



An in Vivo Evaluation of Correlations of Open and Closed Tray Implant Impressions with Implant Longevity in Uncontrolled Diabetes Mellitus of Middle Aged Patients: An Original Research Study

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ABSTRACT:

Aim: This study aims to evaluate the correlation between open and closed tray implant impressions and implant longevity in middle-aged patients with uncontrolled diabetes mellitus.

Materials and Methods: Fifty patients reported the absence of their right mandibular first molar, with 40 choosing dental implants. Participants aged 35 to 60, including both genders with a diabetes history, were assessed before treatment with clinical evaluations and cone beam computed tomography (CBCT). Exclusions included those with mental instability, smokers, or pregnant women. After informed consent, chlorhexidine rinses were used to reduce infection risk, and pain management was achieved with an inferior alveolar nerve block. A flap was created for implant placement, followed by suturing. Two months later, a healing abutment was fitted, and custom implant-supported prostheses were created using both open and closed tray impression techniques. The study specifically focused on 40 patients with uncontrolled diabetes, divided into two groups: Group 1 (20 patients) used the open tray technique, while Group 2 (20 patients) used the closed tray method. Microcomputed Tomography (Micro-CT) assessed osseointegration and healing, evaluating the impact of impression techniques on implant longevity in this population.

Statistical Analysis and Results: The study examined 40 patients missing their right mandibular first molar who sought dental implants. Aged 35 to 60, participants included 23 males and 17 females, as shown in Table 1. They were divided into two groups: Group 1 had 20 patients using the open tray technique, and Group 2 had 20 patients using the closed tray technique. Both methods were assessed with Microcomputed Tomography (Micro-CT) to evaluate osseointegration and potential complications. In Group 1, 8 out of 20 patients with uncontrolled diabetes showed significant implant longevity, while 5 out of 20 patients in Group 2 demonstrated



notable longevity. The results indicated that Group 1 had better impression accuracy and implant longevity than Group 2. Table 4 summarises these findings, which were analysed using one-way ANOVA to evaluate the impression techniques' effectiveness.

Conclusion: The study found both impression methods viable but noted that implant durability can suffer from compromised wound healing and an increased risk of peri-implant diseases. Strict glycemic control and good oral hygiene are crucial. The open-tray technique provides better accuracy and implant longevity while the closed-tray method may lead to misalignment. The micro-CT technique is identified as a simpler, non-invasive evaluation method, highlighting the need for further research to improve clinical practice.

Introduction

Diabetes mellitus (DM) is a significant global health concern, where the burden of this chronic condition is escalating. Diabetes manifests primarily in two forms: Type 1, characterised by the autoimmune destruction of insulin-producing beta cells, and Type 2, where insulin resistance predominates, leading to elevated blood glucose levels due to both inadequate insulin production and ineffective utilisation.¹⁻³ A considerable proportion of diabetes cases remain undiagnosed, which can lead to long-term complications affecting various physiological systems, including cardiovascular, renal, and neurological functions. In the realm of dental health, individuals with diabetes often experience distinct challenges, particularly when considering dental implants as a replacement for missing teeth. While enhancements in implant technology, materials, and surgical techniques have significantly bolstered their safety and efficacy, the presence of diabetes can complicate the osseointegration process—that is, the integration of the implant with the surrounding bone tissue.⁴⁻⁶ Diabetic patients are at a heightened risk for periodontal disease, which can lead to additional tooth loss and compromised oral health. Moreover, the healing process post-surgery tends to be slower in diabetic individuals, a factor that complicates recovery and increases the likelihood of complications.^{7,8} Dietary adjustments, while critical for blood sugar management, often pose a dual challenge as they can inadvertently impact oral health and complicate the outcomes of dental restorations. Despite the critical role of effective diabetes management, the specific influences of diabetes treatment modalities and the duration of the disease on the success rate of dental implants remain poorly understood.^{9,10} In the field of implant dentistry, the open tray impression technique is widely regarded

as the gold standard for capturing impressions of implant sites. This technique enables a high level of accuracy by utilizing impression copings that directly capture the spatial orientation and position of the implants. While this method may prove to be more complex and potentially uncomfortable for certain patients, it typically provides superior outcomes compared to the closed tray technique, which can lead to discrepancies due to less precise transfer of implant positions.^{11,12} Microcomputed tomography (micro-CT) is an advanced imaging technology that offers high-resolution 3D images, particularly useful in dental implantology. It allows for detailed visualization of bone morphology and the integration between the implant and the surrounding bone. This capability is instrumental in surgical planning and evaluating the biomechanical interfaces, ensuring optimal implant placement and adaptation to the bone structure. Additionally, micro-CT enables assessment of bone quality and implant stability over time. Nevertheless, there are significant considerations regarding the use of micro-CT in clinical settings. These include concerns about patient radiation exposure and the overall costs associated with implementing this technology. Further research is necessary to address these issues and to determine the feasibility of widespread clinical application, ensuring that the benefits of micro-CT can be realized without compromising patient safety or increasing healthcare costs excessively.^{13,14} This study aims to evaluate the correlation between open and closed tray implant impressions and implant longevity in middle-aged patients with uncontrolled diabetes mellitus.



Materials and Methods

A total of 50 patients initially presented with complaints regarding the absence of their right mandibular first molar, expressing a desire for its replacement. Among these individuals, 40 opted for the replacement through the placement of dental implants paired with implant-supported prostheses. The inclusion criteria for this study encompassed individuals aged between 35 and 60 years, inclusive of both male and female participants. Each patient had a history of diabetes mellitus, whether type 1 or type 2, and all provided informed consent to participate in the study. Conversely, the exclusion criteria strictly ruled out individuals exhibiting mental instability, those who smoked, and pregnant patients, ensuring a focused and relevant participant pool. Prior to commencing the procedures, a thorough clinical assessment was conducted, complemented by cone beam computed tomography (CBCT) to facilitate meticulous treatment planning and precise implant placement. Before initiating any treatment, each patient engaged in an extensive consultation designed to ensure a comprehensive understanding of the procedure, potential risks, benefits, and expectations. This step was crucial for fostering informed consent and alleviating any concerns regarding the upcoming intervention. To uphold the highest standards of hygiene and patient safety, participants were instructed to perform a chlorhexidine mouthwash rinse immediately before the procedure. This practice underscores our unwavering commitment to a sterile environment and significantly reduces the risk of postoperative infections. Following this preparatory measure, an inferior alveolar nerve block was meticulously administered, targeting the specific nerve branches to provide effective analgesia and minimize discomfort throughout the surgical procedure. With the area adequately numbed, a carefully calibrated incision was made using a precise 15-scalpel blade. This incision facilitated the creation of a mucoperiosteal flap, allowing us to gain direct access to the underlying bone while preserving the surrounding soft tissue. The elevation of the flap required dexterity and attention to detail to ensure that the periosteum and connective tissues remained intact for optimal healing. Once access to the bone was achieved, the dental implant was systematically placed into the meticulously prepared osteotomy site, ensuring both accuracy in positioning and stability of the implant for long-term

success. This meticulous placement involved careful consideration of angulation and depth, tailored to each patient's unique anatomy. After securing the implant via the appropriate torque, the previously elevated flap was gently repositioned over the implant site, and sutures were thoughtfully applied to promote healing while maintaining stability during the recovery process. Two months following the implant placement, we fitted the healing abutment, a pivotal moment signaling progress in the recovery journey. This component plays a crucial role in shaping the surrounding tissue and ensuring a proper emergence profile for the future prosthesis. Three months later, we advanced to the creation of the custom implant-supported prosthesis. This phase involved executing the implant impression using two complementary techniques: the open tray impression technique, which provides greater accuracy in the capture of implant position, and the closed tray impression technique, which facilitates ease of handling and patient comfort. This dual approach allows for a more versatile and tailored prosthetic solution. The study ultimately encompassed a total of 40 patients diagnosed with uncontrolled diabetes mellitus, systematically divided into two distinct groups. This demographic consideration is vital, as it helps to assess the impact of diabetes on the healing and integration of dental implants, allowing us to contribute valuable data to the ongoing discourse in implantology and patient care. Group 1 included 20 patients who used the open tray technique for implant impressions. This involved placing the impression coping on the implant, creating a custom tray, injecting impression material, allowing it to set, unscrewing the coping screw, and removing the impression. Group 2 also had 20 patients who used the closed tray technique, which involved an indirect impression of the implant with the coping in place. After setting, the tray was removed, the coping unscrewed, and an implant analog attached before reinserting the assembly into the impression to create an accurate lab model. The correlation between these two impression techniques was evaluated through Microcomputed Tomography (Micro-CT), a cutting-edge technology assessing osseointegration, the heightened risk of peri-implant diseases, and potential wound healing deficiencies, as observed and evaluated by the clinician. This study was to explore the intricate relationship between open and closed tray implant impressions and their impact on the longevity of



implants in middle-aged patients grappling with uncontrolled diabetes mellitus.

Statistical Analysis and Results

In this study, all statistical analyses were meticulously conducted using SPSS software version 29.0. It is a leading tool renowned for its robust capabilities in statistical computing and data analysis across the social sciences. To rigorously evaluate the significance of our findings, we employed the chi-square test, which excels in revealing differences in proportions among diverse groups. This rigorous methodology enabled us to perform a comprehensive comparison of categorical data, ensuring that our results not only reflect underlying trends but also compellingly illustrate the critical relationships within the dataset.

Results

This extensive investigation encompasses a total of 40 patients who presented the notable absence of the right mandibular first molar and expressed a strong desire for restoration through the placement of dental implants, complemented by implant-supported prostheses. The participants were meticulously selected from a diverse and heterogeneous demographic, featuring individuals aged between 35 and 60 years. This age range allowed for a balanced representation of both male and female subjects, enriching the study's findings. In Table 1, a detailed statistical analysis methodically outlines the age and gender distribution of the patients, revealing an insightful demographic composition of 23 males and 17 females. To further illustrate these characteristics, Graph 1 provides a visual representation, enhancing the reader's understanding of the cohort's diversity. For a thorough comparative analysis, the 40 participants were categorized into two distinct groups. Group 1 consisted of 20 patients who underwent implant impressions utilizing the open tray technique, recognized for its precision in capturing the details of the implant site. Conversely, Group 2 comprised the remaining 20 patients who received impressions through the closed tray technique, a method equally important in the realm of dental prosthetics. The subtle intricacies of these two

impression methodologies were examined with meticulous care using advanced Microcomputed Tomography (Micro-CT). This cutting-edge imaging technology facilitates an intricate assessment of osseointegration, enabling the identification of potential risks for peri-implant diseases and healing complications, all evaluated by a qualified clinician. Focusing specifically on Group 1, Table 2 highlights the unique characteristics of these 20 patients, each diagnosed with uncontrolled diabetes mellitus. The open tray technique allowed for an implant impression that is crucial for ensuring the precise fabrication of an implant-supported prosthesis. The interrelationship and outcomes of this procedure were rigorously assessed using Microcomputed Tomography (Micro-CT), contributing to the reliability of the findings. The collected data underwent a meticulous statistical examination via the Pearson Chi-Square test, revealing that 8 individuals from this group exhibited significant longevity of their implants following the successful implementation of their implants and prostheses. Similarly, Table 3 delineates the details of Group 2, which also comprised 20 patients diagnosed with uncontrolled diabetes mellitus, but who underwent impression-taking utilizing the closed tray technique. As with their counterparts in Group 1, these impressions were essential for the careful crafting of implant-supported prostheses. They were also thoroughly scrutinized using Microcomputed Tomography (Micro-CT). The statistical findings, derived from the Pearson Chi-Square test, indicated that 5 patients in this group demonstrated notable longevity of their implants. A comparative evaluation between the two groups poignantly establishes that Group 1, utilizing the open tray impression technique, exhibited a moderate enhancement in both the accuracy of their impressions and overall implant longevity, particularly when contrasted with Group 2. Finally, Table 4 offers a comprehensive analysis that amalgamates the findings from all studied groups, employing one-way ANOVA to yield insightful conclusions regarding the efficacy and outcomes of the diverse impression techniques employed throughout this rigorous study.



Table 1: Age & gender based statistical description of contributing patients

Age Group (Yrs)	Male	Female	Total	P value
35-40	5	3	8	0.06
41-45	4	3	7	0.40
46-50	5	4	9	0.01*
51-55	5	3	8	0.03*
56-60	4	4	8	0.40
Total	23	17	40	*Significant

*p<0.05 significant

Graph 1: Patients demographic distribution and associated details

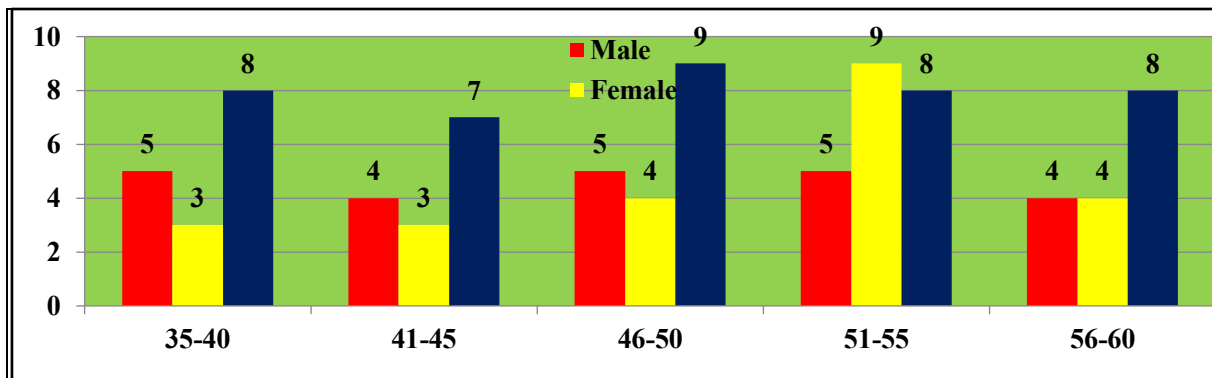


Table 2: Group 1 consisted of 20 patients diagnosed with uncontrolled diabetes mellitus. An implant impression was obtained utilising the open tray impression technique for the purpose of fabricating an implant-supported prosthesis, which was evaluated by a clinician using Microcomputed Tomography (Micro-CT). Statistical analysis was conducted employing the Pearson Chi-Square test to evaluate the results

Impact of Uncontrolled Diabetes On Implant Longevity	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Impaired Osseointegration	5	2.23	2.032	2.043	2.26	2.20	1.0	0.03*
Increased Risk Of Peri-Implant Diseases	4	2.12	1.135	1.146	2.55	2.346	1.0	0.30
Wound Healing Deficiencies	3	1.03	1.148	1.134	1.12	1.121	1.0	0.15
Increased Implant Longevity	8	2.34	2.045	2.063	2.54	2.67	1.0	0.06

*p<0.05 significant



Table 3: Group 2 consisted of 20 patients diagnosed with uncontrolled diabetes mellitus. An implant impression was obtained utilising the closed tray impression technique for the purpose of fabricating an implant-supported prosthesis which was evaluated by a clinician using Microcomputed Tomography (Micro-CT). Statistical analysis was conducted employing the Pearson Chi-Square test to evaluate the results

Impact of Uncontrolled Diabetes On Implant Longevity	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Impaired Osseointegration	7	2.24	2.035	2.045	2.32	2.34	1.0	0.05*
Increased Risk Of Peri-Implant Diseases	5	2.23	2.032	2.043	2.26	2.20	1.0	0.03*
Wound Healing Deficiencies	3	1.03	1.148	1.134	1.12	1.121	1.0	0.15
Increased Implant Longevity	5	2.23	2.032	2.043	2.26	2.20	1.0	0.03*
*p<0.05 significant								

Table 4: Estimation amongst all studied groups using one-way ANOVA

Variables	Degree of Freedom	Sum of Squares Σ	Mean Sum of Squares $m\Sigma$	F	Level of Sig. (p)
Between Groups	2	1.345	1.097	1.4	0.02*
Within Groups	21	2.452	2.026		—
Cumulative	113.10	05.675	*p<0.05 significant		

Discussion

Młynarska et al reviewed in their study that the classification of diabetes is multifaceted, encompassing various forms such as Type 1, Type 2, gestational diabetes, and other specific types. A thorough understanding of these categories is essential for healthcare professionals to formulate effective and personalised treatment plans. Type 1 diabetes is characterised by the autoimmune destruction of pancreatic β -cells, while Type 2 diabetes primarily involves insulin resistance combined with diminished insulin secretion.^{15,16} Singh A et al included in their study that recognising the symptoms of diabetes, such as

excessive thirst (polydipsia), frequent urination (polyuria), heightened fatigue, and delayed wound healing, is particularly critical during dental implant procedures.¹⁷ Wagner J et al included in their study that the patients with poorly controlled diabetes may face significant challenges, as it can severely hinder osseointegration, the biological process by which dental implants securely integrate with the jawbone. Although initial clinical outcomes in diabetic patients may superficially resemble those of their non-diabetic counterparts, long-term complications can emerge, potentially jeopardising the success of the implant.^{18,19} Nibali L et al showed in their study that as such, the practice of immediate loading of dental



implants, attaching the prosthetic tooth shortly after implant placement, should be approached with heightened caution in diabetic patients. This is essential to mitigate risks such as peri-implantitis, an inflammatory condition that can lead to the loss of the implant, and to ensure vigilant monitoring for signs of gingivitis, which can escalate into severe infections if left unchecked.^{20,21} Seif MM et al reviewed in their study that the degree to which glycemic control is managed directly influences both the process of osseointegration and the overall longevity of dental implants. Therefore, regular evaluations of HbA1c levels, an important measure of long-term blood glucose control, are essential, and necessary adjustments to therapeutic interventions must be made to optimise patient outcomes. In the realm of implant dentistry, the choice of impression technique can significantly affect the accuracy of the dental implant procedure. The open tray impression technique is renowned for its superior ability to capture the precise position of implants, though it is often more complex and may cause discomfort to some patients. In contrast, the closed tray technique offers a quicker and more straightforward alternative; however, it may lack the precision needed for achieving optimal outcomes, which is particularly crucial in the intricate field of implantology. Careful consideration of these factors is essential for dental professionals aiming to ensure the best possible results for their patients with diabetes undergoing dental implant procedures.^{22,24} Ram SM et al reviewed in their study that additionally, advanced imaging technologies, such as micro-computed tomography (micro-CT), significantly contribute to our understanding of implant stability. However, it is imperative to exercise caution regarding the associated radiation exposure. Ultimately, the integration of effective diabetes management, precise impression techniques, and advanced imaging methods is crucial for enhancing success rates in dental implantology, thereby ensuring the longevity of implants and supporting the overall health of patients.²⁵

Conclusion

Within the limitations of the study, the authors examined the relationship between open and closed tray implant impression techniques and the longevity of implants in middle-aged patients with uncontrolled diabetes mellitus. Their findings concluded that both impression methods can be used; however, the

longevity of implants in this patient population is significantly affected by compromised wound healing and a higher risk of peri-implant diseases. These results emphasise the critical importance of maintaining strict glycaemic control and ensuring optimal oral hygiene among these patients. The open-tray impression method is generally considered more accurate, especially implant longevity. In contrast, the closed-tray technique can be useful in restricted spaces, but it may lead to misalignment. Therefore, open tray impressions are preferred whenever possible, particularly for patients with diabetes. Additionally, the study highlights the micro-CT technique as a simpler, non-invasive, and time-saving method for evaluating different impression techniques. It calls for further comprehensive research to enhance our understanding of these mechanisms and to improve clinical applications in the future.

References

1. Rodriguez-Saldana J, editor. The diabetes textbook: Clinical principles, patient management and public health issues. Springer Nature; 2023 Jun 2.
2. Sidahmed S, Geyer S, Beller J. Socioeconomic inequalities in diabetes prevalence: the case of South Africa between 2003 and 2016. *BMC Public Health*. (2023) 23:324.
3. Tattersall RB, Matthews DR. The history of diabetes mellitus. *Textbook Diabetes*. (2024), 1–21.
4. Punthakee Z, Goldenberg R, Katz P. Definition, classification and diagnosis of diabetes, prediabetes and metabolic syndrome. *Can J Diabetes*. (2018) 42:S10–S5.
5. Bishu KG, Jenkins C, Yebyo HG, Atsbha M, Wubayehu T, Gebregziabher M. Diabetes in Ethiopia: A systematic review of prevalence, risk factors, complications, and cost. *Obes Med*. (2019) 15:100132.
6. American Diabetes Association, Classification and diagnosis of diabetes: standards of medical care in diabetes—2020. *Diabetes Care*. (2020) 43:S14–31.
7. Khader YS, Dauod AS, El-Qaderi SS, Alkafajei A, Batayha WQ. Periodontal status of diabetics compared with nondiabetics: a meta-analysis. *J Diabetes Complications*. 2006;20(1):59–68.



8. Chrcanovic BR, Albrektsson T, Wennerberg A. Diabetes and oral implant failure: a systematic review. *J Dent Res*. 2014;93(9):859–67.
9. Devaraju K, Rao SJ, Joseph JK, Kurapati SR. Comparison of biomechanical properties of different implant-abutment connections. *Indian Journal of Dental Sciences*. 2018; 10(3):180.
10. Chang BM, Wright RF. A solid bar splint for open-tray implant impression technique. *Journal of Prosthetic Dentistry*. 2006; 96(2):143-4.
11. Toth R. A tray-less impression technique for complete arch implant-supported immediately loaded provisional and definitive restorations. *J Prosthet Dent*. 2005;94(2):202-3.
12. Linkevicius T, Svediene O, Vindasiute E, Linkeviciene L. A technique for making impressions of deeply placed implants. *J Prosthet Dent*. 2011;106(3):204-5.
13. Agarwal S, Ashok V, Maiti S. Open- or Closed-Tray Impression Technique in Implant Prosthesis: A Dentist's Perspective. *J Long Term Eff Med Implants*. 2020;30(3):193-198.
14. Bouxsein ML, Boyd SK, Christiansen BA, Guldberg RE, Jepsen KJ, Muller R. Guidelines for assessment of bone microstructure in rodents using micro-computed tomography. *J Bone Miner Res*. 2010;25(7):1468-1486.
15. Młynarska E, Czarnik W, Dzieża N, Jędraszak W, Majchrowicz G, Prusinowski F, Stabrawa M, Rysz J, Franczyk B. Type 2 Diabetes Mellitus: New Pathogenetic Mechanisms, Treatment and the Most Important Complications. *Int J Mol Sci*. 2025 Jan 27;26(3):1094.
16. American Diabetes Association Professional Practice Committee. 2. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes-2025. *Diabetes Care*. 2025 Jan 1;48(1 Suppl 1):S27-S49.
17. Singh A, Shadangi S, Gupta PK, Rana S. Type 2 Diabetes Mellitus: A Comprehensive Review of Pathophysiology, Comorbidities, and Emerging Therapies. *Compr Physiol*. 2025 Feb;15(1):e70003.
18. Wagner J, Spille JH, Wiltfang J, Naujokat H. Systematic review on diabetes mellitus and dental implants: an update. *Int J Implant Dent*. 2022 Jan 3;8(1):1.
19. Enteghad S, Shirban F, Nikbakht MH, Bagherniya M, Sahebkar A. Relationship Between Diabetes Mellitus and Periodontal/Peri-Implant Disease: A Contemporaneous Review. *Int Dent J*. 2024 Jun;74(3):426-445.
20. Nibali L, Gkraniias N, Mainas G, Di Pino A. Periodontitis and implant complications in diabetes. *Periodontol 2000*. 2022 Oct;90(1):88-105.
21. Abuduwaili K, Huang R, Song J, Liu Y, Chen Z, Huang B, Li Z. Comparison of photogrammetric imaging, intraoral scanning and conventional impression accuracy of full-arch dental implant rehabilitation: an in vitro study. *BMC Oral Health*. 2025 May 21;25(1):753.
22. Seif MM, Hakim AAA, Abouelkheir HM, Negm RA. Comparison Of Transfer Accuracy Among Hexed Implant Mounts, Clips Impression Copings, And Open-Tray Impression Copings at Different Implant Angulations: An In Vitro Study. *BMC Oral Health*. 2025 Jun 6;25(1):928.
23. Junquera L, Pelaz A, Gallego L, García-Consuegra L, Costilla S. Bisphosphonate-related osteonecrosis associated with dental implants: a microcomputed tomography study. *Implant Dent*. 2014 Jun;23(3):258-63.
24. Fouda A, Wyatt C, McCullagh A, Vora SR, Ford NL, Gebril M. Evaluation of the accuracy of digital workflow for implant-supported full-arch fixed dental prostheses using a novel micro-CT measurement technique. *J Prosthodont*. 2025 Apr 25.
25. Ram SM, Ranadive NN, Nadgere JB. Microcomputed tomography a noninvasive method to evaluate the fit of a restoration as compared to conventional replica technique. *J Indian Prosthodont Soc* 2019;19:233-9.