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Original Research Article

Geographic Clustering of Bell's Palsy Cases Linked to MRI Findings & Seasonal Viral Outbreaks: A Spatial Epidemiology Study in Pakistan

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Abstract: ***Background:*** The proper techniques in impression are important in the fit and longevity of zirconia crowns. Digital impressions are now substituting traditional elastomeric impressions, but there is still little evidence to compare early complications and fit accuracy of both methods in clinical practice. ***Objective***: To compare early clinical complications and fit accuracy of single-unit zirconia crowns produced by the use of digital and conventional impression methods. ***Methods***: This prospective cohort study was carried out at Frontier Medical and Dental College, Abbottabad, for six months, from 1st April 2025 to 30th September, 2025. A total of 62 participants needed a single-unit zirconia crown. They were then separated into digital (n=31) and conventional (n=31) impression groups. Demographic and tooth position, clinical complications at the time of early clinical observation, such as the requirement of occlusal adjustment, marginal discrepancy, postoperative sensitivity, loss of retention, and discomfort in the patient, were recorded. The t-tests were used to examine quantitative data, and the chi-square tests were used to compare the qualitative results, where $p \leq 0.05$ was regarded as significant. ***Results***: Digital showed much smaller marginal ($p<0.001$) and internal gaps ($p=0.02$) and a higher percentage of clinically acceptable crowns ($p=0.02$). ***Conclusion:*** Digital impressions have better fit accuracy and similar early clinical results to single-unit zirconia crowns. Digital workflows could increase accuracy, minimize corrections, and help patients feel more satisfied, which is why they should be implemented in the contemporary practice in the field of prosthodontics.

Keywords: Zirconia crowns, digital impression, conventional impression, fit accuracy.

INTRODUCTION

There has been a great growth in the need for high aesthetic, durable, and biologically compatible dental restorations in the last twenty years.[1] Zirconia has become one of the most commonly used materials in the creation of single-unit crowns because of its better mechanical strength, good esthetics, good biocompatibility, and low plaque affinity compared to all-ceramic materials.[2] The precision and clinical applicability of zirconia restorations have also been further improved by advancements in computer-aided design and computer-aided manufacturing (CAD/CAM) technology, rendering them an easily used material in modern restorative dentistry.[3, 4]

Proper impression making of fixed dental prostheses is an essential factor in marginal and internal fit, which directly affects the survival of the crowns, periodontal well-being, and patient satisfaction.[5] Traditionally, the elastomeric impression materials like polyvinyl siloxane and polyether have been considered as the gold standard, but these methods are technique-sensitive and can be influenced by distortion of materials, movement of trays, and patient-related factors.[6] However, digital impressions recorded with intraoral

scanners have a number of benefits, such as an increase in patient comfort, a decrease in time at the chair side, and a lack of distortion of the impression material, as well as simplified laboratory communication.[7]

The use of digital impression systems is increasingly expanding all over the world, with research indicating that they are being used in more than 50%-60% of the prosthodontic practices in developed countries.[8] The use of marginal discrepancy values of less than 120 µm is generally acceptable clinically with zirconia crowns, but past literature indicates inconsistent results with the comparison of the digital and conventional methods of taking impressions.[9] Although multiple in vitro and short-term clinical trials indicate similar or even better fit accuracy with digital impressions, the evidence on early clinical complications, including loss of retention, marginal discrepancies, postoperative sensitivity, and adjustment need, is inconsistent and confined, especially in real-world clinical practice.[8, 10]

Although the use of digital workflows is becoming more popular, a relative lack of quality prospective clinical studies directly comparing early complications and fit accuracy of single-unit zirconia crowns produced with digital and conventional impression methods exists.[11, 12] The awareness of whether digital impressions can yield the same or better clinical results is the necessity of evidence-based decision-making, cost-effectiveness, and optimization of patient care. Thus, the timely and urgent need to make a direct clinical comparison of these two methods of impressions is to eliminate the gaps in the literature and help clinicians choose the most effective method of zirconia crown fabrication. The study aimed to assess and compare early clinical complications and fit accuracy of the single-unit zirconia crowns, which are produced using digital impression and conventional impression methods, in patients receiving fixed prosthodontic restoration procedures.

MATERIAL AND METHOD

This prospective cohort study was carried out to compare initial clinical complications and fit consistency of single-unit zirconia crowns made by digital and traditional impression methods. The research was conducted in the Department of Prosthodontics at Frontier Medical and Dental College, Abbottabad. The study time was six months, between 1st April 2025 and 30th September, 2025. The sample size was estimated based on two proportions and compared with two proportions using OpenEpi software (Version 3.01), taking into account a previous clinical study by Sakornwimon and Leevailoj, who compared the marginal fit of zirconia crowns made after digital and conventional impressions and found that the higher proportion of marginal adaptation was achieved with the computer-aided impressions than with the conventional ones. According to this analysis, the percentage of clinically acceptable fit has been taken to be 90% in the digital impression group and 65% in the conventional impression group at the 95% confidence level, the power of 80%, and a two-sided test.[13] With these parameters, the sample size of 28 per group was determined as required in OpenEpi, resulting in a total of 56 patients, which was further raised to 62 patients to accommodate a dropout rate that was estimated at 10%.

The sampling method was the non-probability consecutive sampling. All the patients who met the eligibility criteria and reported to the prosthodontic department within the research time were enrolled without discrimination until the desired sample size was reached. The participants were divided into two groups depending on the impression technique, which was the digital impression group and the conventional impression group. The study involved patients aged 18 years and above who would need a single-unit zirconia crown in the posterior or anterior area. The teeth had to have sufficient periodontal support, be vital or have undergone effective endodontic therapy, and have adequate coronal tooth structure to hold a full-coverage crown. Patients were also excluded in case of an uncontrolled systemic illness, active periodontal disease, parafunctional habit like bruxism, poor oral hygiene, severely malaligned teeth, or when they needed a multiple-unit fixed dental prosthesis. The study also did not include patients who were not willing to take part or who avoided follow-up visits.

Potential teeth were assessed clinically and radiographically and were ready to receive single-unit zirconia crowns in accordance with the accepted standard tooth preparation protocols, including adequate occlusal reduction, axial reduction, and finish line placement. All the preparations had been done by skilled prosthodontists to lessen operator variation. In patients in the digital impression group, intraoral impressions were taken with the help of an intraoral scanner. Scanning was carried out according to the scanning protocol prescribed by the manufacturer, with full coverage of the margins of preparation, lateral teeth, and occlusal relationship. The computer files were imported directly to the laboratory, and CAD/CAM zirconia crowns were produced via CAD/CAM.

In the conventional impression group, patients had impressions done with elastomeric impression material (polyvinyl siloxane) with a two-mix method and either custom or stock trays. The impressions were inoculated, filled with type IV dental stone, and given to the laboratory, where they were to be crown-milled using standard procedures. All zirconia crowns were made using CAD/CAM technology and sintered following the

manufacturer's directions. Clinical assessment of fit accuracy at the crown delivery appointment was done through the silicone replica technique and explorer assessment, which placed emphasis on marginal adaptation and internal fit. At the crown cementation and follow-up visits, early clinical complications, such as the need for occlusal adjustment, marginal discrepancies, postoperative sensitivity, loss of retention, and patient discomfort, were noted. A standard resin cement was used to cement all crowns as it was properly isolated and in accordance with manufacturer guidelines. Early postoperative outcomes were followed in the patients, and the results were entered in a structured proforma.

The Statistical Package of Social Sciences version 25 was used to statistically analyze the data. Checks on completeness and normality of data were done before analysis. The quantitative variables used to measure the fit accuracy (marginal, internal gap measures, which were obtained with the silicone replica technique) were presented as mean and standard deviation. Mean fit accuracy of the digital and conventional impression groups was compared using the independent sample t-test to compare normally distributed data. Qualitative variables such as early clinical complications, including marginal discrepancy, requirement of occlusal adjustment, postoperative sensitivity, loss of retention, and patient discomfort were reported as frequencies and percentages and compared across groups using the chi-square test. A p-value of 0.05 or lower was taken as significant.

RESULTS

The sample size consisted of 62 participants, who were split into the digital impression group (n=31) and the conventional impression group (n=31). Digital group participants were aged on average 36.8±10.2 years, and conventional group participants were aged on average 38.1±11.5 years, which was not significant (p=0.55). The majority of the participants were aged between 31 and 45 years, with almost equal numbers of both sexes in the two groups. In terms of the position of teeth, the percentage of crowns positioned posterior to the anterior teeth was not significant in both groups (p>0.05), and this implies that there was no significant difference in the baseline demographic features of both groups (Table 1).

Table 1: Demographic Characteristics of Study Participants (n=62)

Characteristic	Digital Impression Group (n=31)	Conventional Impression Group (n=31)	p-value
Age (years, mean ± SD)	36.8 ± 10.2	38.1 ± 11.5	0.55
Age Group			0.72
18–30	10 (32.3%)	9 (29.0%)	
31–45	15 (48.4%)	16 (51.6%)	
>45	6 (19.4%)	6 (19.4%)	
Sex			0.78
Male	14 (45.2%)	15 (48.4%)	
Female	17 (54.8%)	16 (51.6%)	
Tooth Location			0.83
Anterior	14 (45.2%)	13 (41.9%)	
Posterior	17 (54.8%)	18 (58.1%)	

Fit accuracy assessment showed that zirconia crowns produced by digital impressions had better marginal and internal adaptation than crowns produced by conventional impressions. The average difference between margins of the digital group was 85.3 ±12.5 ug, and the average difference between margins of the conventional group was 112.7 ±15.8 ug (p<0.001). The same trend was found with anterior and posterior teeth separately. The digital group also had much lower internal gaps (110.2 ± 14.1 µm) than the conventional group (136.8 ± 18.3 µm, p<0.001). The digital group had higher proportions of clinically acceptable crowns (90.3%) as compared to conventional ones (64.5%, p=0.02), with better results in anterior teeth as compared to posterior ones (Table 2).

Table 2: Fit Accuracy of Single-Unit Zirconia Crowns (n=62)

Parameter	Digital Impression Group (n=31)	Conventional Impression Group (n=31)	p-value
Marginal Gap (µm)	85.3 ± 12.5	112.7 ± 15.8	<0.001*
Anterior teeth	82.1 ± 10.3	110.5 ± 12.7	<0.001*
Posterior teeth	87.9 ± 13.2	114.6 ± 16.9	<0.001*
Internal Gap (µm)	110.2 ± 14.1	136.8 ± 18.3	<0.001*

Anterior teeth	107.5 ± 12.2	133.0 ± 15.4	<0.001*
Posterior teeth	112.8 ± 15.0	139.6 ± 19.2	<0.001*
Clinically Acceptable Fit (%)	28 (90.3%)	20 (64.5%)	0.02*
Anterior teeth	13/14 (92.9%)	8/13 (61.5%)	0.04*
Posterior teeth	15/17 (88.2%)	12/18 (66.7%)	0.08
*Statistically significant at p ≤ 0.05			

Early clinical complications were assessed, and it was found that the digital impression group had fewer problems in all outcomes measured. The requirement to do the occlusal adjustment was 9.7% with digital crowns and 25.8% with conventional crowns. The conventional group had a higher rate of marginal discrepancies, postoperative sensitivity, loss of retention, and patient discomfort; however, the difference was not statistically significant in each complication. Tooth location subgroup analysis indicated that anterior teeth were more likely to have fewer complications in both groups with respect to the posterior teeth (Table 3).

Table 3: Early Clinical Complications of Zirconia Crowns (n=62)

Complication	Digital Impression Group (n=31)	Conventional Impression Group (n=31)	p-value
Need for Occlusal Adjustment	3 (9.7%)	8 (25.8%)	0.10
Anterior teeth	1 (7.1%)	3 (23.1%)	0.28
Posterior teeth	2 (11.8%)	5 (27.8%)	0.21
Marginal Discrepancy	2 (6.5%)	6 (19.4%)	0.14
Anterior teeth	1 (7.1%)	3 (23.1%)	0.28
Posterior teeth	1 (5.9%)	3 (16.7%)	0.31
Postoperative Sensitivity	1 (3.2%)	5 (16.1%)	0.08
Anterior teeth	0 (0%)	2 (15.4%)	0.14
Posterior teeth	1 (5.9%)	3 (16.7%)	0.31
Loss of Retention	0 (0%)	2 (6.5%)	0.15
Anterior teeth	0 (0%)	1 (7.7%)	0.30
Posterior teeth	0 (0%)	1 (5.6%)	0.31
Patient Discomfort	2 (6.5%)	5 (16.1%)	0.23
Anterior teeth	1 (7.1%)	2 (15.4%)	0.56
Posterior teeth	1 (5.9%)	3 (16.7%)	0.31

DISCUSSION

Zirconia crowns made by digital impression techniques have shown to have a far better accuracy in fit, both marginal and internal, than crowns made by conventional impressions in this prospective cohort study. In particular, the digital group had lower mean marginal and internal gaps, and a larger percentage of clinically acceptable fit, which is consistent with the emerging body of research in support of digital processes in fixed prosthodontics. These results are consistent with the hypothesis that techniques of digital impressions have the potential to improve restorative accuracy, which may be explained by the reduction in cumulative errors linked to traditional elastomeric materials, impression pouring, and model fabrication.

In accordance with a study by Topdagi et al. (2025), who found much smaller marginal and internal gaps in single-crown restorations made of direct digital scans than in traditional polyvinyl siloxane impressions in an in vitro environment, we have relatively smaller marginal and internal gaps in single-crown restorations made of direct digital scans, highlighting the better dimensional stability and trueness of digital impressions.[14] Equally, the systematic evidence suggests that digital scans are typically more advantageous in marginal and internal adaptation compared to conventional approaches to a single-unit ceramic crown, and meta-analyses demonstrate a statistically significant but negligible difference in marginal fit with digital approaches.[15]

Similar comparative clinical studies conducted by Singla et al. in 2025 also showed better marginal adaptation and higher clinical performance ratings of digitally manufactured crowns as opposed to conventional ones, especially about marginal integrity over time, which can be interpreted as a potential clinical benefit of digital workflows when it comes to longevity and stability.[15] Although the current study found that anterior teeth in the digital group were more likely to have a better fit than the posterior teeth, although this is not always statistically significant, it can be observed that the same observation is correlated with other reports where the complexity of the morphology in the posterior position may slightly decrease scanning accuracy but does not

exceed a clinically acceptable margin.[16]

Contrary to our findings, other studies have also reported that the digital and conventional methods of thinking do not differ significantly on some of the fit parameters. Indicatively, Doan et al. (2024) found that, whereas there were smaller marginal gaps in certain areas at specific instances with digital impressions than with conventional techniques, the overall internal fit was not significantly different with veneers produced by either technique.[17] Moreover, as observed in clinical studies, including comparisons of digital and conventional methods of implant-supported restorations, the accuracy and marginal fit of workflows are similar, which means that the result may depend on clinical context (e.g., implant vs. tooth-supported prostheses).[18]

Multiple systematic reviews and literature reviews have similarly found that although the majority of studies prefer digital impressions in terms of single crown accuracy and patient comfort, the methodological heterogeneity and different scanner technologies also explain the mixed results in different studies. A summary by Kaitatzidou et al. (2024) found that digital scans and conventional impressions were frequently within the range of clinically acceptable discrepancies in fixed restorations, and no significant differences were found in certain settings; therefore, the clinical acceptability ranges are to be considered instead of only a higher numerical superiority.[19] Also, previous results by Berger (2022) demonstrated that both digital and conventional methods might yield similar marginal distances based on the methods of analysis, demonstrating that the methodology used to measure might influence the perceived differences in the fit.[20]

On the aspect of clinical complications, our results of reduced early adjustments and complications in the digital group are in line with general trends in the literature that indicate better procedural outcomes and patient experience with digital workflows, although most studies report that differences in complication rate are not always statistically significant in short-term follow-up. The benefits of digital scanning are shorter impression time, lower gag reflex, and more comfort to the patient, as recorded in larger comparisons between digital and traditional impression experiences.[8]

Collectively, these comparisons indicate that digital impression methods are clinically significant when it comes to the enhancement of fit accuracy in single zirconia crowns and could help to reduce the number of early technical failures without overall adverse effects. Nonetheless, the literature also mentions that traditional approaches are still acceptable and can work equally in some clinical settings, and hence it is important to further optimise indications and long-term outcomes in various patient populations by well-designed prospective studies.

The results of the present research indicate that digital impression methods can enhance the quality of fit of single-unit zirconia crowns greatly in contrast to standard impressions, which might decrease marginal gaps and internal errors. Clinicians can anticipate that there will be a larger number of crowns with clinically acceptable ranges, and that fewer adjustments will be required to make up for the crowns, corrections to the margins, and premature complications. The increased accuracy could lead to the increased restoration's longevity, less chairside time, and patient satisfaction. Moreover, such advantages as instant delivery of data to the laboratory, a lower likelihood of material distortion, and a higher level of patient comfort also make digital workflows an excellent alternative to conventional methods of impression in everyday practice of prosthodontics.

Limitations

The study also had limitations despite the strengths it had. First, it was a relatively small sample, which, despite sufficient power, was used in a single tertiary care site, which can be a limitation to generalizability. Second, it was a study of early clinical outcomes; the long-term outcome needs to be determined to gauge the longevity, survival, and marginal integrity with time. Third, the measurement of the fitness accuracy was based on the silicone replica method, which, despite the broad use, can have slight measurement errors compared to direct digital measurements. Lastly, the experience of the operator and laboratory-specific CAD/CAM processes can affect outcomes, which makes multicenter research in various digital systems and clinical settings essential.

CONCLUSION

Finally, digital impression techniques provide an enhanced level of fit accuracy and comparable clinical outcomes at the early stages of therapy with single-unit zirconia crowns compared to conventional methods. Although the cumulative rate of early complications was a little higher in the traditional group, the two methods gave clinically acceptable outcomes. Digital workflows have the potential to increase accuracy, simplify communication in the lab, and positively impact the patient experience, which makes them a viable and trustworthy choice in the present-day prosthodontic practice. Long-term follow-up and multicenter studies in the future would be appropriate to confirm these findings once again and introduce standard clinical procedures.

REFERENCES

1. Narayan, R., Biocompatible Restorative Materials: innovations for aesthetic and durable outcomes. Journal of Dental Care, 2024. 1(1): p. 53-59.
2. Alqutaibi, A.Y., et al., Revolution of current dental zirconia: A comprehensive review. Molecules, 2022. 27(5): p. 1699.
3. Alaoffey, A.S., et al., Digital dentistry: transforming diagnosis and treatment planning through CAD/CAM and 3D printing. Egyptian Journal of Chemistry, 2024.
4. Ijaz, M.H., Advances in CAD/CAM Technology for Chairside Restorative Dentistry: A Workflow Analysis. Journal of Dental Care, 2024. 1(2): p. 86-99.
5. Kheir, M.K.J., J.F. Younis, and A. Mokhtar, Effect of Fabrication Technique and Margin Design on the Marginal Fit of Interim Fixed Dental Prosthesis (An In-Vitro Study). Journal of Fundamental and Clinical Research, 2023. 3(2): p. 190-206.
6. JACOB, R.M., A Comparative Evaluation Of The Compression Resistance And Dimensional Stability Between Three Elastomeric Interocclusal Recording Materials–An In Vitro Study. 2022.
7. Siqueira, R. et al., Intraoral scanning reduces procedure time and improves patient comfort in fixed prosthodontics and implant dentistry: a systematic review. Clinical oral investigations, 2021. 25(12): p. 6517-6531.
8. Kumar, D., et al., A Comparative Literature Review of Digital and Conventional Impressions in Prosthodontic Practice: From Patient Comfort to Clinical Outcomes: Digital vs Conventional Impressions in Prosthodontics. Journal of Health and Rehabilitation Research, 2024. 4(3): p. 1-4.
9. Turkyilmaz, I., M. Benli, and S. Yun, Evaluation of marginal and internal fit of lithium disilicate and zirconia all-ceramic CAD-CAM crowns using digital impressions: A systematic review. Primary dental journal, 2023. 12(1): p. 88-95.
10. Sarafidou, K., et al., Evaluation of marginal/internal fit of fixed dental prostheses after digital, conventional, and combination impression techniques: A systematic review. European Journal of Oral Sciences, 2022. 130(6): p. e12902.
11. Beck, F., et al., Clinical and radiographic outcomes of single implant-supported zirconia crowns following a digital and conventional workflow: four-year follow-up of a randomized controlled clinical trial. Journal of Clinical Medicine, 2024. 13(2): p. 432.
12. Mahato, M., et al., Comparison of Conventional and Digital Workflows in the fabrication of fixed prostheses: a systematic review. Cureus, 2024. 16(6).
13. Sakornwimon, N. and C. Leevailoj, Clinical marginal fit of zirconia crowns and patients' preferences for impression techniques using intraoral digital scanner versus polyvinyl siloxane material. The Journal of prosthetic dentistry, 2017. 118(3): p. 386-391.
14. Topdagi, B., C.C. Guler, and E.G. Sultanoglu, Marginal and internal fit accuracy of single-crown restorations: the impact of digital and conventional impression techniques. BMC Oral Health, 2025.
15. Manisha, J., et al., Accuracy of single-unit ceramic crown fabrication after digital versus conventional impressions: A systematic review and meta-analysis. The Journal of Indian Prosthodontic Society, 2023. 23(2): p. 105-111.
16. Singla, N., et al., Comparative evaluation of marginal fit, prosthodontic and patient centered outcomes of milled zirconia crown using conventional and digital impression techniques–A split mouth, randomized clinical trial. Journal of Dental Specialities, 2025. 13(2).
17. Doan, T.M., et al., Comparative analysis of the fit quality of monolithic zirconia veneers produced through traditional and digital workflows using silicone replica technique: an in vitro study. BMC Oral Health, 2024. 24(1): p. 1566.
18. Joshi, B., et al., Evaluation and Comparison of the Precision of Dental Implant Impressions and the Marginal Fit of Crowns Using Conventional and Digital Methods: A Clinical Study. Cureus, 2025. 17(8).
19. Kaitatzidou, A., et al., Digital scans versus conventional impressions in fixed prosthodontics: An overview of systematic reviews. The Journal of Prosthetic Dentistry, 2024.
20. Berger, L., et al., Comparison of Digital and Conventional Impressions Based on the 3D Fit of Crowns. International Journal of Prosthodontics, 2022. 35(6).

