



From Patient Comfort to Clinical Outcomes: A Comparative Literature Review of Digital and Conventional Impressions in Prosthodontic Practice

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Abstract

In the past, dental impressions were largely taken manually and time-consuming, often causing discomfort for the patient. Digital impression techniques are a possible substitute for conventional impression methods and have emerged as a revolutionary force in the prosthetics industry, but the importance of this technology cannot be overstated in the fabrication of dental restorations.

Digital impressions are thought to be favored since they save time and are more convenient for patients. On the other hand, research findings regarding accuracy are inconsistent. While some research indicates that digital impressions are on par with or even better than conventional ones, other studies suggest that conventional approaches might still be more advantageous in some circumstances.

While the use of digital impression techniques in dentistry is on the rise, there are still some gaps in the research to date that need to be addressed.

Keywords: digital impression, conventional impression, intraoral scanning, digital dentistry.

1. Introduction:

While the industry struggles to incorporate new technologies, it is crucial to examine the evidence base supporting their use. The rationale for this review stems from the need to understand the evolving landscape of prosthodontic practice in light of digital advancements and is underscored by the potential of digital impression techniques to enhance the quality of care and streamline dental practice. By providing a comprehensive analysis of recent studies, this review will contribute to the theoretical and practical knowledge essential for advancing prosthodontic practice.

The advent of digital impressions has revolutionized the field of dentistry, offering innovative solutions to traditional challenges faced in prosthodontics. This Literature review summarizes the most important results of various research studies comparing digital and conventional impression techniques in dentistry.

The studies are grouped according to the aspects they focus on, such as preference and comfort, accuracy, time efficiency and application to specific dental procedures. Distinct themes and the consensus or disagreements between the studies are highlighted.

2. Digital vs conventional impression techniques:

2.1 Preference and Comfort:

Several studies indicate that patients and clinicians clearly prefer digital impressions due to factors such as comfort, reduced gag reflex and ease of use.

Bahammam H. and Bosoni C. et al show that patients, including children and orthodontic patients, generally prefer digital impressions. ^[1,2] Patients report greater comfort, less gagging and less breathing difficulties with digital impressions. Similarly, Soliman I. et al highlights guardians' preference for digital impressions in neonates due to perceived safety and effectiveness. ^[3] Also, Sakornwimon N et al found that patients' satisfaction with digital impressions was significantly higher than with conventional impressions using polyvinyl siloxane material upon construction of zirconia crowns. ^[4]

The study by Manicone PF et al shows that; digital scanning was preferred by patients over conventional impression making for implant-supported restorations in terms of comfort, anxiety, nausea, and time perception. ^[5]

2.2 Accuracy and Clinical Outcomes:

Studies of D'Ambrosio F. et al and Baghani M. et al address the accuracy of impressions, with some reporting conflicting data, particularly in relation to full-arch rehabilitations. ^[6,7] While digital impressions are often associated with high accuracy, conventional methods are sometimes better than digital impressions in certain scenarios. Jajee M. et al stated that digital impressions were found to be accurate and comparable to conventional impressions, as tooth width measurements were not significantly different. ^[8] The study by Alam M. et al found that provisional crowns fabricated using the 3D printing technique had a higher fracture resistance, followed by CAD/CAM technique and conventional technique. ^[9]

Zhonghua K. emphasizes the importance of establishing guidelines for CAD/CAM rehabilitation and points out the need for standardization of digital techniques. ^[10] Kirova G. compares conventional and digital impression methods in implant dentistry and states that digital impressions are increasingly replacing conventional impressions. ^[11] Tohme H. et al describe a novel technique for converting an acrylic hybrid prosthesis into a metal-ceramic prosthesis using a combined analogue and digital workflow. ^[12] Ishioka Y. et al found that the digital impression would result in a greater deviation in the height of the residual ridge from the morphology of the RPD in use than the conventional impression. ^[13]

2.3 Time Efficiency:

Study of Bosoni C. et al report that digital impressions are generally faster than conventional impressions. ^[2] This is also confirmed with D'Ambrosio F. et al where digital impressions are preferred due to the less time required. ^[6] Jajee M. et al stated that conventional impressions were found to take more time. ^[8] Pereira A. et al found that digital impressions require a shorter treatment time compared to conventional impressions for fixed prostheses with full arch implants. ^[14]

2.4 Specific Dental Procedures:

The study of Soliman I et al evaluate digital impressions in neonates with cleft lip and palate and suggest that digital techniques are a safe and accurate alternative to conventional methods. ^[3] Bahammam H stated that comfort and preference are evaluated in orthodontic patients and a preference for digital impressions is found. ^[1]

In implant dentistry, Kirova G. discusses the accuracy of impressions for fixed prosthetic structures, with digital impressions gaining popularity due to their precision. ^[11]

3. Research Gaps

While the literature reviewed indicates the growing acceptance and preference for digital impression techniques in dentistry, there are notable gaps and discrepancies that deserve attention. Identifying these areas is critical for guiding future research and improving clinical practice.

3.1 Accuracy and Full-Arch Restorations:

One of the biggest gaps in research is the accuracy of digital impressions, especially for full-arch restorations. Studies such as those by D'Ambrosio F. et al and Ishioka Y. et al provide contradictory evidence for the superiority of digital over conventional techniques in capturing the full arch. While digital impressions are praised for their accuracy in single-tooth restorations and short-span prostheses, their reliability in more extensive restorations remains controversial. These conflicting research results suggest that larger, well-designed comparative studies focusing on full-arch impressions are needed to establish clear guidelines. ^[6,13]

3.2 Standardization and Guidelines:

Another gap is the lack of standardized protocols and guidelines for digital impressions. Zhonghua K. highlights this need and points out that without standardized procedures, the results of digital impressions can vary considerably. ^[10] Technological advances have outpaced the development of widely accepted clinical guidelines, which could affect the consistency and predictability of restorative outcomes. Future research should aim not only to create such guidelines, but also to validate them in different clinical settings and patient populations.

3.3 Long-Term Clinical Outcomes:

The long-term clinical outcomes of restorations made with digital impressions compared to conventional techniques are not well-documented. Most studies focus on the immediate advantages of digital technology, such as patient comfort and time efficiency. However, the longevity and success of the restorations, which are critical to patients and practitioners, need to be evaluated over extended periods. Longitudinal studies with follow-up periods reflecting the expected life span of dental restorations would provide valuable data on the efficacy of digital impressions in real-world settings.

3.4 Patient-Specific Factors:

Research often overlooks patient-specific factors such as age, dental anxiety and special needs that may influence the choice of impression technique. While studies such as stated by Bosoni C. et al focus on children, the broader demographic and psychological factors that influence patient preferences and treatment outcomes need to be fully explored. ^[2] Personalized approaches to impression taking based on individual patient characteristics could improve patient satisfaction and treatment adherence.

3.5 Cost-Effectiveness Analysis:

The economic implications of adopting digital impression systems are not thoroughly addressed in the literature. The initial investment in digital technology is significant, and while the reduction in material costs and time savings are often cited benefits, there is a lack of detailed cost-effectiveness analysis. Research in this area should consider not only the direct costs but also the indirect benefits, such as improved workflow efficiency and potential for increased patient throughput.

3.6 Interoperability and Integration:

As digital dentistry evolves, the interoperability and integration of digital impression systems with other digital workflows such as CAD/CAM fabrication and digital orthodontics are becoming increasingly important. Discrepancies in the compatibility of different systems and the seamless transition between different digital platforms are areas that require further investigation. Studies aimed at understanding and improving the integration between these digital solutions would help to streamline the restorative process.

3.7 Methodological Variance:

Methodological differences between studies, such as sample size, study design and statistical analysis, also contribute to the discrepancies in research findings. Many studies are limited by small sample sizes, single center or lack of randomization and blinding. To address these issues, future research should favor multicenter, randomized, controlled trials with sufficient statistical power to draw more definitive conclusions.

Conclusion:

Digital impressions are preferred in dentistry due to their time efficiency, patient comfort, and convenience. However, studies show contradictory results when it comes to accuracy. While digital impressions are promising in dental specialties like prosthodontics, orthodontics, and implantology, there are gaps in research that need to be addressed, including full arch restoration accuracy, standardization, long-term outcomes assessment, patient-specific factors analysis, system interoperability improvements and the elimination of methodological discrepancies. Addressing these gaps will help to optimize the clinical application of digital impression techniques and ensure high-quality dental care.

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