International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 7, July 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.7.2024.30

ORIGINAL RESEARCH

Comparative study of retentive anchor systems for overdentures

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Received Date: 24 April, 2024 Acceptance Date: 27 May, 2024

ABSTRACT

Background: Retention of overdentures is crucial for patient comfort and function. Various retentive anchor systems are available, each with distinct advantages and limitations. This study aims to compare the effectiveness of different retentive anchor systems for overdentures in a sample population from Dental patients in Bhagalpur District, Bihar, over a period of 6 to 9 months.

Materials and Methods: A total of 30 patients requiring overdentures were selected for the study. Participants were randomly assigned to one of three groups, each receiving a different type of retentive anchor system: ball attachments, bar attachments, and locator attachments. The retention force, patient satisfaction, and oral health-related quality of life were evaluated at baseline, 3 months, and 6 months. Data were collected using standardized questionnaires and mechanical retention tests. Statistical analysis was performed using ANOVA and post-hoc tests to determine significant differences between the groups.

Results: The initial retention force for the ball attachments was 15 N, increasing to 18 N at 3 months and stabilizing at 17 N by 6 months. Bar attachments showed an initial retention force of 20 N, which slightly decreased to 19 N at 6 months. Locator attachments exhibited the highest initial retention force of 22 N, which remained relatively stable throughout the study period. Patient satisfaction scores improved significantly in all groups, with the locator attachment group showing the highest increase (baseline: 60, 6 months: 85). Oral health-related quality of life scores also improved across all groups, with the bar attachment group demonstrating the most consistent enhancement.

Conclusion: All three retentive anchor systems for overdentures improved retention and patient satisfaction over the 6 to 9 months period. However, locator attachments provided the highest initial retention force and maintained it effectively, resulting in the highest patient satisfaction scores. This study suggests that while all systems are effective, locator attachments may offer superior performance in terms of retention and patient satisfaction.

Keywords: Overdentures, retentive anchor systems, ball attachments, bar attachments, locator attachments, patient satisfaction, retention force, oral health-related quality of life.

INTRODUCTION

Overdentures are a widely accepted treatment modality for edentulous patients, offering improved function, aesthetics, and patient satisfaction compared to conventional complete dentures (1). Retention and stability are critical factors that influence the success of overdentures and various retentive anchor systems have been developed to enhance these properties (2). Commonly used systems include ball attachments, bar attachments, and locator attachments, each with unique characteristics and clinical outcomes (3).

Ball attachments are popular due to their simplicity and cost-effectiveness, providing adequate retention and ease of use (4). However, their retention force may decrease over time due to wear and tear (5). Bar attachments, on the other hand, offer increased retention and stability, particularly beneficial for patients with limited bone support (6). They distribute occlusal loads more evenly, reducing the risk of implant overload and failure (7). Despite these advantages, bar attachments are more complex and require precise fabrication, which can increase treatment time and cost (8).

Locator attachments have gained popularity for their high retention force and ease of maintenance (9). They offer a dual retention mechanism, ensuring stability even in cases of slight misalignment between the overdenture and the implants (10). Studies have shown that locator attachments provide superior retention compared to ball and bar attachments, contributing to higher patient satisfaction and improved oral health-related quality of life (11-13).

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Despite the extensive use of these retentive anchor systems, comparative studies assessing their long-term effectiveness in diverse populations are limited. This study aims to compare the performance of ball, bar, and locator attachments in terms of retention, patient satisfaction, and oral health-related quality of life over a period of 6 to 9 months in a sample population fromDental patients inBhagalpur District , Bihar. The findings will contribute to evidence-based clinical decision-making in selecting the most appropriate retentive anchor system for overdentures.

MATERIALS AND METHODS

Study Design and Setting: This comparative study was conducted at a dental clinic in Bhagalpur District, Bihar, over a period of 6 to 9 months. Ethical approval was obtained from the institutional review board, and informed consent was obtained from all participants prior to enrollment.

Sample Selection: A total of 30 edentulous patients requiring mandibular overdentures were selected for the study. Inclusion criteria were patients aged between 45 and 75 years, good general health, and sufficient bone volume for implant placement. Exclusion criteria included patients with systemic conditions affecting bone healing, heavy smokers, and those with poor oral hygiene.

Grouping and Interventions: Participants were randomly assigned to one of three groups, with each group receiving a different type of retentive anchor system for their overdentures:

1. **Group A (Ball Attachments):** 10 patients received two implants placed in the mandibular canine regions, with ball attachments connected to the implants.
2. **Group B (Bar Attachments):** 10 patients received two implants placed in the mandibular canine regions, with a bar attachment connecting the implants.
3. **Group C (Locator Attachments):** 10 patients received two implants placed in the mandibular canine regions, with locator attachments connected to the implants.

Implant Placement and Overdenture Fabrication: Standard surgical protocols were followed for implant placement. After a healing period of 3 months, impressions were taken, and the overdentures were fabricated using conventional techniques. The retentive attachments were then incorporated into the overdentures as per the group assignments.

Outcome Measures: The primary outcomes measured were retention force, patient satisfaction, and oral health-related quality of life (OHRQoL). Secondary outcomes included implant survival and complications.

Data Collection:

- **Retention Force:** Measured using a digital force gauge at baseline, 3 months, and 6 months.
- **Patient Satisfaction:** Assessed using a validated questionnaire, which included questions on comfort, ease of use, and overall satisfaction. Scores ranged from 0 (very dissatisfied) to 100 (very satisfied).
- **OHRQoL:** Evaluated using the Oral Health Impact Profile (OHIP-14), with scores ranging from 0 (no impact) to 56 (high impact).

Statistical Analysis: Data were analyzed using SPSS software (version 25.0). Descriptive statistics were used to summarize the data. ANOVA was employed to compare retention forces, patient satisfaction, and OHRQoL scores between the groups at different time points. Post-hoc tests were conducted to determine significant differences between specific groups. A p-value of <0.05 was considered statistically significant.

Blinding: The investigators conducting the retention force measurements and administering the questionnaires were blinded to the group assignments to minimize bias.

Follow-Up: Patients were followed up at 3-month intervals, with additional visits scheduled as necessary to address any complications or adjustments needed for the overdentures.

Results

Patient Demographics: The study included 30 patients (15 males and 15 females) with an average age of 60 years (range: 45-75 years). The demographic distribution across the three groups was comparable ($p > 0.05$).

Retention Force: The retention force for each group was measured at baseline, 3 months, and 6 months. The results are summarized in Table 1.

Time Point	Group A (Ball Attachments)	Group B (Bar Attachments)	Group C (Locator Attachments)
Baseline (N)	15	20	22
3 Months (N)	18	19	22
6 Months (N)	17	19	21

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The retention force increased in Group A from 15 N at baseline to 18 N at 3 months and slightly decreased to 17 N at 6 months. Group B showed a slight decrease in retention force from 20 N at baseline to 19 N at 6 months. Group C maintained a high retention force throughout the study period.

Patient Satisfaction: Patient satisfaction scores were collected at baseline, 3 months, and 6 months. The results are summarized in Table 2.

Time Point	Group A (Ball Attachments)	Group B (Bar Attachments)	Group C (Locator Attachments)
Baseline (0-100)	55	60	65
3 Months (0-100)	70	75	80
6 Months (0-100)	75	78	85

Patient satisfaction improved significantly in all groups over time, with Group C showing the highest satisfaction scores at 6 months.

Oral Health-Related Quality of Life (OHRQoL):OHRQoL scores were evaluated using the OHIP-14 questionnaire at baseline, 3 months, and 6 months. The results are summarized in Table 3.

Time Point	Group A (Ball Attachments)	Group B (Bar Attachments)	Group C (Locator Attachments)
Baseline (0-56)	40	38	36
3 Months (0-56)	30	28	25
6 Months (0-56)	25	23	20

OHRQoL scores improved in all groups, indicating better oral health and quality of life, with Group C showing the most significant improvement.

Implant Survival and Complications: All implants remained stable throughout the study period, with a 100% survival rate. Minor complications such as mucosal irritation and attachment wear were observed but were managed effectively without impacting the overall outcomes.

These results demonstrate that while all three retentive anchor systems for overdentures improved retention, patient satisfaction, and OHRQoL, the locator attachments provided the highest retention and satisfaction levels.

DISCUSSION

This comparative study evaluated the effectiveness of three different retentive anchor systems for mandibular overdentures: ball attachments, bar attachments, and locator attachments. The findings indicate that all three systems significantly improved retention, patient satisfaction, and oral health-related quality of life (OHRQoL) over the 6 to 9 months period, with locator attachments demonstrating superior performance.

The increased retention force observed in all groups aligns with previous studies highlighting the efficacy of these attachment systems in enhancing denture stability (1,2). Specifically, the retention force for locator attachments remained consistently high throughout the study, corroborating the findings of Chaves et al. (3), who reported similar retention stability with locator attachments. The slight decrease in retention force for ball attachments over time is consistent with the literature, which suggests that wear and tear can impact their long-term effectiveness (4).

Patient satisfaction scores improved significantly across all groups, with the highest scores recorded for the locator attachments. This is in agreement with Krennmair et al. (5), who found that patients preferred locator attachments due to their ease of use and high retention. The consistent improvement in patient satisfaction for bar attachments, despite being lower than locator attachments, can be attributed to their ability to distribute occlusal loads evenly, as noted by Naert et al. (6).

OHRQoL scores also showed marked improvement across all groups. The significant enhancement observed with locator attachments is supported by previous research indicating that these attachments can substantially improve patients' quality of life by providing stable and comfortable dentures (7,8). The consistent improvement in OHRQoL scores for bar attachments aligns with findings from Burns et al. (9), who demonstrated that bar attachments contribute positively to patients' oral health and overall well-being.

Despite the promising results, this study has several limitations. The sample size was relatively small, and the follow-up period was limited to 9 months. Longer-term studies with larger sample sizes are necessary to validate these findings. Additionally, the study was conducted in a single geographic location, which may limit the generalizability of the results to other populations.

The 100% implant survival rate and the management of minor complications such as mucosal irritation and attachment wear indicate that all three retentive systems are viable options for overdentures. However, the superior performance of locator attachments

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suggests that they may be the preferred choice in clinical practice, particularly for patients seeking high retention and ease of maintenance.

CONCLUSION

In conclusion, while all three retentive anchor systems for overdentures provide significant benefits, locator attachments offer the highest retention and patient satisfaction. These findings can guide clinicians in selecting the most appropriate attachment system based on individual patient needs and preferences. Further research is warranted to explore the long-term outcomes and cost-effectiveness of these retentive systems in diverse populations.

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