



Comparative Evaluation of Masticatory Efficiency and Patient Satisfaction Using Three Different Impression Techniques in Completely Edentulous Resorbed Mandibular Ridge: A Randomised Controlled Trial

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(Received: 16 May 2025

Revised: 20 June 2025

Accepted: 24 July 2025)

KEYWORDS

Complete denture, Resorbed mandibular ridge, Impression techniques, masticatory efficiency, patient satisfaction.

ABSTRACT:

Restoration of function and comfort in completely edentulous patients with resorbed mandibular ridges remains a clinical challenge. This study evaluates the influence of three different impression techniques—conventional, cocktail, and neutral zone—on masticatory efficiency and patient satisfaction. A total of 24 edentulous patients were randomly divided into three groups (n=8 each), with each group receiving complete dentures fabricated using one of the three impression methods. All subsequent clinical steps followed a standardized protocol. Masticatory efficiency was assessed using a pre- and post-chewing gum weighing method, while patient satisfaction was measured through the OHIP-EDENT questionnaire, scored on a 5-point Likert scale. Statistical analysis revealed a significant improvement in both masticatory efficiency and satisfaction in patients treated with the neutral zone technique, followed closely by the cocktail method. The conventional technique showed comparatively lower effectiveness. Although the difference between the neutral zone and cocktail groups was not statistically significant, both outperformed the conventional approach. These findings suggest that impression technique plays a pivotal role in the functional and subjective success of complete dentures in patients with compromised ridges. Further studies with larger sample sizes are warranted to support these outcomes and refine treatment strategies.

INTRODUCTION

Complete denture therapy is undoubtedly among the age old forms of dental treatment used to rehabilitate an edentulous patient. The key to successful denture

therapy lies in precise execution of the treatment plan formulated by evaluation of a complete comprehensive history and through examination.¹



Residual ridge resorption is a common biophysical process that occurs after tooth extraction. It is most dramatic during the first year after tooth loss, followed by a slower but more progressive rate of resorption thereafter. Factors influencing ridge resorption include anatomic factors such as the rate of vertical bone loss in a broad high ridge, metabolic factors like parathyroid hormone imbalance, postmenopausal osteoporosis, continuous prostaglandin synthesis, mechanical factors like the frequency, direction, strength of forces acting on bone, bruxism, prosthetic factors like the type and fit of prosthesis, duration of prosthodontic treatment and occlusal disharmony. Treatment of atrophied ridges is a clinical challenge for dentists worldwide, as severely resorbed ridges present difficulties in fabricating an adequate prosthesis.²

The main aim of the impression procedure is to gain maximum area of coverage with minimum pressure by obtaining, a fairly long retro mylohyoid flange for a better border seal and retention and to educate and train the patient to maintain tongue position; i.e. forward and resting on top of lower anterior ridge when the mouth is open. In cases of resorbed mandibular ridges where minimum tissue is present to fulfil the fundamental requirement of retention, stability and support. No matter how good the prosthesis is constructed, it will not function as intended if it was not made on an accurate impression.³

The loss of natural teeth not only results in aesthetic issues to individuals, but can also seriously risk masticatory function. Long-term dentation could eventually result in bone resorption, temporomandibular disorders or muscle hypo-tonicity which ultimately leads to direct damage to the masticatory process.⁴ Masticatory efficiency, critical for proper food breakdown and digestion, is frequently compromised in complete denture patients with resorbed mandibular ridges. The diminished structural support and altered anatomy resulting from ridge resorption contribute to instability and reduced retention of dentures, thereby impairing masticatory function.⁵

Success of treatment with complete dentures is often assessed differently by dentists and patients. Accordingly, clinical success of denture treatment can be assessed in terms of patient satisfaction. Satisfaction outcomes are easy to measure and allow direct

quantification of patient's opinions and feelings towards different aspects of prosthodontic treatment. Satisfaction measures were found to be positively associated with oral health related quality of life (OHRQoL).⁶

Several questionnaires employing a variety of methodological approaches have been designed in the last few decades to assess the personal outcomes of oral disorders. Among others, the Oral Health Impact Profile (OHIP), Oral Health Quality of Life (United Kingdom) and Oral Impacts on Daily Performances health scales are the most often used in longitudinal and cross sectional studies.⁷

The null hypothesis of the study was that there was no difference in masticatory efficiency and patient satisfaction using three different impression techniques in completely edentulous resorbed mandibular ridge using conventional impression technique, cocktail impression technique and neutral zone technique in completely edentulous resorbed mandibular ridge.

CASE STUDY

This study was conducted in the Department of Prosthodontics and Crown & Bridge, I.T.S Dental College, Ghaziabad, to compare the effects of conventional, cocktail, and neutral zone impression techniques on masticatory efficiency and patient satisfaction in patients with resorbed mandibular ridges.

A total of 24 completely edentulous patients were selected from the outpatient department. All participants were thoroughly examined, and informed consent was obtained before enrolling in the study. Patient allocation was randomised using sequentially numbered opaque sealed envelopes as mechanism for the allocation concealment. Patients were segregated under three groups:

Group 1: Conventional impression technique (n=8).

Group 2: Cocktail impression technique (n=8).

Group 3: Neutral zone impression technique (n=8)

Inclusion Criteria

- Age between 50 and 80 years
- Presence of a resorbed mandibular ridge



- Ability to understand and respond to the questionnaire
- Previous denture wearer dissatisfied with existing prosthesis

Exclusion Criteria

- Acute or chronic temporomandibular disorders
- Uncontrolled systemic conditions
- Psychological disorders that could affect treatment response
- Tobacco users and smokers

Conventional Technique: Border molding was done with green stick compound followed by a final impression using zinc oxide eugenol. Standard procedures were followed for jaw relations, teeth setting with balanced occlusion, and denture fabrication.

Cocktail Technique: A functional impression was made using a 3:7 mix of green stick and impression compound, reinforced by muscle movements. The method utilized a modified tray with posterior rests for stabilization during impression making.⁸

Neutral Zone Technique: The neutral zone was recorded using tissue conditioner (Viscogel) loaded on a modified record base. Patients performed functional movements to shape the zone, which guided subsequent teeth arrangement within the muscle balance area.^{9,10}

Masticatory Efficiency Evaluation

Chewing efficiency was assessed using pre-weighed chewing gum. Each patient chewed the gum for 25 strokes. Samples were washed, dried, and desiccated for

24 hours. The difference in pre- and post-desiccation weights was used to calculate the percentage weight loss, representing masticatory efficiency.^{11,12}

Patient Satisfaction Evaluation

The OHIP-EDENT questionnaire, consisting of 20 items covering functional, psychological, and social impacts, was used to evaluate patient satisfaction. The questionnaire was provided in Hindi. Patients rated each item on a 5-point Likert scale (1 = never to 5 = always). The total score ranged from 20 (highest satisfaction) to 100 (lowest satisfaction).¹³

Data obtained were compiled and statistically analyzed to compare the effectiveness of the three impression techniques.

RESULTS

The study was conducted to compare and evaluate the masticatory efficiency and patient satisfaction between the three impression techniques. The data collected from the study were analyzed using Microsoft Excel XP and the Statistical Package for the Social Sciences (SPSS 16 Inc, Chicago IL, USA).

To ensure the accuracy of the analysis, the normality of the data was assessed using the Shapiro-Wilk test. For normally distributed data, descriptive statistics such as mean, standard deviation, and median were calculated. Comparative analysis between groups was performed using the one-way ANOVA and Post hoc Tukey test for parametric data, while the Mann-Whitney U test and Kruskal Wallis test were used for non-parametric data. The level of significance was set at $p < 0.05$, with a confidence interval of 95%.

MASTICATORY EFFICIENCY

Table 1: Comparison of the masticatory efficiency between three groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	210.193	2	105.096	27.355	<0.001*
Within Groups	80.682	21	3.842		
Total	290.875	23			

Table 1 compares the masticatory efficiency between the different groups. Statistically significant difference was found in the masticatory efficiency between the three groups tested ($p < 0.001$).

**Table 2: Pairwise comparison of masticatory efficiency between three groups**

Comparison	Mean difference	SE	p-value
Group 1 vs Group 2	-5.00	0.980	<0.001*
Group 1 vs Group 3	-7.05	0.980	<0.001*
Group 2 vs Group 3	-2.05	0.980	0.117

Table 2 presents the pairwise comparison of the masticatory efficiency between the three groups. There was statistically significant difference ($p < 0.001$) between the masticatory efficiency in group II (cocktail impression technique) as compared to group I (conventional impression technique). There was statistically significant difference ($p < 0.001$) between

the masticatory efficiency in group III (neutral zone technique) as compared to group I (conventional impression technique). However, there was no significant difference ($p > 0.05$) between the group II (cocktail impression technique) and group III (neutral zone technique).

Patient satisfaction

Table 3: Comparison of the patient satisfaction (%) between three groups

Group	Median	Mean Rank	chi-square value	p-value
Group 1	32.50	19.31	12.525	0.002*
Group 2	23.50	11		
Group 3	21.00	7.19		

Table 3, compares the patient satisfaction scores among the three groups. It shows that there was a statistically significant difference ($p < 0.05$) in the patient satisfaction score between the three groups tested.

Table 4: Pairwise comparison of patient satisfaction score between three groups

Comparison	SE	p-value
Group 1 vs Group 2	3.504	0.049*
Group 1 vs Group 3	3.504	0.002*
Group 2 vs Group 3	3.504	0.830

Table 4 presents the pairwise comparison of patient satisfaction between the three groups. There was statistically significant difference ($p < 0.05$) in the patient satisfaction in group III (neutral zone technique) as compared to group I (conventional impression technique). There was statistically significant difference ($p < 0.05$) in the patient satisfaction in group II (cocktail impression technique) as compared to group I

(conventional impression technique). However, there was no significant difference ($p > 0.05$) between group III (neutral zone technique) and group II (cocktail impression technique).

DISCUSSION

The results of the study showed that the masticatory efficiency and oral satisfaction was highest for neutral



zone technique followed by cocktail impression technique and least in conventional impression technique. There was significant difference ($p < 0.05$) between the masticatory efficiency and patient satisfaction ($p < 0.05$) in neutral zone technique as compared to conventional impression technique. Likewise, significant difference was noticed in the masticatory efficiency ($p < 0.001$) and patient satisfaction ($p < 0.05$) in cocktail impression technique as compared to conventional impression technique. However, there was no significant difference in the masticatory efficiency and patient satisfaction between cocktail impression technique and neutral zone technique ($p > 0.05$).

Although there are no direct studies for comparing the results of present study, similar results were reported by Al-Magaleh et al.¹⁴ who stated that dentures made with neutral zone offered significantly higher levels of patient satisfaction than conventional dentures in all functional aspects as well as in comfort and appearance. Patient's comfort with the neutral zone dentures, that could be explained because the polished surfaces of the mandibular denture were contoured and designed to conform to the shape of the tongue, lips, and cheeks. The artificial teeth were positioned in the zone of muscle balance. The dentures were designed to harmonize with the surrounding musculature, not only during rest but also during function, providing better stability and retention. This favourable, mutual denture-musculature relationship also eliminated pain-induced discomfort related to cheek/ tongue biting and that related to denture instability or looseness, which in turn made the dentures more physically comfortable. The better retention, stability, masticatory efficiency, aesthetics, and speech clarity subjectively felt by the participants definitely contributed to their overall psychological comfort.

In another study done by Bhatt et al.,¹⁵ it was observed that more than two third patients had improved masticatory efficiency when provided with denture made with neutral zone technique.

In the present study, neutral zone technique showed comparatively better results as it had been noted in various studies^{14,16-18} that the dentures fabricated with neutral zone technique were more comfortable and functionally stable than dentures fabricated by

conventional technique. In the neutral zone concept, although it is agreed that leverage is unfavourable, but it is overcome by the fact that the dislodging muscle forces are activated to retain and stabilize the lower complete denture.^{15,18,19}

In a study done by Ladha et al.²¹ patients rated their previous set of denture with two sets of dentures fabricated using the swallowing and phonetic neutral zone technique. It was observed that patients preferred dentures made from neutral zone over their previous dentures. However, no significant difference was found between the dentures fabricated by two neutral zone technique.

Zaigham¹⁷ stated that neutral zone dentures provided adequate space for tongue, better labial flange contours and anterior tooth positions than conventional dentures leading to the success of denture prostheses.

Barrenas and Odman²² advocated that myodynamic dentures offer better comfort and function to patients than conventional dentures. They experienced minimum post insertion problems with the myodynamic dentures.

However, the results are in contradiction to the study conducted by Fahmy and Khairat¹⁶ who documented that mastication was better with the conventional dentures as compared to dentures fabricated with neutral zone technique. They stated that owing to teeth arrangement over the center of alveolar ridge, mechanics of mastication was more favourable in conventional dentures. Nevertheless, patients exhibited a definite superiority of comfort and speech with the neutral zone dentures. Likewise, studies done by Geerts,^{23,24} it was stated that there is no statistical difference was found between neutral zone and conventional mandibular dentures.

Improved masticatory efficiency with cocktail impression technique can be attributed to the fact that it utilizes the combination of different impression techniques to obtain a definitive impression i.e., dynamic impression technique described by Tryde et al.,²⁵ impression material recommended by McCord and Tyson's technique²⁶ for atrophic mandibular ridge followed by functional impression as in closed mouth impression technique.²⁷ The technique effectively avoids the dislocating effects of muscles on improperly extended denture borders by using a specially designed



tray that maximizes both active and passive tissue fixation. Mandibular rests stabilize the custom tray against the maxillary alveolar ridge, preventing horizontal displacement during the impression process. Additionally, the admixed technique captures muscle function in a single step, reducing chair time and costs compared to using tissue conditioners.

The results are in accordance to the technique advocated by Praveen et al.⁸ who emphasised the utilization of cocktail impression technique for obtaining definitive impression, thereby making it possible to economically yet effectively rehabilitate a patient with flat, atrophic, depressed, mandibular ridge and improving the function. Further, in a study conducted by Yadav et al.,²⁸ it was observed that mandibular denture made using functional impression technique showed the highest mean values of complete denture retention whereas denture made using green stick compound with metallic oxide final wash showed the lowest mean values of complete denture retention.

The study highlights that impression technique influences both denture stability and patient comfort, with the neutral zone method showing the highest masticatory efficiency—beneficial for patients with resorbed ridges. Key satisfaction factors can guide better communication and personalized treatment. However, the study is limited by its small sample size, short follow-up, and single-center design. Future research should include larger, multicentric trials, longer assessments, and objective tools like electromyography, as well as explore digital techniques for improved outcomes.

CONCLUSIONS

Within the limitation of the study the following conclusions were drawn:

1. The masticatory efficiency was found highest for neutral zone technique followed by cocktail impression technique and least in conventional impression technique. There was statistically significant difference ($p < 0.001$) between the masticatory efficiency in neutral zone technique and cocktail impression technique as compared to conventional impression technique. However, there was no significant difference ($p > 0.05$) in the masticatory

efficiency between cocktail impression technique and neutral zone technique.

2. The patient satisfaction was found highest in neutral zone technique followed by cocktail impression technique and least in conventional impression technique. There was statistically significant difference ($p < 0.05$) in the patient satisfaction in neutral zone technique and cocktail impression technique as compared to conventional impression technique. However, there was no significant difference ($p > 0.05$) in the patient satisfaction between cocktail impression technique and neutral zone technique.

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Figure : Plain dessicator



Figure : 7:3 Ratio for admixed technique



Figure : Impression made by conventional impression technique



Figure: Impression made by cocktail impression technique



Figure : Fabrication of custom tray for cocktail impression technique



Figure : Fabrication of acrylic stent



Figure : Recording of Neutral zone



Figure : Measuring of weight



Figure : Neutral zone recorded with viscogel material



Figure : Chewing gum stored in desiccator for 24 hours



Figure : Putty index was made and molten wax was poured



Figure : Measuring of weight post desiccation



Figure : Polished surface recorded