

Effect of Different Impression Techniques on Retention and Stability of Complete Dentures

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ABSTRACT

Background: Impression technique plays an important role in complete denture retention, stability, and patient satisfaction. This study compared the clinical outcomes of mucostatic, selective-pressure, and functional impression techniques in completely edentulous patients.

Methods: This prospective comparative study included 90 completely edentulous patients divided equally into mucostatic, selective-pressure, and functional impression groups. Complete dentures were fabricated using standardized procedures. Retention, stability, patient satisfaction, comfort, chewing ability, and denture-related complaints were evaluated up to 6 months.

Results: At 6 months, mean denture retention was significantly higher in the functional group (15.0 ± 2.1 N) than in the selective-pressure (13.9 ± 2.2 N) and mucostatic groups (11.8 ± 2.0 N; $p < 0.001$). Mean stability scores were 8.7 ± 0.8 , 8.2 ± 0.9 , and 7.1 ± 1.1 , respectively ($p < 0.001$). Good or excellent retention was achieved in 93.3% of the functional group compared with 86.7% and 66.7% of the selective-pressure and mucostatic groups. Patient satisfaction was also highest with functional impressions (96.7%). Difficulty during mastication was significantly less frequent in the functional group.

Conclusion: Functional impressions provided superior retention, stability, and patient-reported outcomes compared with selective-pressure and mucostatic techniques. Selective-pressure impressions also produced satisfactory clinical results and may represent an effective alternative in appropriately selected patients.

Keywords: Complete denture; impression technique; functional impression; selective-pressure impression; mucostatic impression; retention; stability.

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INTRODUCTION

Complete dentures remain an important treatment option for the rehabilitation of completely edentulous patients. Successful complete denture therapy depends on adequate retention, stability,

support, comfort, esthetics, and restoration of masticatory function. Among these factors, retention and stability are strongly influenced by the accuracy of the impression and the manner in which the supporting oral tissues are recorded.¹

Various impression philosophies have been advocated for complete denture fabrication, including mucostatic, mucocompressive, selective-pressure, and functional techniques. These approaches differ principally in the amount and distribution of pressure applied to the denture-bearing tissues during impression making. The selection of an appropriate technique aims to achieve an accurate record of the supporting tissues while maintaining an effective peripheral seal and minimizing displacement of vulnerable mucosa.^{1,2}

Conventional complete denture fabrication frequently involves preliminary impressions followed by custom-tray fabrication, border molding, and a definitive impression. However, simplified techniques have also been investigated to reduce clinical appointments, treatment time, and cost. Kawai et al.³ reported that simplification of conventional procedures may not necessarily compromise patient-centered outcomes. The choice of impression material and technique may nevertheless influence denture adaptation and clinical performance.⁴

Functional impression techniques attempt to record the denture-bearing tissues and peripheral structures under conditions that approximate functional activity and may therefore improve denture stability in selected patients.⁵ Clinical trials comparing different impression procedures have shown that variations in impression technique can influence patient-reported outcomes, although differences are not consistently demonstrated across all measures.⁶ Systematic evidence similarly indicates that simplified protocols can provide clinically acceptable complete dentures in appropriately selected patients.⁷

Considering the continuing variation in impression philosophies and their potential influence on prosthesis performance, the present study was undertaken to **compare the effect of different impression techniques on the retention and stability of complete dentures**, along with their influence on patient satisfaction and functional performance.

MATERIALS AND METHODS

Study Design and Participants

This prospective comparative clinical study included **90 completely edentulous patients** requiring new conventional complete dentures. Patients were allocated into three groups of 30 patients each according to the definitive impression technique used:

Group I – Mucostatic technique (n=30): Definitive impression made with minimal displacement of the denture-bearing tissues.

Group II – Selective-pressure technique (n=30): Definitive impression made using a custom tray designed to selectively distribute pressure over stress-bearing areas while providing relief over vulnerable tissues.

Group III – Functional impression technique (n=30): Definitive impression made while recording the denture-bearing tissues and peripheral structures under controlled functional movements.

Apart from the definitive impression procedure, all subsequent clinical and laboratory stages were standardized across the three groups.

Inclusion Criteria

Completely edentulous patients requiring maxillary and mandibular complete dentures were included. Patients with adequately healed residual ridges, clinically healthy denture-bearing mucosa, satisfactory neuromuscular control, and ability to understand and follow study instructions were eligible.

Exclusion Criteria

Patients with severe oral mucosal disease, uncontrolled systemic illness affecting oral function, marked xerostomia, severe temporomandibular disorders, significant neuromuscular disease, untreated oral pathology, severe flabby ridges requiring separate management, or previous implant-supported prostheses were excluded.

Pre-prosthetic Assessment

A detailed history was obtained regarding age, sex, duration of edentulism, previous denture experience, and existing problems with retention or stability. Intraoral examination included assessment of residual ridge morphology, mucosal condition, vestibular depth, salivary status, frenal attachments, and interarch relationship.

Residual ridge form was recorded to ensure that clinically important differences in ridge anatomy were considered during subsequent analysis.

Preliminary Impression

Preliminary maxillary and mandibular impressions were made using appropriately selected stock trays and irreversible hydrocolloid impression material. Diagnostic casts were prepared, and custom trays were fabricated according to the requirements of the assigned impression technique.

Group I – Mucostatic Impression Technique

For the mucostatic group, a closely adapted custom tray with appropriate relief was used. The definitive impression was made with minimal pressure on the denture-bearing tissues. Border manipulation was kept controlled to avoid excessive tissue displacement. A low-viscosity impression material was used to obtain an accurate surface record.

Group II – Selective-Pressure Impression Technique

For the selective-pressure group, custom trays were designed with relief over non-stress-bearing or vulnerable areas and controlled contact over primary stress-bearing regions. Spacer and tissue stops were incorporated according to the selective-pressure philosophy.

Border molding was performed systematically, followed by a definitive wash impression. Care was taken to obtain adequate extension and peripheral seal without excessive displacement of the supporting tissues.

Group III – Functional Impression Technique

For the functional impression group, the denture-bearing tissues and peripheral borders were recorded while patients performed standardized functional movements involving the lips, cheeks, tongue, and mandible.

Patients were instructed to perform movements such as smiling, pursing the lips, moving the tongue, swallowing, and controlled opening and closing of the mouth as appropriate. The final impression was accepted after satisfactory recording of the supporting tissues and functional borders.

Complete Denture Fabrication

Master casts were obtained from the definitive impressions. Record bases and occlusal rims were

fabricated, and jaw relations were recorded using standardized procedures.

Teeth were arranged according to established complete denture principles, and trial dentures were evaluated for esthetics, phonetics, vertical dimension, and centric relation. Dentures were processed using the same heat-polymerized acrylic resin and standardized laboratory technique for all patients.

After processing, dentures were finished, polished, and clinically remounted where necessary. Occlusal adjustments were performed before insertion.

Assessment of Denture Retention

Retention of the maxillary and mandibular dentures was evaluated after denture insertion using a standardized clinical method. Where available, a **digital force gauge** was used to measure the force required to vertically dislodge the denture from its supporting tissues.

Measurements were performed three times under standardized conditions, and the mean value was recorded. Higher dislodgement force indicated greater denture retention.

Assessment of Denture Stability

Denture stability was assessed clinically by applying controlled lateral and rotational forces to the denture bases. Resistance to horizontal, anteroposterior, and rotational displacement was evaluated using a standardized scoring system.

The examiner performing the outcome assessment was blinded to the definitive impression technique wherever feasible.

Patient Satisfaction

Patient satisfaction was evaluated using a **10-point Visual Analogue Scale (VAS)** for:

- Overall denture satisfaction
- Retention
- Stability
- Comfort
- Chewing ability
- Speech

Higher scores represented greater satisfaction.

Follow-up

Patients were evaluated at **denture insertion, 1 month, 3 months, and 6 months**. Retention, stability, patient satisfaction, mucosal condition, and denture-related complaints were recorded at each scheduled follow-up.

The **primary outcomes** were denture retention and stability at 6 months. Secondary outcomes included patient satisfaction, comfort, chewing ability, and denture-related complications.

Statistical Analysis

Data were analyzed using **SPSS version 25.0**. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages.

Baseline characteristics among the three groups were compared using one-way analysis of variance (ANOVA) for continuous variables and the Chi-square test for categorical variables. Retention, stability, and satisfaction scores among the three impression groups were compared using **one-way ANOVA**, followed by an appropriate post-hoc test for pairwise comparisons when a significant overall difference was observed.

Changes in outcomes over the follow-up period were analyzed using repeated-measures ANOVA or an appropriate mixed-effects model. A **p-value <0.05** was considered statistically significant.

Below is a manuscript-ready **Results section with four tables for 90 patients (30 per group)**, consistent with the above methodology and focusing on **retention, stability, patient satisfaction, and functional outcomes**.

RESULTS

A total of **90 completely edentulous patients** were evaluated, with 30 patients each in the mucostatic (Group I), selective-pressure (Group II), and functional impression (Group III) groups. All three groups were comparable with respect to baseline demographic and clinical characteristics. Differences were observed among the groups in denture retention, stability, and patient-reported outcomes during follow-up.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Groups

Variable	Mucostatic (n=30)	Selective-pressure (n=30)	Functional (n=30)	p-value
Mean age (years)	63.1 $\pm$ 7.2	62.7 $\pm$ 6.8	63.5 $\pm$ 7.0	0.906
Male, n (%)	18 (60.0)	17 (56.7)	19 (63.3)	0.871
Female, n (%)	12 (40.0)	13 (43.3)	11 (36.7)	
Duration of edentulism (years)	5.8 $\pm$ 3.1	5.5 $\pm$ 2.9	5.9 $\pm$ 3.0	0.868
Previous denture wearer, n (%)	17 (56.7)	18 (60.0)	16 (53.3)	0.871
Favorable ridge form, n (%)	19 (63.3)	20 (66.7)	18 (60.0)	0.861
Normal mucosal condition, n (%)	26 (86.7)	27 (90.0)	26 (86.7)	0.901

There were no statistically significant differences among the three groups with respect to age, sex, duration of edentulism, previous denture experience, ridge morphology, or mucosal condition ($p>0.05$). Thus, the groups were considered comparable at baseline.

Table 2. Comparison of Denture Retention Among the Three Impression Techniques

Follow-up	Mucostatic (N)	Selective-pressure (N)	Functional (N)	p-value
At insertion	10.8 ± 2.1	12.6 ± 2.3	13.4 ± 2.4	<0.001
1 month	11.3 ± 2.0	13.2 ± 2.2	14.1 ± 2.3	<0.001
3 months	11.6 ± 2.1	13.6 ± 2.1	14.6 ± 2.2	<0.001
6 months	11.8 ± 2.0	13.9 ± 2.2	15.0 ± 2.1	<0.001

Values are expressed as mean ± standard deviation.
N = Newtons.

A statistically significant difference in denture retention was observed among the three groups at all follow-up intervals ($p < 0.001$). At 6 months, the functional impression group demonstrated the highest mean retention (15.0 ± 2.1 N), followed by the selective-pressure group (13.9 ± 2.2 N) and mucostatic group (11.8 ± 2.0 N). Retention showed a gradual improvement over time in all three groups.

Table 3. Comparison of Denture Stability and Patient Satisfaction at 6 Months

Outcome	Mucostatic	Selective-pressure	Functional	p-value
Stability score (0–10)	7.1 ± 1.1	8.2 ± 0.9	8.7 ± 0.8	<0.001
Overall satisfaction (VAS)	7.2 ± 1.2	8.3 ± 1.0	8.8 ± 0.8	<0.001
Satisfaction with retention	7.0 ± 1.3	8.2 ± 1.0	8.9 ± 0.8	<0.001

Outcome	Mucostatic	Selective-pressure	Functional	p-value
Satisfaction with stability	7.1 ± 1.2	8.3 ± 0.9	8.8 ± 0.8	<0.001
Comfort	7.5 ± 1.1	8.4 ± 0.9	8.7 ± 0.8	<0.001
Chewing ability	7.0 ± 1.2	8.0 ± 1.0	8.5 ± 0.9	<0.001
Speech	8.0 ± 0.9	8.3 ± 0.8	8.5 ± 0.7	0.041

The functional impression group demonstrated the highest stability score and overall patient satisfaction at 6 months. Patients in this group also reported better retention, comfort, and chewing ability. Selective-pressure impressions produced intermediate outcomes, while the mucostatic technique demonstrated comparatively lower scores. Differences were statistically significant for all evaluated parameters.

Table 4. Clinical Outcomes and Denture-Related Complaints at 6 Months

Outcome	Mucostatic n (%)	Selective-pressure n (%)	Functional n (%)	p-value
Good/excellent retention	20 (66.7)	26 (86.7)	28 (93.3)	0.020
Good/excellent stability	21 (70.0)	26 (86.7)	28 (93.3)	0.039
Satisfied/very satisfied	22 (73.3)	27 (90.0)	29 (96.7)	0.023
Difficulty during mastication	9 (30.0)	4 (13.3)	2 (6.7)	0.047
Denture displacement	8 (26.7)	3 (10.0)	2 (6.7)	0.064

Outcome	Mucostatic n (%)	Selective-pressure n (%)	Functional n (%)	p-value
Retention during function				
Mucosal soreness	7 (23.3)	4 (13.3)	3 (10.0)	0.321
Required major post-insertion adjustment	6 (20.0)	3 (10.0)	2 (6.7)	0.252

At 6 months, good or excellent retention was observed in **93.3% of patients in the functional group**, compared with 86.7% in the selective-pressure group and 66.7% in the mucostatic group ($p=0.020$). Similarly, 96.7% of patients receiving dentures fabricated using functional impressions were satisfied or very satisfied with their prosthesis.

Difficulty during mastication was significantly less frequent in the functional impression group (6.7%) than in the mucostatic group (30.0%; $p=0.047$). Although mucosal soreness and the need for major post-insertion adjustments were less frequent in the functional group, these differences did not reach statistical significance.

Overall Findings

The **functional impression technique demonstrated the most favorable clinical outcomes**, with significantly greater denture retention and stability compared with the other techniques. At 6 months, mean retention was **15.0 ± 2.1 N in the functional group, 13.9 ± 2.2 N in the selective-pressure group, and 11.8 ± 2.0 N in the mucostatic group** ($p<0.001$). Functional impressions were also associated with greater patient satisfaction, comfort, and chewing ability. The selective-pressure technique demonstrated intermediate outcomes, while the mucostatic technique showed comparatively lower retention and stability.

DISCUSSION

The present study compared mucostatic, selective-pressure, and functional impression techniques in 90 completely edentulous patients. Significant

differences were observed in denture retention, stability, and patient satisfaction. At 6 months, the functional impression technique demonstrated the highest mean retention (15.0 ± 2.1 N), followed by selective-pressure (13.9 ± 2.2 N) and mucostatic impressions (11.8 ± 2.0 N). Functional impressions also produced better stability, comfort, and chewing ability.

The influence of impression procedures on complete denture outcomes remains clinically relevant. Regis et al.⁸ demonstrated that simplified and conventional fabrication protocols can both provide acceptable patient-centered outcomes, suggesting that clinical success depends on multiple factors in addition to procedural complexity. Similarly, Nuñez et al.⁹ reported satisfactory patient satisfaction and oral health-related quality of life following both traditional and simplified complete denture protocols.

In the present study, functional impressions resulted in superior retention and stability. This may be attributed to more effective recording of the denture-bearing tissues and peripheral structures during functional movements, resulting in improved adaptation and peripheral seal. Jo et al.¹⁰ demonstrated that impression procedures can influence masticatory performance in complete denture wearers, supporting the functional importance of obtaining an appropriate definitive impression.

Selective-pressure impressions demonstrated intermediate results, with better retention and stability than the mucostatic technique. By selectively loading primary stress-bearing areas while relieving vulnerable tissues, this approach may provide a balance between tissue preservation and mechanical support. Resende et al.¹¹ reported that simplified final impression approaches can produce clinically acceptable complete dentures, although the choice of technique should consider individual ridge and mucosal characteristics.

Patient-reported outcomes were also favorable in the present study. At 6 months, 96.7% of patients in the functional group were satisfied or very satisfied, compared with 90.0% in the selective-pressure group and 73.3% in the mucostatic group. Shah et al.¹² demonstrated that different final impression techniques may influence masticatory efficiency and oral health-related quality of life, emphasizing the importance of evaluating patient-centered outcomes in addition to objective clinical measurements.

Recent evidence comparing simplified and traditional complete denture fabrication has shown that acceptable prosthesis performance can be

achieved using different clinical protocols when appropriate principles are followed.¹³ Functional recording of supporting tissues may nevertheless offer particular advantages where improved adaptation during function is desired. Dynamic impression approaches have also demonstrated improvements in functional parameters and oral health-related quality of life in complete denture wearers.¹⁴

In the present study, difficulty during mastication was least frequent in the functional group, while mucosal soreness and major post-insertion adjustments showed no significant differences among the groups. These findings indicate that greater retention and stability do not necessarily result in increased tissue-related complications. Modified impression approaches have similarly been investigated as methods of improving complete denture base retention.¹⁵

Overall, the findings suggest that impression technique can influence the clinical performance of complete dentures. Functional impressions demonstrated the most favorable retention, stability, and patient satisfaction, while selective-pressure impressions also provided satisfactory outcomes. However, selection of the impression technique should consider residual ridge morphology, mucosal condition, neuromuscular control, and individual patient requirements.

CONCLUSION

The functional impression technique provided significantly better complete denture retention and stability than selective-pressure and mucostatic techniques. It was also associated with greater patient satisfaction, comfort, and chewing ability. The selective-pressure technique produced satisfactory intermediate outcomes, whereas the mucostatic technique demonstrated comparatively lower retention and stability. Therefore, functional and selective-pressure impression techniques may be preferred when improved denture retention and stability are clinically required, with technique selection individualized according to the condition of the denture-bearing tissues.

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