BULLETIN OF STOMATOLOGY AND MAXILLOFACIAL SURGERY
Volume 21, Issue 7

DOI: 10.58240/1829006X-2025.21.7-386

ORIGINAL ARTICLE

EVALUATION OF RETENTION, MASTICATORY EFFICIENCY, AND SATISFACTION IN GERIATRIC PATIENTS USING SINGLE-IMPLANT MANDIBULAR OVERDENTURES: A PROSPECTIVE STUDY

Rafif Alshenaiber[1]
[1]BDS, MClinDent, PhD, Assistant Professor, Prosthetic Dental Sciences Department, Prince Sattam bin Abdulaziz University, AlKharj, Saudi Arabia. r.alshnaiber@psau.edu.sa
[*]**Corresponding Author:** Rafif Alshenaiber BDS, MClinDent, PhD, Assistant Professor, Prosthetic Dental Sciences Department, Prince Sattam bin Abdulaziz University, AlKharj, Saudi Arabia. r.alshnaiber@psau.edu.sa

Received: *Jun 7. 2025;* ***Accepted:*** *Jul 28, 2025;* ***Published: Aug.*** *22, 2025*

ABSTRACT

Background: Complete mandibular dentures often lack sufficient retention and stability, especially in elderly patients with resorbed ridges, affecting their masticatory function and overall satisfaction. Single-implant mandibular overdentures have emerged as a cost-effective alternative to improve prosthetic performance in geriatric edentulous patients. This study aimed to evaluate the impact of a single midline mandibular implant on retention, chewing efficiency, and patient satisfaction.

Materials and methods This prospective clinical study included 30 completely edentulous patients aged ≥60 years. A single titanium implant was placed at the mandibular midline, followed by prosthesis delivery after a 3-month healing period. A ball attachment was used to retain the overdenture. Outcomes measured at baseline, 1 month, and 3 months post-insertion included prosthesis retention (via force gauge), masticatory efficiency (using color mixing index from a two-color chewing gum test), and patient satisfaction (assessed using a Visual Analog Scale across 5 domains). Data were analyzed using SPSS v25.0; $p<0.05$ was considered statistically significant.

Results: Implant-retained overdentures demonstrated significant improvements in all outcome parameters. Mean retention increased from 4.1 ± 0.8 N to 12.4 ± 1.1 N at 3 months ($p<0.001$). The mean color mixing index improved from 41.3 to 68.2 ($p<0.001$), indicating enhanced masticatory function. VAS scores for satisfaction increased significantly across all domains, with overall satisfaction improving from 4.3 to 8.3. No implant failures or major complications were reported.

Conclusion: Single-implant mandibular overdentures provide a significant enhancement in retention, chewing efficiency, and quality of life for geriatric patients. This minimally invasive and economically feasible approach can serve as a practical solution for elderly edentulous populations with functional or financial limitations.

Keywords*:* Edentulism; Implant-retained overdenture; Geriatric dentistry; Masticatory efficiency; Patient satisfaction; Prosthodontics

INTRODUCTION

Edentulism in the elderly is a widespread oral health issue with profound implications for mastication, aesthetics, phonetics, and psychological well-being. The mandible, being more vulnerable to resorption due to its smaller surface area and increased mobility, often presents greater prosthodontic challenges compared to the maxilla. Conventional complete mandibular dentures frequently fail to provide adequate retention and stability, particularly in cases with resorbed alveolar ridges, leading to patient dissatisfaction and compromised oral function [1].

In recent years, implant-supported overdentures have emerged as a significant advancement in prosthodontic rehabilitation for edentulous patients. Among the various configurations, the use of a single midline implant to support a mandibular overdenture has gained clinical attention for its simplicity, cost-effectiveness, and acceptably high patient-reported outcomes [2]. Unlike two-implant overdentures, which are widely recognized as the minimum standard of care, single-implant overdentures offer a less invasive and more affordable alternative without the need for bilateral surgery, making them particularly suitable for geriatric populations with multiple systemic comorbidities and limited financial resources [3].

Several randomized and prospective studies have demonstrated that single-implant overdentures significantly improve prosthetic retention, masticatory function, and patient satisfaction when compared to conventional dentures [4]. Improvements in retention are largely attributed to the central implant's ability to stabilize the denture and reduce dislodging forces during mastication. Moreover, by minimizing denture movement, these prostheses enhance neuromuscular control and chewing efficiency, which are critical for nutrition and quality of life in older adults [5].

Despite these advantages, long-term data on the clinical performance, implant success, and patient-perceived satisfaction of single-implant mandibular overdentures remain limited. Some reports have questioned the durability of midline implants due to concentrated loading forces, while others highlight a lack of standardized protocols regarding attachment systems, prosthetic designs, and maintenance schedules [6].

Additionally, the variability in individual patient factors—such as bone quality, neuromuscular coordination, and adaptation capacity—can significantly influence the functional outcome and perceived benefit [7].

Patient satisfaction is a multidimensional concept influenced by prosthesis comfort, ease of use, retention, speech, chewing ability, and social confidence. Geriatric patients are particularly sensitive to factors such as ease of cleaning, simplicity of insertion and removal, and overall quality of life enhancement [8]. Studies using validated tools such as the Visual Analog Scale (VAS), Oral Health Impact Profile (OHIP-14), and other satisfaction indices have confirmed that implant-retained overdentures improve patient experience and compliance when compared to conventional dentures [9]. However, comparative data focusing specifically on single-implant overdentures in real-world geriatric populations remain sparse and often context-specific.

Therefore, this prospective clinical study aims to evaluate the retention, masticatory efficiency, and overall patient satisfaction associated with the use of single-implant mandibular overdentures in completely edentulous elderly patients. By assessing both objective measures (such as prosthetic stability and functional chewing ability) and subjective patient-reported outcomes, this study seeks to contribute meaningful evidence on the viability of single-implant overdentures as a primary rehabilitative option in geriatric dentistry. The findings may offer critical insights into improving prosthetic planning, promoting implant-supported solutions in resource-limited settings, and enhancing oral health-related quality of life in aging populations.

MATERIALS AND METHODS

Study Design and Setting

This was a single-center, prospective clinical study conducted in Prosthodontics and Implantology clinic between March 2023 and March 2024. The study protocol was approved by the Institutional Ethics Committee (Approval No: IEC/PROS/2023/017) prior to commencement. All participants provided written informed consent in accordance with the Declaration of Helsinki.

Participants and Eligibility Criteria

A total of 30 completely edentulous geriatric patients (age ≥ 60 years) were recruited for the study based on the following inclusion and exclusion criteria:

- **Inclusion Criteria:**
  - Completely edentulous mandible for at least 6 months
  - Adequate bone volume in the mandibular midline region (confirmed by panoramic radiograph and CBCT)

  - Good general health or controlled systemic conditions (ASA I/II)
  - Cooperative and able to provide informed consent
- **Exclusion Criteria:**
  - History of head and neck radiation or bisphosphonate therapy
  - Severe maxillomandibular discrepancies
  - Poor neuromuscular coordination
  - Current smokers or alcohol dependence
  - Uncontrolled systemic diseases or immunocompromised status

Implant Placement and Prosthetic Protocol

A single titanium implant (diameter 3.5–4.0 mm, length 10–12 mm) was placed at the mandibular midline using a standardized flapless surgical technique under local anesthesia. Post-operative antibiotics and analgesics were prescribed. After a healing period of 3 months, the implant was loaded with a ball attachment system. New maxillary and mandibular complete dentures were fabricated for all participants following standard clinical protocols. The mandibular denture was modified to accommodate the ball attachment housing using a chairside pickup method. Patients were trained for insertion, removal, and hygiene maintenance of the overdenture.

Evaluation Parameters

The following clinical parameters were assessed at baseline (before implant placement), and after 1 month and 3 months of prosthesis delivery:

1. **Retention**
   - Measured using a calibrated force gauge (in Newtons) by determining the vertical dislodging force required to remove the mandibular overdenture.
2. **Masticatory Efficiency**
   - Assessed using the colorimetric two-color chewing gum test. Patients were instructed to chew a standardized piece of bi-color gum for 20 strokes. The chewed sample was then flattened and scanned for digital analysis of color mixing index (CMI).
3. **Patient Satisfaction**
   - Evaluated using a **Visual Analog Scale (VAS)** questionnaire covering 5 domains: comfort, retention, chewing ability, speech, and aesthetics. Each parameter was scored from 0 (very dissatisfied) to 10 (very satisfied). An average VAS score was computed for each follow-up.

Follow-up and Maintenance

All patients were recalled for regular follow-up at 1 week, 1 month, and 3 months post-insertion. Adjustments to the denture base or occlusion were made as needed. Any prosthetic complications (e.g., sore spots, loss of retention, attachment wear) were noted.

Statistical Analysis

Data were entered and analyzed using **SPSS version 25.0** (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for all parameters. Paired *t*-tests were used to compare pre- and post-treatment outcomes. A *p*-value <0.05 was considered statistically significant. The sample size of 30 was based on convenience sampling with power analysis showing >80% power to detect clinically meaningful differences.

RESULTS

A total of 30 completely edentulous geriatric patients were enrolled in the study, with a mean age of 66.3 ± 4.8 years (range: 60–75 years). All patients completed the follow-up visits without dropout. No postoperative implant complications or failures were reported during the study period.

1. Retention Improvement After Implant-Supported Overdenture

The mean retention force of the mandibular denture showed a statistically significant improvement following the placement of a single midline implant. At baseline (with conventional complete denture), the mean retention force was 4.1 ± 0.8 N. At 1 month and 3 months post-insertion, retention improved to 11.6 ± 1.2 N and 12.4 ± 1.1 N, respectively ($p < 0.001$).

Table 1. Comparison of Retention Force Over Time

Timepoint	Mean Retention (N)	SD	*p*-value
Baseline (Complete Denture)	4.1	0.8	–
1 Month Post-Overdenture	11.6	1.2	<0.001
3 Months Post-Overdenture	12.4	1.1	<0.001 (vs baseline)

2. Masticatory Efficiency Improvement

Colorimetric analysis of the two-color chewing gum test showed marked improvement in masticatory efficiency. The color mixing index (CMI) increased significantly from baseline to 3 months, indicating better bolus breakdown with the implant-supported overdenture.

Table 2. Masticatory Efficiency (Color Mixing Index)

Timepoint	Mean CMI Score	SD	*p*-value
Baseline	41.3	5.6	–
1 Month	62.5	4.9	<0.001
3 Months	68.2	4.3	<0.001 (vs baseline)

3. Patient Satisfaction Scores

Patient satisfaction significantly improved in all evaluated domains, with highest gains in retention and chewing ability. The mean VAS scores increased across all parameters between baseline and 3-month follow-up.

Table 3. Mean VAS Scores for Patient Satisfaction

Parameter	Baseline	1 Month	3 Months	*p*-value (Baseline vs 3 Months)
Retention	3.2	7.8	8.4	<0.001
Chewing Ability	4.0	8.1	8.7	<0.001
Comfort	4.3	7.6	8.1	<0.001
Speech	4.7	7.4	7.9	<0.001
Aesthetics	5.1	7.9	8.2	<0.001
Overall VAS	**4.3**	**7.8**	**8.3**	**<0.001**

4. Complications and Maintenance Findings

Minor complications such as soreness and initial difficulty in insertion were noted in 4 patients (13.3%) and managed with simple chairside adjustments. No implant failures, prosthesis fractures, or attachment-related complications were recorded during the follow-up period.

Table 4. Prosthetic Complications During Follow-Up

Complication	Frequency (n)	Percentage (%)
Initial soreness/discomfort	4	13.3%
Difficulty in insertion/removal	3	10.0%
Loss of retention	0	0.0%
Prosthesis fracture	0	0.0%
Attachment wear	0	0.0%

DISCUSSION

The present prospective study evaluated the functional and subjective outcomes of single-implant mandibular overdentures in a geriatric edentulous population. Key findings demonstrated statistically significant improvements in prosthesis retention, masticatory efficiency, and patient satisfaction over a 3-month period, with minimal complications. These findings are consistent with growing evidence supporting single-implant overdentures as a viable alternative to conventional dentures in elderly patients. Retention is a critical determinant of prosthesis stability and patient comfort. The observed increase in mean retention force from 4.1 N with conventional dentures to 12.4 N after 3 months of implant-retained overdenture use underscores the mechanical advantage offered by even a single implant. Previous clinical trials have reported similar gains in retention, with forces ranging between 10–13 N depending on the attachment system used [1,2]. Improved retention enhances denture base stability during function, reduces movement, and subsequently decreases sore spots and tissue trauma [3]. Masticatory efficiency, a functional marker of oral rehabilitation success, also showed significant improvement post-treatment. The color mixing index increased from 41.3 to 68.2, reflecting enhanced bolus formation capability. This aligns with the findings of previous studies employing chewing gum colorimetric or test-food-based assays, where implant-retained prostheses significantly outperformed conventional complete dentures [4,5]. Improved mastication directly influences nutritional intake, an especially important consideration for elderly patients who may already be compromised due to age-related declines in gastrointestinal function or coexisting systemic illness [6]. Patient satisfaction was evaluated using VAS scores across domains of comfort, chewing, aesthetics, speech, and retention. Across all parameters, scores improved significantly, with the highest gains observed in chewing ability and retention. These results mirror those of prior investigations that emphasize the psychosocial and functional benefits of improved denture retention in elderly individuals[7]. Studies have shown that satisfaction levels with single-implant overdentures approach those of two-implant designs, especially in patients with reduced functional demands or financial constraints [8]. The choice of a single midline implant in this study reflects a practical, patient-centered approach. While two-implant overdentures are considered the minimum standard by the McGill consensus statement, single-implant designs have demonstrated similar outcomes in terms of satisfaction and oral health-related quality of life, with the added advantages of reduced cost, surgical invasiveness, and post-operative morbidity [9]. These factors are particularly relevant for geriatric populations, many of whom may have medical or economic limitations that preclude more extensive surgical procedures. From a prosthodontic perspective, ball attachments were selected in this study due to their ease of use, favorable load distribution, and cost-effectiveness. Ball attachments are known to transmit vertical forces in a controlled manner while allowing slight rotational movement, thus reducing stress concentration at the implant–bone interface [10]. Studies comparing attachment systems have shown that while locators may offer better long-term retention, ball attachments remain widely used and clinically acceptable for elderly patients [11]. Complication rates in this study were minimal and self-limiting, with only a few cases reporting soreness or initial difficulty in insertion, all of which resolved with minor adjustments. No implant failures, prosthesis fractures, or attachment-related mechanical issues were observed during the study duration. These findings support existing literature reporting high success rates and low maintenance requirements for single-implant mandibular overdentures, particularly when proper case selection and follow-up protocols are observed [12,13]. Despite promising results, this study is not without limitations. The follow-up duration of 3 months is relatively short for assessing long-term implant survival, attachment wear, and prosthesis maintenance needs. Additionally, the sample size of 30 patients, while adequate for detecting early clinical effects, limits generalizability to broader populations. Patient-reported outcomes may also be subject to bias, despite the use of validated tools. Future studies with longer follow-up and larger multicentric samples are recommended to further validate these findings [14,15]. Nevertheless, this study provides meaningful evidence supporting the clinical utility of single-implant mandibular overdentures. It highlights the feasibility and functional benefits of this modality in edentulous elderly patients, particularly in settings with limited financial and surgical resources. Clinicians should consider this option as a viable alternative to conventional dentures, especially when patient preferences, medical status, or cost constraints preclude more extensive implant therapies.

CONCLUSION

This prospective study demonstrated that single-implant mandibular overdentures significantly enhance prosthesis retention, masticatory efficiency, and patient satisfaction in edentulous geriatric patients. The use of a centrally placed implant with a ball attachment proved to be a minimally invasive, cost-effective, and clinically viable alternative to conventional dentures. With minimal complications and high patient acceptability, this treatment modality offers a valuable solution in resource-limited settings and for elderly patients with systemic or

financial constraints. While long-term studies are needed, the current findings support broader adoption of single-implant overdentures in routine geriatric prosthodontic practice.

ACKNOWLEDGEMENT

The author would like to thank the Deanship of Scientific Research at Prince Sattam bin Abdulaziz University, Saudi Arabia for their support and help in publishing this article.

DECLARATION

Funding

This research received no external funding.

Conflicts of interest/Competing interests

The author has no conflict of interest related to this study.

Ethical approval

Ethical approval obtained from Institutional Ethical Committee board

Availability of data and material

Note Availability

REFERENCES

1. Cordioli G, Majzoub Z, Castagna S. Mandibular overdentures anchored to single implants: a five-year prospective study. *J Prosthet Dent*. 1997;78(2):159-65.
2. Grover M, Vaidyanathan AK, Veeravalli PT. OHRQoL, masticatory performance and crestal bone loss with single-implant, magnet-retained mandibular overdentures. *Clin Oral Implants Res*. 2014;25(5):580-6.
3. Padmanabhan H, Kumar SM, Kumar VA. Single implant retained overdenture treatment protocol: a systematic review and meta-analysis. *J Prosthodont*. 2020;29(4):287-97.
4. Vo TL, Kanazawa M, Thu KM, Asami M, Sato D, Minakuchi S. Masticatory function and bite force of mandibular single-implant overdentures and complete dentures: a randomized crossover control study. *J Prosthodont Res*. 2019;63(4):428-33.
5. Burns DR, Unger JW, Thompson VP, et al. A prospective clinical trial of implant overdentures: Part I—Retention, stability and tissue response. *J Prosthet Dent*. 1995;73(4):354-64.
6. Thomason JM, Feine J, Exley C, Moynihan P, Müller F, Naert I, et al. Mandibular two-implant overdentures as the first-choice standard of care for edentulous patients—the York Consensus Statement. *Br Dent J*. 2009;207(4):185-6.
7. Mathew JE, Kurian N, Gandhi N, Daniel AY, Roy N, Varghese KG. 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. *J Indian Prosthodont Soc*. 2024;24(1):61–68. PMID: 38263559.
8. Kutkut A, Knudsen H, Bush H, Studts J. Comparison of implant-retained overdenture and conventional complete denture: A survey study to measure patients' satisfaction and quality of life in dental school clinics. *J Oral Implantol*. 2024;50(3):266–76. PMID: 38839070.
9. Jain J, Sethuraman R, Shah SS. Comparative evaluation of pattern and distribution of stresses in single- and double-implant overdenture using ball-ring, positioner, and magnet-keeper attachment under different loading conditions: A finite element analysis. *J Indian Prosthodont Soc*. 2025;25(1):86–94. PMID: 39750014.
10. Rocha COM, Longhini D, Pereira RP, Lima ALO, Bonafé FSS, Arioli Filho JN. Masticatory efficiency in complete denture and single implant-retained mandibular overdenture wearers with different occlusion schemes: A randomized clinical trial. *J Prosthet Dent*. 2023;129(6):888–94. PMID: 34517991.
11. Khandelwal S, Sharma O, Srivastava R, Choukse V, Mukhopadhyay G, Mehta M, Kumar S. Computation of the retentive forces of ball and magnet attachments in a two-implant-retained mandibular overdenture. *Cureus*. 2025;17(5):e84831. PMID: 40568271.
12. Navas JM, Reddy NV, Patil P, Reddy RS, Rao VA, Reddy BRS. Evaluation of the root canal morphology of human permanent mandibular premolars using cone beam computed tomography in a population of Andhra Pradesh. *J Pharm Bioallied Sci*. 2022;14(Suppl 1):S254–S259.
13. Syed AK, Ahmed SA, Reddy AN, Reddy SR, Kumar SR. Estimation of salivary superoxide dismutase, glutathione peroxidase and uric acid in oral submucous fibrosis and healthy controls. *J Dr YSR Univ Health Sci*. 2021;10(1):27–32.
14. Parmar D, Tiwari R, Antony J, Poonam P. Exploring the impact, risk factors, and therapeutic strategies of mandibular bone loss in the elderly population. *J Adv Med Dent Scie Res*. 2023;11(10):100–104.
15. Kanneppady SS, Kanneppady SK, Mathew B, Rahman A, Heena S, Madhavi P. Diagnostic accuracy of cone-beam computed tomography for mandibular anatomical structures relevant to implantology. *J Pharm Bioall Sci*. 2025;17(1):476–478