onlays, and veneers, enabling faster and more accurate fabrication than conventional methods (Ender A. *et al.*, 2016). For full-mouth reconstructions, they support comprehensive digital workflows, particularly in complex cases like full-arch restorations (Gjelvold B *et al.*, 2016). Additionally, they integrate with chairside CAD/CAM systems, allowing for the same-day creation of restorations (Patel N *et al.*, 2010).

### DISCUSSION

Impression techniques in dentistry play a critical role in capturing accurate representations of a patient's oral structures, essential for creating various dental restorations like crowns, bridges, and dentures (Wismeijer D *et al.*, 2014). Both conventional and digital impression methods are widely used, with each having distinct advantages based on clinical needs (Srinivasan M *et al.*, 2019). Conventional techniques use a tray to take impressions with materials like polyvinyl siloxane (PVS) and polyether, producing highly accurate models that can be uncomfortable for patients (Gherlone EF *et*

*al.*, 2016). Conversely, digital impressions use intraoral scanners to capture 3D images, offering greater comfort, precision, and efficiency (Yoshimasa Takeuchi *et al.*, 2018). Digital systems reduce the risk of inaccuracies caused by material distortions and allow for quicker fabrication of restorations using CAD/CAM technology (Dawood *et al.*, 2015). Despite the benefits of digital impressions, such as better patient experience and faster procedures, conventional methods remain widely used due to cost-effectiveness and adaptability in various clinical situations (Sachin KC *et al.*, 2019). Digital techniques, particularly in implant dentistry, show great promise for enhancing accuracy and improving outcomes in restorative treatments, making them a key part of modern dental practice (Hayama H *et al.*, 2018). As digital technology continues to advance, its integration into dentistry is expected to further streamline workflows and improve the overall quality of dental care.

### CONCLUSION

Digital impressions offer greater accuracy and can produce 3-unit FPDs with a significantly closer fit compared to Vinyl Polysiloxane (VPS) impressions (Svanborg *et al.*, 2014). They are also time-efficient, with patients preferring the digital method over traditional impressions (Yuzbasigolu *et al.*, 2014). When used with the correct scanning technique, digital impressions yield excellent clinical results within their indications (Ender *et al.*, 2014). Additionally, they are seen as the most effective technique, with students finding traditional methods more challenging (Lee *et al.*, 2013). Digital impressions are faster, more efficient, and less invasive than conventional methods (Galhano *et al.*, 2012), and they allow for immediate evaluation of preparation and margins (Potincy *et al.*, 2010). However, conventional impressions remain effective, particularly in practices without digital infrastructure or in certain clinical situations. Digital impressions utilizing intraoral scanners (IOSs) have recently gained widespread adoption for the fabrication of removable partial dentures (RPDs). Overall, digital impressions are generally considered better in terms of accuracy and precision compared to conventional impressions. They offer enhanced consistency, streamline the workflow, and improve patient comfort, leading to better clinical outcomes. However, conventional impressions are still widely used due to their cost-effectiveness and established reliability, particularly in practices. However, as technology evolves, the digital impression method is expected to expand, leading to more personalized and efficient dental care with more benefits compared with the conventional methods.

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