RESEARCH PAPER

Comparative Evaluation of Residual Ridge Resorption and Occlusal Changes in Patients Wearing Conventional Complete Dentures Versus Implant-Supported Overdentures

Kishore Kumar Khatri[1], Tamana Khatri[2], Hafiz Muhammad Ali Nawaz[3], Farnaz Ilyas[4], Aiman Yaseen[5], Kamran Parvez[6]

[1]PhD Student University of Sains Malaysia Kubang Kerian Kelantan Malaysia/ Consultant, Aga Khan Hospital, Karimabad, Karachi, Sindh, Pakistan.
[2]TMD & Orofacial Pain Resident at University of Buffalo, New York, USA.
[3]Dental Surgeon, Chaklala Cantonment Medical Center, Rawalpindi, Punjab, Pakistan.
[4]Associate Professor, Department of Prosthodontics, Bahria University Medical and Dental College, Karachi, Sindh, Pakistan.
[5]Resident Prosthodontics, Altamash Institute of Dental Medicine, Karachi, Sindh, Pakistan.
[6]Assistant Professor, HOD / Incharge Department of Prosthodontics, Karachi Medical and Dental College Karachi Metropolitan University, Karachi, Sindh, Pakistan.

***Corresponding:** Kishore Kumar Khatri,
PhD Student University of Sains Malaysia Kubang Kerian Kelantan Malaysia/ Consultant, Aga Khan Hospital, Karimabad, Karachi, Sindh, Pakistan. Email: khatri.kishore@aku.edu

Received: 05-08-2026, Revised: 08-10-2026, Accepted: 19-10-2026, Published: 30-10-2026

ABSTRACT

Background: Residual ridge resorption and occlusal instability are significant problems of conventional complete dentures. Overdentures that are supported by implants can provide better prosthetic function and maintain residual alveolar bone.

Objective: To compare residual ridge resorption and occlusal changes in patients wearing conventional complete dentures and implant-supported overdentures.

Methods: A comparative, cross-sectional study was undertaken of 50 completely edentulous patients, with 25 patients in each of the two treatment groups: conventional complete denture (CCD) and implant-supported overdenture (ISOD). The clinical denture performance, dimensions of the mandible and occlusion were evaluated. Data were analyzed using SPSS 26 software, appropriate parametric and non-parametric test and multivariable linear regression. Statistical significance was set at $p \leq 0.05$.

Results: Implant-supported overdenture users demonstrated significantly better retention (92% vs. 52%), stability (96% vs. 56%) and support (92% vs. 60%). The anterior and posterior ridge resorption were less in implant supported group (0.76 ± 0.21 mm and 0.82 ± 0.18 mm, respectively) than in conventional denture group (1.12 ± 0.24 mm and 1.04 ± 0.19 mm, respectively). There were also less occlusal discrepancies (24% compared to 60%).

Conclusion: Implant-supported overdentures demonstrated comparatively favourable clinical, radiographic and occlusal outcomes.

Keywords: Complete Dentures; Implant-supported Overdentures; Residual Ridge Resorption; Occlusal Changes; Edentulism

How to cite this article: Khatri KK, Khatri T, Nawaz HMA, Ilyas F, Yaseen A, Parvez K. Comparative Evaluation of Residual Ridge Resorption and Occlusal Changes in Patients Wearing Conventional Complete Dentures Versus Implant-Supported Overdentures. IJDDT. 2026;16(90s):1240-1245. DOI: 10.25258/ijddt.16.90ss.122

INTRODUCTION

Residual ridge resorption is a natural, non-reversible biological process that takes place after the loss of tooth structure and is an ongoing process throughout life, especially in complete denture wearers.[1] Alveolar bone loss (ABL) impacts denture-bearing tissues, causing a loss of ridge height, width, and denture retention and stability, and decreasing denture support and masticatory efficiency.[2] The functional forces generated by conventional CDs are transmitted directly to the underlying mucosa and residual alveolar ridge and could accelerate the bone remodeling process and lead to changes in the morphology of the alveolar ridges.[3] Beyond the anatomical changes, progressive ridge resorption can also impact occlusal relationships, leading to decreased occlusal stability, changes in vertical dimension, uneven masticatory force distribution, and chewing dysfunction.[4]

Overdentures that are supported with implants are another treatment option that enhances the retention and stability of the prosthesis with osseointegrated implants.[5] Implant-supported overdentures offer additional support and retention, and they change the distribution of functional loading when compared to traditional complete dentures.[6] The placement of implants may also help maintain peri-implant alveolar bone, although there may still be some residual ridge resorption in non-implant-supported areas.[6] Oclusal changes can also occur over time due to attachment wear, settling of the prostheses, changes in supporting tissues, and changes in contact between the teeth.[7] Thus, the dimensions of residual ridges as well as the occlusal characteristics are parameters that should be included in assessing the long-term clinical success of these approaches to prosthetic rehabilitation.

There is clinical evidence for differences in ridge resorption between these rehabilitation modalities. The study by Km et al. in 2021 was a random pilot study that compared single implant-supported mandibular overdentures to conventional complete dentures over the course of a year.[8] The residual ridge resorption was 0.88 ± 0.22 mm in the implant-supported group and 1.04 ± 0.15 mm in the conventional denture group at the posterior part of the mandible. In the maxillary anterior region, the bone loss was 0.62 ± 0.20 mm and 0.89 ± 0.27 mm, respectively, which also showed comparatively lower bone loss among the implant overdenture users.[8]

Likewise, Sarıbal et al. (2022) compared the mandibular alveolar bone changes of 126 patients who were edentulous and placed with conventional complete dentures (CCD) or implant-supported overdentures (IO) using radiographic measurements at two and six years. The implant-supported overdenture group showed significantly reduced alveolar bone loss at multiple sites, such as the anterior and molar sites.[9]

Another factor that is significant in long-term studies of complete denture rehabilitation is any changes in occlusion.[4, 10, 11] Displacements in dentures, changes in tissue support, and occlusal changes brought on by residual ridge remodeling can result in progressive changes to the occlusal contacts of conventional dentures.[12] Prosthetic stability and retention are often better with implant-supported overdentures, and this might lead to better occlusal contact and functional loading. However, both treatment methods can have a change in the distribution of occlusion, the vertical dimension, and the prostheses. These changes can be compared with the measurement on radiographs of residual ridge resorption to give a wider picture of prosthetic outcomes. The purpose of the present study was to compare each patient to compare the residual ridge resorption and occlusal changes in conventional complete denture versus implant-supported overdenture patients.

METHODS

A comparative cross-sectional study was performed to assess the residual ridge resorption and occlusal modification of patients with conventional complete dentures and patients with implant-supported overdentures. The study was carried out at the Department of Prosthodontics, Aga Khan University Hospital, Karachi, in Karimabad. The study was carried out for a period of 6 months from 1st October 2025 to 31st March 2026.

A sample size was calculated by using OpenEpi version 3.01 for two independent means comparison, where the primary outcome was the resorption of the mandibular posterior ridge. The calculation was based on the previous randomized pilot study of Km et al. (2021) that found that the mean ridge resorption in conventional complete denture wearers was 1.04 ± 0.15 mm after 12 months and that of implant-supported overdenture wearers was 0.88 ± 0.22 mm after 12 months.[8] With a two-sided 95% confidence, 80% statistical power, and a hypothesized mean difference of 0.16 mm, a sample size of 22 per group was calculated. The final sample size was 50 patients, 25 in each group, after allowing for possible incomplete records and non-evaluable participants.

Non-probability consecutive sampling was employed, and the eligible patients who presented to the Prosthodontics Department during the study period were recruited until the required sample size was obtained. Patients in the study were completely edentulous and between the ages of 45-75 years, wearing traditional complete dentures or mandibular implant-supported overdentures for at least six months. Patients with clinically satisfactory prostheses, good follow-up records, and available radiographic evaluation were selected. Patients were excluded if they had a history of systemic or metabolic bone disorders, previous head and neck radiotherapy, medications affecting bone metabolism, previous oral surgical procedures, active periodontal and oral mucosal disease, traumatic injuries to the jaws, or poorly fitting and damaged dentures. Incomplete clinical and/or radiographic records were also excluded.

After obtaining approval from the institutional ethical review committee, written informed consent was obtained from all participants. The participants were split into two groups based on their prosthetic rehabilitation. Group I consisted of patients with conventional maxillary and mandibular complete dentures, while Group II consisted of patients with mandibular implant-supported overdentures opposing conventional maxillary complete dentures. A structured proforma was used for taking demographic information such as age, gender, duration of edentulism, duration of denture use, smoking history, and medical history. A clinical examination was conducted to evaluate the retention, stability, support, occlusal contacts, and the condition of the prostheses.

Standardized orthopantomograms (OPGs) were used to evaluate the residual ridge height, and measurements were made at predetermined areas of the anterior and posterior mandibles with the aid of digital radiographic software. In cases where radiographs were available, they were reviewed to assess changes in residual ridge height over time. The occlusal changes were examined by the use of articulating paper and shimstock to determine the

pattern of occlusal contacts, early contacts, and occlusal discrepancies. Available baseline prosthetic records were also used to document changes in the occlusion and vertical dimension. Standardized assessment protocols were used for all clinical and radiographic evaluations, and results were noted for each group.

Analysis of the data was carried out using SPSS 26. The quantitative data such as age, duration of denture use, residual ridge height, ridge resorption, and occlusal measurements were expressed as mean ± SD or median (IQR) as appropriate. Quantitative variables, such as age, gender, smoking status, denture type, and frequency of occlusal discrepancies, were summarized as frequencies and percentages. Shapiro-Wilk test was used to determine if quantitative data were normally distributed. An independent-samples t-test was applied for comparison between the two groups, while chi-square and Fisher's exact test were used for categorical variables. Multivariable linear regression was used as needed to control for potential confounding factors, such as age, length of time edentulous, and length of time wearing dentures. A p-value of ≤ 0.05 was identified as statistically significant.

RESULTS

The baseline demographic and clinical parameters of the study group did not show any significant difference between the two groups with respect to age, gender distribution, and duration of edentulism, duration of denture use, smoking history, and diabetes mellitus. This comparability reduced the possible effect of differences at baseline on the following clinical and radiographic comparisons (Table 1).

Clinical evaluation showed significantly better retention, stability, and support in patients receiving implant-supported overdentures than in conventional complete dentures. However, the difference in overall prosthetic condition between the groups was not statistically significant (Table 2).

The results of the radiographic evaluation showed significantly higher anterior and posterior mandibular ridge heights in the implant-supported overdenture group. Moreover, the measurements of anterior and posterior residual ridge resorptions were significantly lower in this group, thus reflecting a comparatively better preservation of the mandibular residual ridge (Table 3).

All the patients wore conventional complete dentures, and the occlusal assessment revealed that they had a higher incidence of premature contacts, lack of even occlusal contact distribution, low occlusal stability, and occlusal discrepancies overall. Patients with implant-supported overdentures had a significantly more satisfactory occlusal relationship. The change in the vertical dimension in the two groups, however, was not statistically significant (Table 4).

Multivariable linear regression showed that implant-supported overdentures were independently related to a decrease in posterior mandibular ridge resorption. Longer duration of edentulism was also significantly associated with increased ridge resorption, whereas age and duration of denture use were not significant predictors (Table 5).

Table 1

Demographic and baseline characteristics of study participants (N = 50)

Variable	Conventional complete dentures (n = 25)	Implant-supported overdentures (n = 25)	p-value
Age (years), mean ± SD	61.8 ± 7.2	59.6 ± 6.8	0.270
Male, n (%)	14 (56.0)	13 (52.0)	0.777
Female, n (%)	11 (44.0)	12 (48.0)	
Duration of edentulism (years), mean ± SD	8.4 ± 3.1	7.9 ± 2.8	0.551
Duration of denture use (years), mean ± SD	5.6 ± 2.4	4.9 ± 2.1	0.278
Smoking history, n (%)	6 (24.0)	5 (20.0)	0.733
Diabetes mellitus, n (%)	5 (20.0)	4 (16.0)	0.713

Table 2

Clinical assessment of denture performance

Clinical variable	Conventional complete dentures (n = 25)	Implant-supported overdentures (n = 25)	p-value
Retention			
Good	13 (52.0)	23 (92.0)	0.002
Poor	12 (48.0)	2 (8.0)	
Stability			
Good	14 (56.0)	24 (96.0)	0.001
Poor	11 (44.0)	1 (4.0)	
Support			
Adequate	15 (60.0)	23 (92.0)	0.009
Inadequate	10 (40.0)	2 (8.0)	
Prosthetic Condition			
Satisfactory	17 (68.0)	22 (88.0)	0.095
Unsatisfactory	8 (32.0)	3 (12.0)	

Table 3

Comparison of radiographic residual ridge measurements

Radiographic variable	Conventional complete dentures (n = 25) Mean ± SD	Implant-supported overdentures (n = 25) Mean ± SD	p-value
Anterior mandibular ridge height (mm)	18.42 ± 2.31	20.16 ± 2.18	0.009
Posterior mandibular ridge height (mm)	12.36 ± 2.14	14.28 ± 2.26	0.004
Anterior ridge resorption (mm)	1.12 ± 0.24	0.76 ± 0.21	<0.001

Radiographic variable	Conventional complete dentures (n = 25) Mean ± SD	Implant-supported overdentures (n = 25) Mean ± SD	p-value
Posterior ridge resorption (mm),	1.04 ± 0.19	0.82 ± 0.18	<0.001

Table 4
Comparison of occlusal changes between study groups

Occlusal variable	Conventional complete dentures (n = 25)	Implant-supported overdentures (n = 25)	p-value
Premature occlusal contacts	11 (44.0)	4 (16.0)	0.031
Uneven occlusal contact distribution	14 (56.0)	5 (20.0)	0.009
Reduced occlusal stability	13 (52.0)	3 (12.0)	0.003
Altered vertical dimension	9 (36.0)	3 (12.0)	0.095
Occlusal discrepancies	15 (60.0)	6 (24.0)	0.010
Satisfactory occlusal relationship	10 (40.0)	19 (76.0)	0.010

Table 5
Multivariable linear regression for factors associated with posterior mandibular ridge resorption

Predictor	Adjusted β	Standard error	95% confidence interval	p-value
Prosthesis type (implant-supported vs conventional)	−0.21	0.07	−0.35 to −0.07	0.004
Age (per year)	0.003	0.003	−0.003 to 0.009	0.310
Duration of edentulism (per year)	0.018	0.007	0.004 to 0.032	0.014
Duration of denture use (per year)	0.009	0.008	−0.007 to 0.025	0.260

DISCUSSION

The present findings indicated that patients with implant-supported overdentures experienced superior clinical denture performance, higher residual mandibular ridge height, less ridge resorption, and fewer occlusal disturbances when compared to complete denture wearers. These results are similar to those reported in recent prosthodontic literature, but due to differences in study design, follow-up period, and measuring methods, comparisons should be made with caution.

With regard to residual ridge resorption, the present results are similar to those of Km et al. (2021), who performed a randomized pilot study based on 28 subjects. At 12 months, they found that single implant-supported mandibular overdenture users had significantly less ridge resorption compared to conventional complete denture users. The results of their study confirm the findings of the present study, especially the reduction in the anterior and posterior ridge height seen in the implant-supported group.[8]

Likewise, Sarıbal et al. (2022) compared 126 conventional complete denture (CCD) and 126 implant-supported overdenture (ISOD) wearers over a two-year period and a six-year period. However, they reported that those who wore implants over dentures showed significantly less alveolar bone loss at multiple sites in the mandible, but not at all anatomic sites at the long-term follow-up. This regional difference has significance since it suggests that implant-supported rehabilitation can possibly limit residual ridge resorption, but not completely prevent it.[9]

These clinical findings are also corroborated by Abe et al. (2021), who compared occlusal force adjustment of those with natural dentition, implant-supported overdenture, and conventional complete denture. They concluded that the implant overdenture wearers were more successful at adjusting their occlusal force than conventional denture wearers, but not as successful as people with natural teeth. This is in agreement with the lower incidence of occlusal disturbances found in the implant-supported group in the present study.[13]

Floriani et al. (2022) assessed the ability of conventional complete dentures and implant-retained overdentures to occlude using digital and conventional approaches. They found that there were significant variations in occlusal contact distribution when comparing the two types of prosthetics for lateral mandibular movements. They concluded that it is important to evaluate occlusal contacts and not just denture retention and stability, which was done in the present study.[14]

In the same way, Rocha et al. (2023) examined the masticatory efficiency for conventional complete denture and single implant-retained overdenture users in various occlusal schemes. The masticatory efficiency showed significant improvement in the implant overdenture group (p=0.012) and no significant difference between the bilateral balanced and the lingualised occlusion. This is consistent with the finding of better functional performance in the present implant-supported group, although this was not directly assessed in the present study.[15]

Another study that supports this is a Systematic Review and Meta-analysis by Srinivasan et al. (2023), which covered 30 studies investigating oral function among completely edentulous patients. They found that, after different periods, they showed significant improvements in oral function after implant-supported rehabilitation. The results of the present study are supported by these findings, and the significant variations in the studies included should be noted.[16]

Mathew et al. (2024) performed a clinical prospective study to compare the success rate of a single implant-retained mandibular overdenture with a conventional complete denture. They were found to have better masticatory efficiency, clinical performance, and patient satisfaction with implant-supported rehabilitation. They confirm the much higher retention, stability, and support that was seen with the people who used implant-supported overdentures in the current study.[17]

In addition, Leles et al. (2024) assessed rehabilitations with mandibular overdentures held by four mini implants for masticatory performance and bite force. They found that both functional parameters improved significantly at 12-month follow-up. The results of their study offer further evidence that implant-based rehabilitation results in functional improvements, but they compare the differences between the groups after treatment, not between two separately recruited groups.[18]

Badr et al. (2024) conducted another clinical study that examined the maximum biting force and patient satisfaction of mandibular overdentures supported by two implants using different bar fabrication methods. Although significant differences between the three fabrication groups were generally not observed, their findings highlighted the importance of prosthetic design in evaluating functional outcomes. This indicates that occlusal performance could be influenced by not only support of the implants but also the construction and maintenance of the prostheses.[19]

Conventional and CAD/CAM-milled denture bases in four-implant-supported mandibular overdentures were assessed for occlusal contact stability by Abdelghany et al. (2025). They found that CAD/CAM-milled overdentures had more occlusal contact stability, and that there were differences in occlusal changes between the posterior contact areas. These results corroborate the significance of prosthetic stability and occlusal contact distribution in the interpretation of the lower number of occlusal discrepancies found in the present group of implants.[20]

Overall, the findings of the present study are broadly supported by these previous investigations. The results indicate that the implant-supported overdentures can enhance the stability of the overdenture, functional performance, and occlusal outcomes, with comparatively lower residual ridge resorption. The benefits of these, however, can differ depending on implant type, attachment system, prosthetic design, length of use, and patient factors. Therefore, the present findings should be interpreted as comparative observations, not a finding of the prevention of the whole ridge resorption by implant-supported overdentures.

Limitations

Some of the limitations of this study were: First, the relatively small sample size of 50 patients and single-center setting may limit the generalizability of the findings. Secondly, the cross-sectional design limited evaluation of changes in residual ridge dimensions over time. Third, the length of edentulism and denture-wearing habits, implant configuration, and prosthetic design might have contributed to the clinical results. Moreover, there may be differences in magnification and positioning of radiographic measurements on orthopantomograms. The other part of the assessment of occlusal contacts required clinical judgement and involved the use of articulating paper and shimstock. It is recommended that larger multicenter longitudinal studies be performed with standardized assessments of radiographs and digital occlusals.

CONCLUSION

Patients wearing implant-supported overdentures demonstrated better denture retention, stability, and support, greater residual mandibular ridge height, and fewer occlusal disturbances than conventional complete denture users. Lower anterior and posterior ridge resorption was also noted in the implant-supported group. The differences in the modified vertical dimension and in the general condition of the prostheses were not statistically significant, however. These findings suggest comparatively favorable clinical and radiographic outcomes with implant-supported overdentures. Larger populations and additional studies over time are needed to validate these observations.

REFERENCES

1. Maria, M.T.S., et al., The impact of residual ridge morphology on the masticatory performance of complete denture wearers. Heliyon, 2023. 9(5).
2. Wu, W., et al., Evaluation of the 5-year clinical efficacy of cross-arch fixed dental prostheses as periodontal splints on periodontal tissue stability. Journal of Dentistry, 2026: p. 106529.
3. Li, N., et al., Advances in biomaterials for oral-maxillofacial bone regeneration: spotlight on periodontal and alveolar bone strategies. Regenerative Biomaterials, 2024. 11: p. rbae078.
4. Aldowish, A.F., et al., Occlusion and its role in the long-term success of dental restorations: a literature review. Cureus, 2024. 16(11).
5. Elawady, D., et al., Single implant-retained mandibular overdentures: a literature review. Cureus, 2024. 16(1).
6. Heboyan, A., et al., Implant-Supported and Conventional Dentures: A Meta-Analysis in Older Adults. international dental journal, 2026. 76(5): p. 109782.
7. Assoratgoon, I., et al., Occlusal contact changes in implant-supported fixed prostheses: a systematic review. Journal of Oral Rehabilitation, 2025. 52(11): p. 2185-2194.
8. Km, S., et al., Comparison of ridge resorption and patient satisfaction in single implant-supported mandibular overdentures with conventional complete dentures: A randomised pilot study. J Oral Biol Craniofac Res, 2021. 11(1): p. 71-77.
9. Şirin Sarıbal, G., N. Ersu, and E.M. Canger, Effects of conventional complete dentures and implant-supported overdentures on alveolar ridge height and mandibular bone structure: 2-year and 6-year follow-up study. Clin Oral Investig, 2022. 26(9): p. 5643-5652.
10. Poljak, N., et al., The influence of occlusion type on oral health-related quality of life in patients with complete

dentures—Lingualized vs. bilaterally balanced occlusion. Journal of personalized medicine, 2024. 14(9): p. 921.
11. Batista Santiago, J., et al., Evaluation of Masticatory Function, Satisfaction, and Quality of Life Among Users of Complete Dentures Relined with Resilient Materials: A Systematic Review. International Journal of Prosthodontics, 2024. 37(2): p. 210.
12. Kamal, M.N.M., Comparison between relining of ill-fitted maxillary complete denture versus CAD/CAM milling of new one regarding patient satisfaction, denture retention and adaptation. BMC Oral Health, 2025. 25(1): p. 18.
13. Abe, M., et al., Ability to adjust occlusal force in implant-supported overdenture wearers. Journal of Prosthodontic Research, 2021. 65(1): p. 106-114.
14. Floriani, F., et al., Digital and analog analysis of occlusion in conventional and implant-retained complete dentures: Preliminary results of a prospective clinical trial. Int J Prosthodont, 2022. 35(1): p. 27-36.
15. Rocha, C.O., et al., Masticatory efficiency in complete denture and single implant-retained mandibular overdenture wearers with different occlusion schemes: A randomized clinical trial. The Journal of Prosthetic Dentistry, 2023. 129(6): p. 888-894.
16. Srinivasan, M., et al., Oral function in completely edentulous patients rehabilitated with implant-supported dental prostheses: A systematic review and meta-analysis. Clinical Oral Implants Research, 2023. 34: p. 196-239.
17. Mathew, J.E., et al., Comparative evaluation of masticatory efficiency, clinical performance, and patient satisfaction of single implant-retained mandibular overdenture versus conventional complete denture: A prospective in vivo study. The Journal of the Indian Prosthodontic Society, 2024. 24(1): p. 61.
18. Leles, C.R., et al., Changes in masticatory performance and bite force after treatment with mandibular overdentures retained by four titanium–zirconium mini implants: One-year randomised clinical trial. Journal of oral rehabilitation, 2024. 51(8): p. 1459-1467.
19. Badr, A.M.I., et al., Evaluation of patient satisfaction and maximum biting force of three differently constructed bars on two implants retaining mandibular overdenture-one year follow-up (a randomized controlled clinical trial). BMC Oral Health, 2024. 24(1): p. 1360.
20. Abdelghany, A.A., et al., Impact of mandibular 4-implant overdenture base construction techniques on assessment of occlusion with digital occlusion analysis system (clinical crossover study). BMC oral health, 2025. 25(1): p. 853.