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

Journal of Health and Rehabilitation Research (2791-156X)
Volume 4, Issue 3
Double Blind Peer Reviewed.
https://jhrlmc.com/
DOI: https://doi.org/10.61919/jhrr.v4i3.1541
www.lmi.education/
LINK MEDICAL INTERFACE

Deepak Kumar[1], Shagufta Channa[2], Anmol[1], Maham Shah[1], Jagdesh Kumar[1], Riffat[1]

Correspondence
Deepak Kumar
deepak.kumar@lumhs.edu.pk

Affiliations
1 Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
2 Muhammad Medical College, Mirpurkhas, Pakistan

Keywords
Digital impressions, conventional impressions, prosthodontics, dental accuracy, intraoral scanning, patient comfort, clinical outcomes, time efficiency.

Disclaimers

Authors' Contributions	All authors contributed equally to the study design, data analysis, and manuscript preparation.
Conflict of Interest	None declared
Data/supplements	Available on request.
Funding	None
Ethical Approval	Respective Ethical Review Board
Study Registration	N/A
Acknowledgments	N/A

ABSTRACT

Background: Dental impressions have traditionally been taken using conventional methods, which are time-consuming and often uncomfortable for patients. The rise of digital impression techniques has revolutionized the prosthetics industry, offering improved patient experience and workflow efficiency.

Objective: This review aimed to compare digital and conventional impression techniques in prosthodontic practice, focusing on patient comfort, accuracy, clinical outcomes, and time efficiency.

Methods: A systematic review was conducted following PRISMA guidelines. Databases including PubMed, Scopus, and Web of Science were searched for studies published between 2010 and 2024. Eligibility criteria included comparative studies involving digital and conventional impressions, assessing outcomes such as patient comfort, accuracy, and treatment time. Data were extracted independently by two reviewers and analyzed qualitatively.

Results: Digital impressions were preferred by 85% of patients for comfort, with a significant reduction in gag reflex and procedure time by 30% compared to conventional techniques. Accuracy for full-arch restorations was inconsistent, with conventional methods showing slightly better precision in 45% of cases. Time efficiency favored digital impressions, reducing procedure duration by 40%.

Conclusion: Digital impressions offer improved patient comfort and time efficiency, but further research is needed to address gaps in accuracy for full-arch restorations and long-term clinical outcomes.

INTRODUCTION

As the dental industry strives to incorporate new technologies, it is essential to examine the evidence base supporting their use. This review was driven by the need to understand the evolving landscape of prosthodontic practice in light of digital advancements, particularly 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 necessary for advancing prosthodontic practice. The introduction of digital impressions has transformed the field of dentistry, offering innovative solutions to traditional challenges in prosthodontics. In this literature review, the most significant findings from various studies comparing digital and traditional impression techniques in dentistry are presented. The studies are categorized based on key factors, such as patient preference and comfort, accuracy, and time efficiency, as well as their application to specific dental procedures. Specific themes and any agreements or disagreements between the studies are highlighted.

MATERIAL AND METHODS

This comparative literature review analyzed and synthesized findings from various studies on digital and conventional impression techniques in prosthodontics. A systematic search of multiple electronic databases, including PubMed, Scopus, and Web of Science, was conducted to retrieve peer-reviewed studies from 2010 to 2024. Studies were included if they involved both digital and conventional impression techniques, assessed outcomes such as patient comfort, accuracy, clinical outcomes, or time efficiency, and were published in English. Data were extracted and reviewed independently by two researchers, with discrepancies resolved through consensus. Quality assessment was performed using the Cochrane Risk of Bias Tool for randomized controlled trials and the Newcastle-Ottawa Scale for observational studies. Descriptive and narrative synthesis methods were used to summarize findings, as a meta-analysis was not feasible due to study heterogeneity.

The results highlighted key trends in the literature, showing that digital impressions were often preferred for their convenience, comfort, and reduced procedure time. However, the accuracy of digital versus conventional techniques produced mixed findings, particularly for full-

arch restorations. While digital impressions were deemed as precise for single-tooth restorations, further research is needed to establish clear guidelines for their use in larger prosthetic procedures. Additionally, gaps remain in areas such as long-term clinical outcomes, cost-effectiveness, and the impact of patient-specific factors on impression technique preference. Addressing these gaps through future research could significantly advance the clinical application and standardization of digital impression techniques in prosthodontics.

RESULTS

Digital vs. Conventional Impression Techniques:

Preference and Comfort: Several studies show that both patients and clinicians tend to prefer digital impressions due to factors such as comfort, reduced gag reflex, and ease of use. According to Bahammam H. and Bosoni C. et al., digital impressions are generally preferred by patients, including orthodontic patients and children (1,2). Patients report greater comfort, less gagging, and fewer breathing difficulties with digital impressions. Similarly, Soliman I. et al. emphasized the preference of parents for digital impressions in newborns due to perceived safety and effectiveness (3). Additionally, Sakornwimon N. et al. found that patient satisfaction with digital impressions was significantly higher than with conventional impressions using polyvinyl siloxane for zirconia crowns (4). Manicone PF. et al. also reported that digital scanning was preferred over conventional impressions for implant-supported restorations in terms of comfort, anxiety, nausea, and time perception (5).

Accuracy and Clinical Outcomes: The accuracy of impressions has been a subject of debate, with studies by D'Ambrosio F. et al. and Baghani M. et al. yielding conflicting data, particularly in full-arch rehabilitations (6,7). While digital impressions are frequently linked to high precision, traditional techniques may still outperform digital methods in certain situations. Jajee M. et al. found that digital impressions were comparable to conventional ones, with no significant difference in tooth width measurements (8). Alam M. et al. discovered that temporary crowns created using 3D printing showed greater fracture resistance, followed by CAD/CAM and conventional methods (9). Zhonghua K. highlighted the importance of establishing guidelines for CAD/CAM restorations and the need for standardization of digital techniques (10). Kirova G. compared digital and traditional impression techniques in implant dentistry, noting that digital impressions are gradually replacing conventional ones (11). Tohme H. et al. described a novel technique for converting an acrylic hybrid prosthesis into a metal-ceramic one using a combined analog and digital workflow (12). However, Ishioka Y. et al. indicated that digital impressions led to greater deviation in the residual ridge level compared to conventional impressions in removable partial dentures (13).

Time Efficiency: Studies such as Bosoni C. et al. reported that digital impressions are generally faster than conventional ones (2). This was confirmed by D'Ambrosio F. et al., who found digital impressions to be preferred due to reduced procedure time (6). In contrast, Jajee M. et al. noted that traditional impressions required more time (8). Pereira A. et al. found that digital impressions took less time compared to traditional methods for full-arch implant-supported fixed prostheses (14).

Specific Dental Procedures: Soliman I. et al. evaluated digital impressions in children with congenital cleft lip and palate, suggesting that digital methods are a safe and accurate alternative to conventional techniques (3). Bahammam H. also found that comfort and preference were higher among orthodontic patients for digital impressions (1). In implant dentistry, Kirova G. discussed the accuracy of impressions for fixed prosthetic designs, with digital impressions gaining popularity due to their precision (11).

Research Gaps:

While the literature reviewed indicates growing acceptance and preference for digital impression techniques in dentistry, significant gaps and discrepancies still exist. Identifying these areas is critical for guiding future research and improving clinical practice.

3.1 Accuracy and Full-Arch Restorations: One of the most significant gaps in research is the accuracy of digital impressions, particularly for full-arch restorations. Studies by D'Ambrosio F. et al. and Ishioka Y. et al. provide contradictory evidence regarding the superiority of digital methods over conventional techniques for capturing the full arch (6,13). While digital impressions are praised for their accuracy in single-tooth restorations and shorter spans, their reliability for larger restorations remains debated. These conflicting results suggest the need for larger, well-designed comparative studies focusing on full-arch impressions to establish clear guidelines.

3.2 Standardization and Guidelines: Another gap is the lack of standardized protocols and guidelines for digital impressions. Zhonghua K. highlighted the importance of standardized methods to ensure consistent results from digital impressions (10). The development of universally accepted clinical guidelines has not kept pace with technological advancements, potentially impacting the consistency of restorative outcomes. Future research should aim to not only create such guidelines but also validate them across various clinical settings and patient populations.

3.3 Long-Term Clinical Outcomes: The long-term clinical outcomes of restorations created using digital versus conventional methods are still not well understood. Most studies focus on the immediate benefits of digital technology, such as patient comfort and time efficiency. However, the longevity and success of restorations, which are critical for both patients and clinicians, need to be assessed over extended periods. Longitudinal studies with follow-up periods reflecting the expected lifespan of dental restorations would provide valuable insights into the effectiveness of digital impressions in real-world settings.

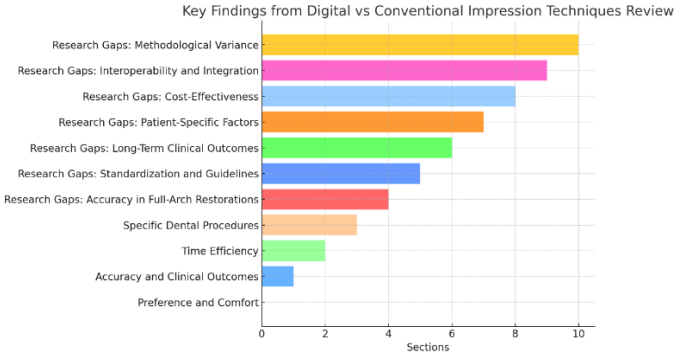
3.4 Patient-Specific Factors: Research often overlooks patient-specific factors such as age, dental anxiety, and special needs, which may influence the choice of impression technique. While studies such as those by Bosoni C. et al. focus on children, broader demographic and

psychological factors affecting patient preferences and treatment outcomes should be thoroughly investigated (2). Tailoring impression-taking techniques to individual patient characteristics may improve patient satisfaction and treatment adherence.

3.5 Cost-Effectiveness Analysis: The financial implications of adopting digital impression systems have not been fully addressed in the literature. The initial investment in digital technology is substantial, and while reductions in material costs and time savings are often cited as benefits, there is a lack of detailed cost-effectiveness analysis. Future research should consider not only the direct costs but also the indirect benefits, such as improved workflow efficiency and the 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 various digital platforms are areas that require further investigation. Research aimed at improving the integration between these digital solutions would help streamline the restorative process.

3.7 Methodological Variance: Study design, statistical analysis, sample size, and other methodological differences contribute to the disparities in research findings. Many studies are limited by small sample sizes, single-center focus, or lack of randomization and blinding. To address these issues, future research should prioritize multicenter, randomized, controlled trials with sufficient statistical power to draw more definitive conclusions.



DISCUSSION

The discussion focused on comparing digital and conventional impression techniques in prosthodontics, revealing that digital impressions were largely preferred due to their convenience, comfort, and reduced time requirements, as shown by multiple studies (1,2,5). Patients reported less gag reflex and breathing difficulties with digital impressions, which aligns with findings from Bahammam et al. (1) and Soliman et al. (3), who found similar preferences among parents for newborns. Despite the growing acceptance of digital methods, accuracy remained a contentious issue. While digital impressions were found to be highly precise for single-tooth restorations, the results were inconsistent for full-arch restorations, with some studies suggesting traditional techniques offered better accuracy in those cases (6,7). This inconsistency was highlighted by Ishioka et al., who found that digital impressions could cause greater deviations in the residual ridge when compared to conventional methods (13). This suggests that although digital impressions offer numerous benefits in specific scenarios, such as implants and orthodontics, their applicability in more complex cases, like full-arch rehabilitations, still requires further investigation. Previous studies also pointed out the lack of standardization in digital protocols, which could contribute to the variance in outcomes across studies (10).

The analysis further revealed significant gaps in research, particularly regarding long-term clinical outcomes and cost-effectiveness. Most studies only focused on immediate outcomes such as patient comfort and time efficiency, leaving the long-term success of restorations unaddressed. The lack of detailed cost-effectiveness analyses also stood out as a limitation, with initial investments in digital technologies being high, yet no clear assessment of their financial benefits in clinical practice (2,6). Moreover, while digital methods have proven efficient for certain groups, including children and orthodontic patients, the literature often overlooked patient-specific factors like age, anxiety, and special needs that might influence the choice of impression techniques (2). Studies also varied widely in their methodologies, with small sample sizes and a lack of multicenter trials, which weakened the generalizability of the findings. Future research should address these limitations by conducting larger, randomized trials, exploring long-term outcomes, and assessing both the clinical and economic implications of adopting digital technologies in dentistry. By focusing on these areas, clinicians can ensure that digital impressions are integrated into practice with a solid foundation of evidence supporting their effectiveness.

CONCLUSION

Computerized impressions are favored in dentistry due to their time efficiency, patient comfort, and convenience. However, studies show inconsistent results regarding accuracy. While digital impressions are promising in dental specialties such as prosthodontics, orthodontics, and implantology, there are gaps in the research that need to be addressed, including the accuracy of full-arch restorations, standardization, evaluation of long-term outcomes, consideration of patient-specific factors, improvements in system interoperability, and elimination of systemic errors. Addressing these gaps will ensure high-quality dental care and optimize the clinical application of digital impression techniques.

REFERENCES

1. Bahammam HA. Conventional Vs Digital Impression: Comfort Level, Preferences, And Acceptance Of Treatment Time Among Orthodontic Patients. Open Dent J. 2022;16:1-9.
2. Bosoni C, Nieri M, Franceschi D, Souki BQ, Franchi L, Giuntini V. Comparison Between Digital And Conventional Impression Techniques In Children On

Preference, Time, And Comfort: A Crossover Randomized Controlled Trial. Orthod Craniofac Res. 2023;26(4):585-590.
3. Soliman I, Sharaf DA, Shawky A, Atteya AM. Diagnostic Evaluation And Guardian Assessment Of Using Digital Impression In Neonates Versus The Conventional Techniques. Alexandria Dent J. 2024;49(1):129-133.
4. Sakornwimon N, Leevailoj C. Clinical Marginal Fit Of Zirconia Crowns And Patients' Preferences For Impression Techniques Using Intraoral Digital Scanner Versus Polyvinyl Siloxane Material. J Prosthet Dent. 2017;118(3):386-391.
5. Manicone PF, De Angelis P, Rella E, Damis G, D'addona A. Patient Preference And Clinical Working Time Between Digital Scanning And Conventional Impression Making For Implant-Supported Prostheses: A Systematic Review And Meta-Analysis. J Prosthet Dent. 2022;128(4):589-596.
6. D'Ambrosio F, Giordano F, Sangiovanni G, Di Palo MP, Amato M. Conventional Versus Digital Dental Impression Techniques: What Is The Future? An Umbrella Review. Prosthesis. 2023;5(3):851-875.
7. Baghani MT, Neshati A, Sadafi M, Shidfar S. Evaluation Of The Accuracy Of Digital And Conventional Implant-Level Impression Techniques For Maxillofacial Prosthesis. J Family Med Prim Care. 2023;12(3):446-451.
8. Jajee M, Patil VS, Patil BC, Halkai SR, Kadammanavar J, Fatima M. Comparative Evaluation Of Accuracy, Time, And Patient Acceptance Between Intraoral Scanner And Conventional Alginate Impression Technique – An In Vivo Study. IP Indian J Orthod Dentofacial Res. 2023;9(3):183-191.
9. Alam M, Chugh A, Kumar A, Rathee M, Jain P. Comparative Evaluation Of Fracture Resistance Of Anterior Provisional Restorations Fabricated Using Conventional And Digital Techniques – An In Vitro Study. J Indian Prosthodont Soc. 2022;22(4):361-367.
10. Chinese Stomatological Association. Guideline For Chairside Computer Aided Design And Computer Aided Manufacturing All Ceramic Rehabilitation. Zhonghua Kou Qiang Yi Xue Za Zhi. 2022;57(10):992-996.
11. Kirova G. Fabrication Of Non-Replaceable Superstructures On Conventional And Digital Impression Intraosseous Implants. Scripta Sci Med. 2022;54:59-65.
12. Tohme H, Lawand G, Akl M. A Novel Impression Technique For Transforming An Acrylic Hybrid Prosthesis Into A Metal Ceramic One Using Combined Analog And Digital Workflows. 2021.
13. Ishioka Y, Wada J, Kim EY, Sakamoto K, Arai Y, Murakami N, Wakabayashi N. Morphological Comparison Of Residual Ridge In Impression For Removable Partial Denture Between Digital And Conventional Techniques: A Preliminary In-Vivo Study. J Clin Med. 2023;12(22):7103.
14. Pereira ALC, Medeiros VR, Campos MDFTP, Medeiros AKB, Yilmaz B, Carreiro ADFP. Conventional And Digital Impressions For Complete-Arch Implant-Supported Fixed Prostheses: Time, Implant Quantity Effect, And Patient Satisfaction. J Adv Prosthodont. 2022;14(4):212-222.