Original Article

COMPARISON OF CONVENTIONAL AND PIEZOGRAPHY TECHNIQUES FOR REMOVABLE DENTURES USING THE ALBANIAN OHIP-EDENT

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ABSTRACT

Removable prosthodontic rehabilitation is an important option for restoring function, speech, and aesthetics in edentulous patients. This study aimed to compare the impact of the traditional technique of constructing removable dentures compared to the piezography technique on the quality of life of edentulous patients, assessed with the OHIP-EDENT questionnaire. 122 edentulous patients who came to the University Dental Clinic, Tirana, were randomly divided into two equal groups (n=61). Group A was treated with removable dentures constructed with the traditional technique, while Group B was treated with removable dentures constructed with the piezography technique. The basic procedures (first impression with alginate, functional impression with zinc oxide-eugenol, centric relation determination, try-in, flasking, and traditional polymerization) were the same for both groups. The difference was the recording of the piezography impression in the try-in phase. After one month of denture delivery, the patients completed the OHIP-EDENT questionnaire. After 1 month, the mean OHIP-EDENT total score was 18.89 ± 11.96 for the conventional group and 13.34 ± 9.59 for the piezography group. The difference was statistically significant (t = 2.82, p = 0.0056; *Cohen's d* = 0.51; 95 % CI 1.68–9.42), indicating a moderate and clinically meaningful improvement. The most significant improvements were observed in the domains of functionality, physical pain, and psychological comfort. Based on the results of the study, we can conclude that the piezography technique provides more comfortable and functional dentures, significantly improving the quality of life of edentulous patients.

Key words: Edentulism, Piezography, Removable dentures, OHIP-EDENT, Quality of life.

Introduction

Edentulism remains a major public health problem, with a high prevalence worldwide, especially in older populations [1, 2]. Tooth loss has been shown to significantly impair oral health-related quality of life, with greater tooth loss associated with worse functional, psychological, and social outcomes [3-6]. The main cause of edentulism is dental caries and periodontal disease, but also other factors such as trauma, systemic pathologies, and lack of access to dental care [7-9].

Tooth loss is associated with numerous functional and psychological consequences. It affects chewing, phonetics, and aesthetics, which often results in a reduction in the consumption of foods rich in fiber and protein, negatively affecting systemic health [10-13]. Apart from the practical consequences, edentulism significantly affects psychological health, social engagement, and self-worth.[14, 15]. Although the development in the field of implantology, the removable complete dentures remain a common treatment for completely edentulous patients and have shown significant improvements in oral function and quality of life [16-18].

However, the stability and retention of complete dentures are often compromised over time due to progressive residual ridge resorption, particularly in the mandible, where resorption rates are higher and the destabilizing surrounding soft-tissue musculature and perioral forces have a higher influence [19-21]. In these cases, conventional techniques may not always achieve optimal results. The piezography technique, known as neutral zone recording, is a functional method that records the physiological limits of the denture as determined by the muscles of the tongue, cheeks, and lips during functions such as speech, chewing, and swallowing [22]. This technique aims to construct removable dentures in harmony with the neuromuscular environment, improving in this way the stability, retention, and comfort [23, 24].

The OHIP-EDENT (Oral Health Impact Profile for edentulous patients), a shortened version of the OHIP-49, was designed specifically for completely edentulous patients. This instrument includes 19 questions distributed in 7 domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap [25].

The OHIP-EDENT has been proven to be a sensitive and reliable tool to compare different denture techniques and to assess changes after treatment [26-29].

This study aims to compare the impact of traditional and

piezography techniques in the construction of removable dentures on the quality of life of edentulous patients, using the OHIP-EDENT questionnaire as a measurement instrument. The null hypothesis is that there is no statistically significant difference in the overall OHIP-EDENT total scores between patients treated with removable dentures fabricated using the piezography and conventional technique [30-33].

Materials and Methods

The study was conducted at the University Dental Clinic, Tirana, and included a total of 122 edentulous patients who requested treatment with removable dentures. The main goal was to compare the results of oral health-related quality of life in patients treated with traditional removable dentures and patients treated with removable dentures, including the piezography technique. The patients were fully informed about the study prior to the start of the procedures. Patients who were edentulous and who consented to participate in follow-up appointments and fill out the OHIP-EDENT questionnaire met the inclusion criteria. Patients with neurological or mental conditions that might influence how symptoms are perceived and reported were excluded. The patient's written consent was obtained.

The study was approved by the Ethical Committee of the University of Medicine, Tirana. The study was a controlled intervention, divided into two random groups (randomized controlled trial). Patients were randomly assigned to: Group A (control, n=61): dentures constructed with the traditional technique. Group B (experimental, n=61): dentures constructed with the piezography technique.

After careful clinical examinations, the clinical procedures began. In both groups, the clinical protocol was identical until the dental trial phase: Anatomical impressions were taken with alginate using standard stock trays; Functional impressions were taken with zinc oxide–eugenol through individual trays prepared from photopolymerized resin **(Figures 1a and 1b)**. In the centric relation stage, the occlusal plane, vertical dimension, and the maxillo-mandibular relations were recorded. During the try-in procedure, the control of occlusion accuracy was done, and the control of phonetics and aesthetics as well. The conventional approach was used for the polymerisation and flasking processes. During the insertion phase, small pre-contacts were eliminated and focal occlusion was examined. In the piezography group, during the dental try-in phase, the piezographic impression was performed to record the external denture surfaces **(Figure 1c)**.

The clinicians conducted passive movements of the lips and cheeks. The patient was also instructed to perform active movements such as functional and phonetic exercises: whistling, laughing, swallowing, and pronunciation of phonemes (oo, ee, m, p, b, s). By determining the prosthesis's external surface, this recording reduced destabilizing forces by enabling the lip, cheek, and tongue muscles to rest physiologically on the device.

The OHIP-EDENT questionnaire was translated into Albanian using the standard forward–backward translation method to ensure linguistic accuracy and conceptual equivalence. Two bilingual dentists with advanced English proficiency independently translated the original English version into Albanian. Following a comparative review and discussion to resolve discrepancies, a consensus version was produced [34-38].

This version was then back-translated into English by an independent translator unfamiliar with the original questionnaire. The back-translated and original versions were compared, and minor adjustments were made to achieve semantic and cultural consistency before final approval of the Albanian version. Patients completed the OHIP-EDENT questionnaire one month after the application of the dentures. This instrument includes 19 questions distributed in 7 domains (functioning, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap). The rating scale was 0-never to 4-very often. Total score varies from 0–76 (the higher the score, the lower the quality of life) [39-42].

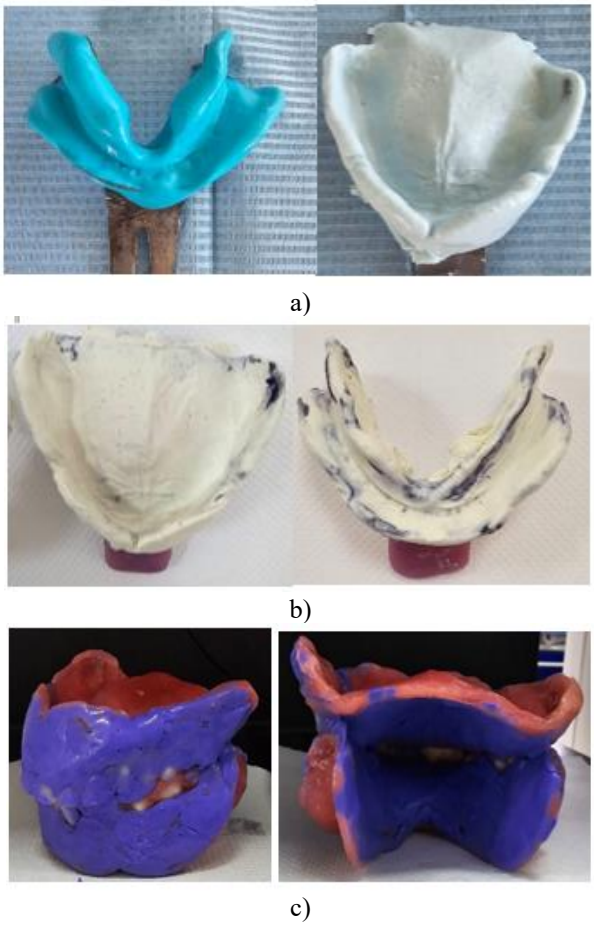


Figure 1. a) Primary Impressions. b)Final Impressions. c)Piezography Impression

Results and Discussion

Statistical analysis

Data were analyzed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA)**.** Descriptive statistics (mean ± SD) were computed for all OHIP-EDENT domains. Intergroup comparisons were performed using Welch's t-test due to potential variance heterogeneity. The level of statistical significance was set at $p < 0.05$. Cohen's d was calculated to estimate effect size (0.2 = small, 0.5 = moderate, 0.8 = large).

A total of 122 completely edentulous patients were enrolled and randomized equally into two groups: 61 patients were treated with conventional removable dentures (control group), and 61 patients were treated with removable dentures constructed with the piezographic technique (experimental group). All participants completed the one-month follow-up assessment with the OHIP-EDENT questionnaire, and no dropouts were recorded.

OHIP-EDENT total scores

At one month after denture delivery, patients treated with removable dentures constructed with the piezography technique reported significantly lower OHIP-EDENT scores compared with those treated with the conventional technique. The mean total OHIP-EDENT score for the conventional group was 18.89 ± 11.96**,** while for the piezography group it was 13.34 ± 9.59**.** This difference was statistically significant (Welch's t = 2.82, p = 0.0056**)** and corresponded to a moderate effect size (Cohen's d = 0.51; 95 % CI, 1.68–9.42). Lower OHIP-EDENT scores reflect better oral health-related quality of life, indicating, in our case, superior patient-reported outcomes for the piezography procedure **(Table 1, Figure 1)**.

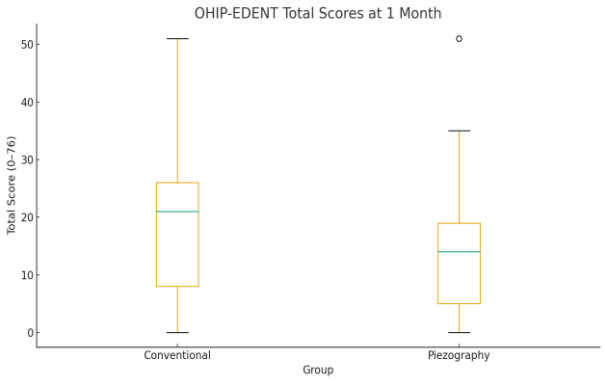
OHIP-EDENT domain scores

Domain-level analysis demonstrated consistent improvements across all seven OHIP-EDENT dimensions for the piezography group relative to the conventional group. The greatest differences were observed in psychological disability, functional limitation, and physical disability, highlighting the clinical relevance of improved comfort, function, and psychosocial adaptation. Mean ± SD values for each domain are presented in **Table 2**, and graphical comparisons are shown in **Figure 2**.

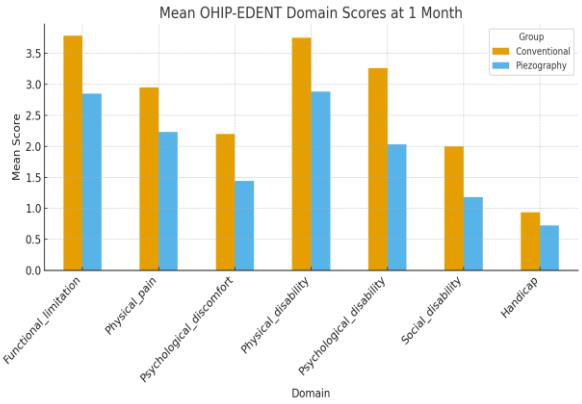
Table 1. OHIP-EDENT total scores at one month

Group	Mean	SD	N
Conventional	18.89	11.96	61.0
Piezography	13.34	9.59	61.0
Between-group difference	--	p = 0.0056, Cohen's d = 0.51	--

Figure 1. Boxplot of OHIP-EDENT total scores at one month after denture delivery in the conventional (n = 61) and piezography (n = 61) groups. Lower scores indicate better oral health-related quality of life. The piezography group showed significantly lower scores compared with the conventional group (p = 0.0056).



a)



b)

Figure 2. Mean OHIP-EDENT domain scores at one month after denture delivery in the conventional and piezography groups.

Table 2. Mean ± SD OHIP-EDENT domain scores at one month by group

Group	Functional_limitation	Physical_pain	Psychological_discomfort	Physical_disability	Psychological_disability	Social_disability	Handicap
Conventional	3.79 ± 3.19	2.95 ± 2.45	2.2 ± 1.98	3.75 ± 2.6	3.26 ± 2.83	2.0 ± 1.86	0.93 ± 1.2
Piezography	2.85 ± 2.56	2.23 ± 1.9	1.44 ± 1.52	2.89 ± 2.79	2.03 ± 1.97	1.18 ± 1.18	0.72 ± 0.92

Our study showed that patients who were treated with

removable dentures using the piezography technique had significantly better outcomes than patients who were treated with conventional dentures after one month of use. Patients in the piezography group reported significantly lower overall OHIP-EDENT scores (13.3 ± 9.6) compared with the patients in the conventional group (18.9 ± 12.0; p = 0.0056), with a moderate effect size (Cohen's d ≈ 0.51). Improvements were found across all OHIP-EDENT domains, particularly functional limitation, physical disability, and psychological well-being, confirming the clinical relevance of dentures with an external surface constructed with perioral muscle recording.

The findings support the long-established principle of the neutral zone, which defines a physiological "balance zone" within the peri-prosthetic space where internal forces of the lips and cheeks are counteracted by external pressure of the tongue. The positioning of the artificial teeth within this balance and shaping the outer surfaces under the activation of peri-oral musculature is related to an increase in stability, retention, and comfort during speech, chewing, and swallowing. In difficult clinical cases with advanced residual ridge resorption, in cases where anatomical support is compromised, the piezography impression tends to compensate for the lost tissue support, improving the outcome of the dentures.

Several studies are in line with our results, which conclude that dentures constructed through the neutral zone had improved fit and stability [43-47]. Brignardello-Petersen [43] compared complete dentures made with the neutral zone technique with the dentures made with a conventional technique; the patients were more satisfied with the neutral zone constructed dentures, particularly in terms of comfort, stability, and overall function. Clarke *et al*. [45] further emphasized that accurate tooth placement and smooth surface design are essential for achieving denture stability in atrophic jaws. Recent systematic reviews confirm these advantages: Soliman *et al*. [46] and Limpuangthip *et al*. [47] found higher satisfaction and comfort reported by patients who were treated with removable dentures constructed with the neutral zone compared to conventional methods. Also, Al-Magaleh *et al*. [48] studied the impact that dentures had on patient satisfaction through the positioning of the artificial teeth within the neutral zone; they found that dentures that were constructed according to the neutral zone

The concept resulted in significantly improved comfort and stability, chewing, and speech compared to conventional tooth positioning.

Rehmann *et al*. [49] included 21 patients who were unsatisfied with their lower complete dentures. Improved denture stability and an improvement in the patients' dental health-related quality of life were achieved by a modified neutral zone approach. While Porwal *et al*. [50] included 133 patients, with the aim of analyzing the positioning of the neutral zone referred to the residual ridge crest. Confirmed the variation of neutral zone position, highlighting the need for individualized recording. Different materials can be used to realize the impression, such as silicone putty, light silicone, Kerr wax, elastic resin, and tissue conditioner. Agrawal *et al*. [51] and Shanker *et al*. [52] used elastomeric and hydrocolloid materials, respectively, for recording the oral musculature dynamics.

In the literature, there are some articles [51-53] that have not found a significant difference between the two techniques. Rehmann *et al*. [53] reported no significant difference in speech in patients who were treated with both techniques: neutral zone and conventional, suggesting that phonetics remain unaffected by the neutral-zone technique. Geerts *et al*. [54] compared mandibular complete dentures constructed with the neutral zone technique and conventional dentures. Although both types of dentures improved oral health-related quality of life (OHRQoL), there was no significant difference between the two methods. To measure the impact of dentures on patients' perceptions, validated oral health-related quality of life instruments were used.

Likewise, Porwal and Sasaki [55] emphasized the fact that, although the clinical value of the neutral zone is well recognized, its use remains often neglected, inconsistent, and lacks standardized methodology, particularly within digital workflows.

Liu and Xu [56] concluded that clinicians should take into consideration the degree of resorption of the residual ridge when registering the polished surface, reinforcing the necessity to adapt the technique to individual anatomy. Sta Maria *et al*. [57] showed that residual ridge height and morphology significantly influence masticatory performance in patients with complete dentures, highlighting in this way the need to individualize denture design, particularly the polished surface contours, according to the degree of ridge resorption.

Our study quantifies the oral health-related quality of life of the patients by comparing the two groups and by emphasizing the efficacy of the use of the piezography technique using the OHIP-EDENT instrument for Albanian edentulous populations.

Clinical implications

Heterogeneity of evidence and modulating factors. Not all studies have reported large effects on OHRQoL; results may depend on: 1) the degree of resorption and the anatomy of the ridge, 2) the standardization of the functional recording (the functional movements, phonetic exercises, and 3) the timing of impression (in the stage of individual tray, centric relation stage, try in stage); 4) the type of registration (the neutral zone recording, the recording of denture external surface). However, the overall signal of evidence remains in favor of the neutral zone for patient-oriented outcomes.

Directions for future research

Other studies with a larger number of patients and long-term

follow-up are recommended; the use of piezography in implant-supported prostheses and digital workflows (e.g., CAD/CAM neutral-zone), [58-60] to position piezography in contemporary prosthodontics, and cost-benefit analysis to assess the economic justification of additional time/resources.

Conclusion

Respecting the neutral zone, through recording the external contours, significantly reduces the functional and psychosocial burden of edentulism. Our results support the inclusion of the piezography technique, especially in difficult clinical cases with pronounced residual ridge resorption, compromised anatomy, and patients with neuromuscular problems, in patients after surgical intervention.

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Conflict of interest: None

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Ethics statement: The study received approval from the Ethical Board of the University of Medicine, Tirana (Approval No. 28, dated August 29, 2024). Written informed consent was obtained from the patients before participation.

References

1. Zhou Y, Zhou L, Zhang W, Chen Y, She K, Zhang H, et al. Prevalence and influencing factors of oral frailty in older adults: a systematic review and meta-analysis. Front Public Health. 2024;12:1457187. doi:10.3389/fpubh.2024.1457187
2. Guan W, Li J, Liang Q, Huang Y, Li S, Xu X, et al. Disease burden and health inequality of older adults with edentulism and the projected trend until 2040: based on the global burden of disease study 2021. Clin Oral Investig. 2024;29(1):22. doi:10.1007/s00784-024-06111-5
3. Veeraboina N, Doshi D, Kulkarni S, Patanapu SK, Dantala SN, Srilatha A. Tooth loss and oral health-related quality of life among adult dental patients: a cross-sectional study. Indian J Dent Res. 2022;33(1):2–6. doi:10.4103/ijdr.IJDR_426_19
4. de Albuquerque LS, de Queiroz RG, Abanto J, Strazzeri Bönecker MJ, Soares Forte FD, Sampaio FC. Dental caries, tooth loss and quality of life of individuals exposed to social risk factors in Northeast Brazil. Int J Environ Res Public Health. 2023;20(17):6661. doi:10.3390/ijerph20176661
5. Zorawna M, Mäntylä P, Pitkälä K, Suominen MH, Kautiainen H, Saarela RKT, et al. Relationship of occlusal status with health-related quality of life among older adults in long-term care facilities. J Oral Rehabil. 2023;50(6):452–9. doi:10.1111/joor.13431
6. Seoane M, Lorenzo-Erro SM, Massa F, Hilgert JB, Hugo FN, De Marchi RJ, et al. Residual dentition, prosthesis type and oral health-related quality of life in Uruguayan adults. Gerodontology. 2023;40(3):317–25. doi:10.1111/ger.12656
7. Park HA, Shin SH, Ryu JI. Edentulous disparities among geriatric population according to the sexual difference in South Korea: a nationwide population-based study. Sci Rep. 2023;13:7854. doi:10.1038/s41598-023-35029-3
8. Khan S, Chen Y, Crocombe L, Ivey E, Owen AJ, McNeil JJ, et al. Self-reported oral health status, edentulism and all-cause mortality risk in 12 809 Australian older adults: a prospective cohort study. Aust Dent J. 2024;69(2):82–92. doi:10.1111/adj.12987
9. Tung HJ, Ford R. Incident edentulism and number of comorbidities among middle-aged and older Americans. Gerodontology. 2023;40(4):484–90. doi:10.1111/ger.12675
10. Shen J, Qian S, Huang L, Tao Y, Chen H, Deng K, et al. Association of the number of natural teeth with dietary diversity and nutritional status in older adults: a cross-sectional study in China. J Clin Periodontol. 2023;50(2):242–51. doi:10.1111/jcpe.13728
11. Zelig R, Goldstein S, Touger-Decker R, Firestone E, Golden A, Johnson Z, et al. Tooth loss and nutritional status in older adults: a systematic review and meta-analysis. JDR Clin Trans Res. 2022;7(1):4–15. doi:10.1177/2380084420981016
12. Chan AKY, Tsang YC, Jiang CM, Leung KCM, Lo ECM, Chu CH. Diet, nutrition, and oral health in older adults: a review of the literature. Dent J. 2023;11(9):222. doi:10.3390/dj11090222
13. Kaurani P, Kakodkar P, Bhowmick A, Samra RK, Bansal V. Association of tooth loss and nutritional status in adults: an overview of systematic reviews. BMC Oral Health. 2024;24(1):838. doi:10.1186/s12903-024-04602-1
14. Vemulapalli A, Mandapati SR, Kotha A, Rudraraju H, Aryal S. Prevalence of complete edentulism among US adults 65 years and older: BRFSS 2012–2020. J Am Dent Assoc. 2024;155(5):399–408. doi:10.1016/j.adaj.2024.02.002
15. Techapiroontong S, Limpuangthip N, Tumrasvin W, Sirotamarat J. Impact of poor dental status and removable dental prosthesis quality on body

composition, masticatory performance and OHRQoL: a cross-sectional study. BMC Oral Health. 2022;22(1):147. doi:10.1186/s12903-022-02103-7
16. Martins AMC, Guimarães LS, Campos CH, Küchler EC, Pereira DMS, Maia LC, et al. The effect of complete dentures on edentulous patients' OHRQoL in the long-term: a systematic review. Dent Res J (Isfahan). 2021;18:65.
17. Tariq S, Shoaib A, Chaudhary FA, Habib SR, Javed MQ. Impact of complete dentures treatment on OHRQoL in edentulous patients: case series. Pak J Med Sci. 2024;40(9):2130–5. doi:10.12669/pjms.40.9.9402
18. Nono D, Bagenda G, Okullo I, Rwenyonyi CM. Lived experiences of removable complete denture wearers in Uganda. BMC Oral Health. 2024;24(1):709. doi:10.1186/s12903-024-04484-3
19. Chitlange PM, Kambala SR, Pathak V, Doshi K, Dhamande MM. Optimizing denture success: prosthodontic rehabilitation strategy. Cureus. 2024;16(7):e64992. doi:10.7759/cureus.64992
20. Vasudeva D. Prosthodontic management in residual ridge resorption: review. Int J Health Sci. 2021;5(S2):198–204. doi:10.53730/ijhs.v5nS2.5633
21. Borges GA, Borges MH, Dini C, Marcello-Machado RM, Barão VA, Mesquita MF. Prognosis of removable complete dentures considering level of mandibular ridge resorption: systematic review. Clin Oral Investig. 2025;29(6):307. doi:10.1007/s00784-025-06379-1
22. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. J Prosthet Dent. 1976;36(4):356–67.
23. Masumi SI, Makihara E, Yamamori T, Ohkawa S. Effectiveness of denture space recording in edentulous treatment. J Prosthodont Res. 2022;66(2):221–5. doi:10.2186/jpr.JPR_D_21_00035
24. Cagna DR, Massad JJ, Schiesser FJ. The neutral zone revisited. J Prosthet Dent. 2009;101(6):405–12. doi:10.1016/S0022-3913(09)60087-1
25. Allen F, Locker D. Modified short version of OHIP for edentulous adults. Int J Prosthodont. 2002;15(5):446–50.
26. Saxena S, Mahajan N, Vinay V. Reliability and validity of Hindi OHIP-EDENT-H. J Oral Biol Craniofac Res. 2024;14(6):676–81. doi:10.1016/j.jobcr.2024.09.005
27. Poštić SD. Psychometric properties of OHIP-EDENT B&H. PLoS One. 2023;18(1):e0280012. doi:10.1371/journal.pone.0280012
28. Bural C, Geckili O, Erdogan O, Bektas-Kayhan K, Dayan SC. Reliability and validity of Turkish OHIP-EDENT-T. Eur Oral Res. 2021;55(2):67–73. doi:10.26650/eor.20210007
29. Čelebić A, Stančić I, Kovačić I, Popovac A, Topić J, Mehulić K, et al. Psychometric characteristics of Croatian and Serbian OHIP-EDENT versions. Zdr Varst. 2020;60(1):55–64. doi:10.2478/sjph-2021-0009
30. Abdel-Hadi B, Abdel-Fattah SR. Clinical pharmacist intervention in appendectomy—Dexmedetomidine as adjunct therapy. J Adv Pharm Educ Res. 2022;12(2):1–5. doi:10.51847/AYOZXtLMrj
31. Elshorbagy RT, Balbaa AEA, Ayad KE, Allam NM, Eladl HM, Allah WRA. Cognitive task versus focus of attention on dynamic postural control in recurrent ankle sprains. J Adv Pharm Educ Res. 2022;12(2):6–10. doi:10.51847/OYUrFadR58
32. Jeung DY, Chang SJ. The role of emotional labor as a mediator in the relationship between organizational climate and employee burnout. Asian J Indiv Organ Behav. 2023;3(1):1–8. doi:10.51847/OQDl5r3KKA
33. Bahrawi SAH, Ali EARFE. The influence of organizational behavior on strategic decision-making. Asian J Indiv Organ Behav. 2023;3(1):25–35. doi:10.51847/cb7NzhSkVg
34. Almutairi HS, Tashkandi MA, Yousef JM. Protective effects of resveratrol and gamma-glutamylcysteine in azathioprine-induced hepatotoxicity. Pharm Sci Drug Des. 2023;3(1):3–11. doi:10.51847/ceYBxWiWoc
35. Simonyan R, Babayan M, Yekmalyan H, Alexanyan A, Simonyan G, Alexanyan S, et al. Identification and extraction of superoxide-generating protein assemblies from helianthus tuberosus, daucus sativus, and solanum tuberosum. Spec J Pharmacogn Phytochem Biotechnol. 2023;3(1):15–20. doi:10.51847/Vj5MeBCcDs
36. Di Fiore A, Stellini E, Savio G, Rosso S, Graiff L, Granata S, et al. A review of recent literature on the handling of anterior resin-bonded cantilever restorations. J Curr Res Oral Surg. 2024;4(1):1–8. doi:10.51847/JcU1FD46Qw
37. Urusov E, Li A, Davtyan A, Mikhaylova M, Diachkova E, Makarov A. Enhancing prosthetic rehabilitation with metal-free restorations for dental tissue preservation. J Curr Res Oral Surg. 2024;4(1):9–13. doi:10.51847/r1GPip4KHD
38. Kosan Z, Bedir B, Derelioglu SS, Aydin OB, Aras A. Studying the level of knowledge of medical students about oral diseases and their relationship with general health. Turk J Dent Hyg. 2024;4(1):15–20. doi:10.51847/RIM1FBEJpn
39. de Oliveira TC, da Silva DA, de Freitas YNL, da Silva RL, de Castro Pegado CP, de Lima KC. Examining the relationship between demographic characteristics and oral health of the elderly. Turk J Dent Hyg. 2024;4(1):21–7. doi:10.51847/r8U4fC1qAh
40. Hassan F, Hatah E. An analytical exploration of various non-pharmacological approaches utilized in managing diabetes among patients in Malaysia. Int J Soc Psychol Asp Healthc. 2022;2(1):27–37. doi:10.51847/JmKuHOeBQX
41. Ahmed AAB, Alruwaili MN, Alanazi JF, Alanazi DF, Alanazi AS. Exploring diabetic patients' knowledge of complications in Saudi Arabia: a systematic review. Ann Pharm Educ Saf Public Health Advocacy. 2023;3(1):23–9. doi:10.51847/xJwwd2etBy
42. Tătaru DA, Bonțea MG, Matei C, Buzlea C. A review of common and impactful teaching methods in continuing medical education. Ann Pharm Educ Saf Public Health Advocacy. 2023;3(1):43–9. doi:10.51847/2Creeb8Jtf
43. Brignardello-Petersen R. Patients seem to be more satisfied when using complete dentures fabricated using

the neutral zone technique than those fabricated using a conventional technique. J Am Dent Assoc. 2019;150(6):e93. doi:10.1016/j.adaj.2019.01.019
44. Beenu V, Kattak AK, Pattath VS, Nair SJ, Das R, Sreelekshmi MS. Is neutral zone patients' comfort zone? A feedback review. J Pharm Bioallied Sci. 2020;12(Suppl 1):S2–5. doi:10.4103/jpbs.JPBS_56_20
45. Clarke P, Leven AJ, Youngson C. Managing the unstable mandibular complete denture: tooth placement and the polished surface. Dent Update. 2016;43(7):660–8. doi:10.12968/denu.2016.43.7.660
46. Soliman SI, Nosair AA, Abbas Al-Sadat O, Refai OM. Comparison of denture space and patient satisfaction for neutral zone versus standard-designed digital dentures restoring mandibular resorbed ridges: a crossover randomized clinical trial. J Prosthodont. 2025;34(3):252–62. doi:10.1111/jopr.13964
47. Limpuangthip N, Techapiroontong S, Prawatvatchara W. Patient-oriented outcomes following complete denture treatment: neutral zone vs conventional approach. BDJ Open. 2024;10(1):37.
48. Al-Magaleh WR, Al-Sheakly MF, Al-Rifaiy MQ, Al-Subaie SA, Al-Kheraif AA. Effect on patient satisfaction of mandibular denture tooth arrangement in the neutral zone. J Prosthet Dent. 2019;121(3):440–6. doi:10.1016/j.prosdent.2018.06.020
49. Rehmann P, Künkel AK, Weber D, Lotzmann U, Wöstmann B. Using a modified neutral zone technique to improve the stability of mandibular complete dentures: a prospective clinical study. Int J Prosthodont. 2016;29(6):573–8. doi:10.11607/ijp.4780
50. Porwal A, Sasaki K. Current status of the neutral zone: A literature review. J Prosthet Dent. 2013;109(2):129–34. doi:10.1016/S0022-3913(13)60030-X
51. Agrawal KK, Singh SV, Vero N, Alvi HA, Chand P, Singh K, et al. Novel registration technique to register neutral zone. J Oral Biol Craniofac Res. 2012;2(3):198–202. doi:10.1016/j.jobcr.2012.10.003
52. Shanker SS, Umamaheswaran A, Nayar S. Biometric denture space: concept of neutral zone revisited using a hydrocolloid impression material. J Clin Diagn Res. 2015;9(11):ZD10–2. doi:10.7860/JCDR/2015/13341.6744
53. Rehmann P, Künkel AK, Weber D, Lotzmann U, Wöstmann B. Do mandibular complete dentures made using a neutral zone technique improve speech? A pilot study. Gerodontology. 2017;34(4):501–4. doi:10.1111/ger.12285
54. Geerts GAVM. Neutral zone or conventional mandibular complete dentures: a randomised crossover trial comparing oral health-related quality of life. J Oral Rehabil. 2017;44(9):702–8. doi:10.1111/joor.12533
55. Porwal A, Satpathy A, Jain P, Ponnanna AA. Association of neutral zone position with age, gender, and period of edentulism. J Prosthodont. 2018;27(3):232–9. doi:10.1111/jopr.12485
56. Liu XH, Xu J. Change of polished surface contours on mandibular complete denture base in different residual ridge resorption situation: a pilot study. Zhonghua Kou Qiang Yi Xue Za Zhi. 2010;45(7):408–12.
57. Sta Maria MT, Hasegawa Y, Marito P, Yoshimoto T, Salazar S, Hori K, et al. The impact of residual ridge morphology on the masticatory performance of complete denture wearers. Heliyon. 2023;9(5):e16238. doi:10.1016/j.heliyon.2023.e16238
58. Soliman SI, Nosair AAA, Abbas Al-Sadat O, Refai OM. Comparison of denture space and patient satisfaction for neutral zone versus standard-designed digital dentures restoring mandibular resorbed ridges: a crossover randomized clinical trial. J Prosthodont. 2025;34(3):252–62. doi:10.1111/jopr.13964
59. Choi S, Kim S, Chang JS. The neutral zone approach with CAD-CAM record bases. J Prosthodont. 2022;31(6):459–63. doi:10.1111/jopr.13502
60. Carrière M, Prudentos JB, Lecigne A, Laran A, Nguyen CT, Destruhaut F, et al. Digital optimization of teeth setup in an edentulous patient with partial glossectomy: a case report. J Prosthodont. 2023;32(6):461–8. doi:10.1111/jopr.13685