

Functional Rehabilitation And Facial Esthetic Enhancement Using A Neutral Zone-Guided Hollow Cheek Plumper Denture: A Clinical Report

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Abstract:

Background: Complete edentulism with severe residual ridge resorption leads to inadequate denture stability and compromised facial esthetics, necessitating innovative prosthodontic approaches.

Case Presentation: A 55-year-old female patient presented with an ill-fitting maxillary complete denture, poor masticatory function, and sunken cheeks due to severe mandibular ridge resorption. A maxillary complete denture with a hollow fixed cheek plumper was fabricated. The neutral zone was recorded using impression compound to guide physiologic positioning of the denture teeth and polished surfaces within the patient's functional muscular envelope. The cheek plumper was fabricated using the lost salt technique to minimize prosthesis weight while restoring adequate buccal soft tissue support. Non-anatomic teeth were arranged in a monoplane occlusal scheme within the recorded neutral zone. Patient demonstrated satisfactory denture retention, improved masticatory function, enhanced facial esthetics, and high treatment satisfaction.

Conclusion: Integration of the neutral zone technique with a hollow fixed cheek plumper represents a simple, economical, and minimally invasive approach for simultaneous functional rehabilitation and facial esthetic enhancement in edentulous patients with severe ridge resorption and sunken cheeks.

Keywords: complete denture; neutral zone; cheek plumper; hollow cheek plumper; lost salt technique; facial esthetics; edentulism; ridge resorption

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I. Introduction

Complete edentulism remains a significant challenge in prosthodontic rehabilitation because it affects not only oral function but also facial appearance and psychosocial well-being. Progressive residual ridge resorption following tooth loss results in loss of lip and cheek support, reduced lower facial height, and an aged facial appearance characterized by sunken cheeks and prominent nasolabial folds. Consequently, successful complete denture therapy should restore both function and facial esthetics to improve the patient's quality of life.^{1,2}

Conventional complete dentures often restore mastication and speech satisfactorily; however, they may fail to provide adequate support for the buccal soft tissues in patients with advanced ridge resorption. The external or polished surface of a denture plays a critical role in its stability, retention, and interaction with the surrounding musculature. Dentures designed in harmony with the functional movements of the lips, cheeks, and tongue are more likely to remain stable during function and provide better facial support.^{8,9}

The neutral zone technique is based on the principle that denture teeth and polished surfaces should be positioned within the area where the forces of the tongue are balanced by those of the lips and cheeks. Recording this physiologic zone allows the denture to function in equilibrium with the surrounding muscles, thereby improving stability, comfort, phonetics, and masticatory efficiency, particularly in patients with severely resorbed ridges.^{7,9}

Cheek plumpers have been introduced as a conservative prosthodontic approach to restore facial fullness in edentulous patients with sunken cheeks. They provide additional support to the buccal soft tissues without the need for surgical intervention. Both detachable and fixed cheek plumper designs have been reported with satisfactory esthetic outcomes; however, increasing the bulk of the prosthesis may add weight and adversely affect denture retention.^{16,17} Fabricating the cheek plumper as a hollow structure offers a practical solution by reducing prosthesis weight while maintaining adequate cheek support and patient comfort. Recent clinical reports have demonstrated encouraging esthetic and functional outcomes with hollow fixed cheek plumper dentures.²²

Although several techniques for cheek plumper fabrication have been described, reports integrating the neutral zone philosophy with a hollow fixed cheek plumper for patients requiring replacement of ill-fitting complete dentures remain limited. This clinical report describes the rehabilitation of a completely edentulous patient with severe ridge resorption and sunken cheeks using a neutral zone-guided hollow cheek plumper incorporated into a maxillary complete denture to achieve improved denture stability, facial support, and patient

II. Case Report

A 55 year old female patient reported to Department of prosthodontics, Jaipur Dental College with chief complaint of difficulty in eating due to ill-fitting denture and poor facial appearance. Her primary concern was to regain adequate chewing ability while improving the fullness of her face.

History revealed that patient had been edentulous since last 10 years and had been wearing denture from Last 6 years. On intra-oral examination, the patient had moderately resorbed maxillary and severely resorbed mandibular edentulous ridges with healthy mucosa. Extraoral examination revealed marked loss of cheek support, prominent nasolabial folds, and reduced lower facial height, giving the patient an aged appearance. Existing Dentures exhibited inadequate vertical dimension at occlusion with non-anatomic (monoplane) teeth, underextended flanges, poor retention, stability, and esthetics.

After discussing the available treatment options, including detachable and fixed cheek plumper, their respective benefits, limitations, and maintenance requirements, the patient preferred a single maxillary complete denture incorporating fixed cheek plumper that would not require attachment or removal during daily use. Considering the extent of ridge resorption and the need to preserve denture retention, a treatment plan was formulated to fabricate a maxillary complete denture with a hollow cheek plumper. The neutral zone technique was incorporated to ensure that the additional cheek support remained within the patient's functional muscular envelope. Written informed consent was obtained before initiating treatment.



Figure 1: Preoperative frontal (left) and lateral profile (right) photographs

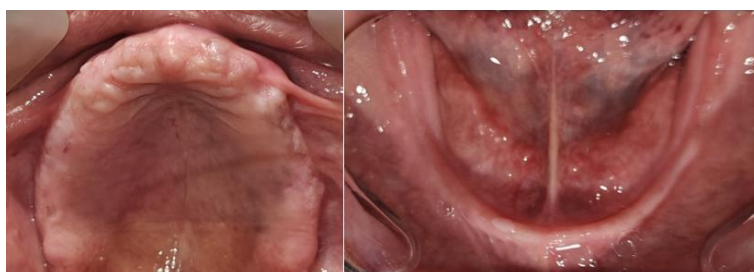


Figure 2: Maxillary and mandibular edentulous arches



Figure 3: Existing dentures

Preliminary impressions of the maxillary and mandibular edentulous arches were made using impression compound (DPI Pinnacle Impression Compound; Dental Products of India Ltd., Mumbai, India). Diagnostic casts were poured in dental plaster, and custom impression trays were fabricated using auto polymerizing acrylic resin (DPI RR Cold Cure; Dental Products of India Ltd., Mumbai, India).³

Border moulding was performed with low-fusing impression compound (DPI Pinnacle Tracing Sticks; Dental Products of India Ltd., Mumbai, India) to accurately record the functional depth and width of the vestibular sulcus. Following satisfactory border moulding, definitive impressions were obtained using zinc oxide eugenol impression paste (DPI Impression Paste; Dental Products of India Ltd., Mumbai, India), which provided an accurate mucostatic recording of the denture-bearing tissues.^{3, 4}

Master casts were poured in Type III dental stone, and record bases with wax occlusion rims were fabricated. The vertical dimension of occlusion was established by evaluating facial esthetics, phonetics, interocclusal rest space, and patient comfort. After confirming an acceptable vertical dimension, the maxillary occlusal plane was oriented using an occlusal plane analyser to achieve parallelism with the interpupillary line anteriorly and the ala-tragus line posteriorly.^{3, 5}



Figure 4: Primary impressions Maxillary arch (left), Mandibular Arch (Right)



Figure 5: Border molding Maxillary arch (left), Mandibular Arch (Right)



Figure 6: final impressions Maxillary arch (left), Mandibular Arch (Right)

The orientation jaw relation was recorded using a Hanau Spring Facebow (Hanau Engineering Co., Buffalo, NY, USA), and the maxillary cast was transferred to a Hanau Wide-View semi-adjustable articulator. Centric relation was initially recorded with a wax interocclusal record and subsequently verified using the extraoral graphic tracing (gothic arch tracing) technique with a Hanau Height Tracer. The apex of the gothic arch tracing was accepted as the definitive centric relation position, following which the mandibular cast was mounted on the articulator using the verified interocclusal record. This procedure ensured precise transfer of the maxillomandibular relationship and provided a stable foundation for subsequent neutral zone recording and prosthetic tooth arrangement.^{3, 5}



Figure 7a: Occlusal plane determination using occlusal plane analyser (left)

Figure 7b: Facebow record (middle)

Figure 7c: Maxillary and mandibular cast mounted on Hanau Vide View Articulator (Right)



Figure 8 : Gothic Arch Tracing



Figure 9 : Neutral zone recording

Neutral Zone Recording

After establishing the vertical dimension of occlusion and centric relation, the maxillary occlusion rim was retained to preserve the established maxillomandibular relationship, whereas the mandibular wax rim was removed and replaced with softened impression compound (DPI Pinnacle Impression Compound; Dental Products of India Ltd., Mumbai, India) adapted over the mandibular record base.^{3,9}

The impression compound was softened in a thermostatically controlled water bath at approximately 55–60°C. It was then molded into a rim of appropriate dimensions and adapted onto the mandibular record base. The record base carrying the softened compound was inserted into the patient's mouth, and the predetermined vertical dimension of occlusion was maintained by gently occluding against the maxillary wax rim.^{3,9}

The patient was instructed to perform a sequence of functional movements, including swallowing, speaking, smiling, pursing the lips, sucking, licking the lips, pronouncing phonetic sounds such as "ee" and "oo," and repeated opening and closing of the mouth. These physiologic movements allowed the surrounding musculature, including the lips, cheeks, and tongue, to dynamically shape the softened impression compound, thereby recording the neutral zone, where the inward forces exerted by the cheeks and lips are balanced by the outward forces of the tongue.⁷⁻⁹

The molded compound rim was carefully removed and cooled in water to stabilize its contours before being reinserted to verify comfort, stability, and accuracy. Any discrepancies were corrected by selectively reheating and remolding the impression compound. Once an acceptable neutral zone record had been obtained, a silicone putty index was fabricated around the molded compound to preserve its contours. The impression compound was subsequently removed, and the indexed space was replaced with modeling wax. Non-anatomic acrylic teeth (0° cuspal inclination) were arranged within the recorded neutral zone using a monoplane occlusal scheme. Tooth arrangement was carried out to establish a stable occlusion while maintaining harmony with the patient's functional muscular envelope.³ The neutral zone-guided arrangement enabled positioning of the denture teeth within the patient's functional muscular balance, while the monoplane occlusal scheme minimized lateral occlusal forces, thereby improving denture stability, phonetics, masticatory efficiency, and support of the facial soft tissues.^{3, 7-9}

Fabrication of Hollow Cheek Plumper Using the Lost Salt Technique

During the wax trial, additional modeling wax (DPI Modelling Wax; Dental Products of India Ltd., Mumbai, India) was incrementally adapted over the buccal flange in the premolar–molar region of the maxillary

trial denture to achieve the desired cheek support. The contour, extension, and thickness of the cheek plumper were refined intraorally while carefully evaluating facial symmetry, fullness of the cheeks, and harmony with the surrounding facial tissues. The patient was encouraged to perform functional movements, including smiling, speaking, and swallowing to ensure that the cheek plumper remained within the previously recorded neutral zone and did not interfere with normal muscular activity. Both the clinician's assessment and the patient's perception of facial esthetics and comfort were considered before finalizing the wax contours.^{9, 22}

Following approval of the trial denture, the prosthesis was invested conventionally, and the wax was eliminated during dewaxing. To fabricate a hollow cheek plumper, a predetermined quantity of coarse table salt was enclosed within the cheek plumper portion of the mold during packing while maintaining a uniform thickness of acrylic resin around the salt core. Trial closure was performed to verify complete flask closure and uniform distribution of the heat-polymerizing acrylic resin (DPI Heat Cure Acrylic Resin; Dental Products of India Ltd., Mumbai, India). The denture was then processed according to the manufacturer's recommended polymerization cycle using the conventional compression molding technique.³

After deflasking, finishing, and polishing, a small access opening was prepared on the intaglio surface of the cheek plumper using an acrylic bur. Warm water was injected through the opening to dissolve and flush out the salt crystals completely, thereby creating a hollow cavity within the cheek plumper. The cavity was repeatedly irrigated until all residual salt particles were removed. The access opening was subsequently sealed with autopolymerizing acrylic resin (DPI RR Cold Cure Acrylic Resin; Dental Products of India Ltd., Mumbai, India), followed by finishing and polishing to restore the integrity of the denture base.⁵

The completed prosthesis was immersed in water to verify the integrity of the seal. The absence of escaping air bubbles confirmed that the hollow cavity had been adequately sealed without leakage. The denture was inserted, and retention, stability, occlusion, phonetics, facial esthetics, and patient comfort were carefully evaluated. Oral hygiene instructions and denture maintenance protocols were explained, and the patient was scheduled for periodic follow-up visits to assess functional adaptation and long-term clinical performance.³ The hollow cheek plumper provided adequate support to the buccal soft tissues without compromising the retention of the maxillary denture. The patient reported marked improvement in facial appearance, masticatory function, speech, and overall confidence.²²



Figure 10: Try in complete denture with hollow cheek plumper



Figure 11: Processed prosthesis **Figure 12:** Water leakage test demonstrating hollow cavity



Figure 13: Final dentures



Figure 14: Denture Insertion



Figure 15: Post treatment frontal photograph

III. Discussion

The rehabilitation of completely edentulous patients requires restoration of both oral function and facial esthetics. Progressive residual ridge resorption following tooth loss leads to loss of soft tissue support, decreased lower facial height, and sunken cheeks, all of which contribute to an aged facial appearance and adversely affect patients' psychological well-being.^{1,2} In the present case, severe mandibular ridge resorption combined with loss of buccal support resulted in compromised denture stability and facial esthetics, necessitating a treatment approach that addressed functional as well as cosmetic concerns.

Successful complete denture therapy depends not only on accurate impression making and occlusal harmony but also on appropriate contouring of the polished surfaces. Lott and Levin emphasized that the external contours of the denture should harmonize with the surrounding musculature to improve retention, comfort, and facial support.⁸ Similarly, Beresin and Schiesser proposed the neutral zone philosophy, demonstrating that denture teeth and polished surfaces should be positioned within the zone where the forces exerted by the tongue are balanced by those of the lips and cheeks.⁷ Recording the neutral zone allows the surrounding musculature to stabilize rather than displace the prosthesis during functional activities. In the present case, impression compound was used to record the neutral zone, permitting physiologic contouring of the polished surfaces and optimal positioning of the artificial teeth. This approach contributed to satisfactory denture stability, phonetics, and patient comfort throughout the follow-up period.^{7,9,10}

The present patient exhibited a severely resorbed mandibular ridge, corresponding to a compromised edentulous condition as described by McGarry et al.¹¹ Such patients frequently experience instability of conventional complete dentures because of reduced denture-bearing surface area and unfavorable muscular forces. Recording the neutral zone becomes particularly valuable in these situations because it compensates for diminished anatomic support by utilizing functional muscular balance. Recent developments, including digital techniques for neutral zone recording, further support the continued clinical relevance of this concept while demonstrating its adaptability to contemporary prosthodontic workflows.¹⁰

Restoration of facial fullness represented another important treatment objective. Loss of posterior alveolar bone and reduced muscle tone frequently produce sunken cheeks that cannot be adequately corrected

by conventional denture flanges alone. Cheek plumpers provide additional support to the buccal soft tissues and represent a conservative alternative to surgical facial augmentation.^{1,16} Numerous attachment designs have been described, including magnets, customized attachments, die pins, detachable mechanical retainers, and magnet-retained prostheses.¹⁴⁻²⁰ Although detachable cheek plumpers facilitate cleaning and permit selective use, they increase laboratory complexity, require additional attachment components, and may present maintenance problems related to wear, corrosion, or loss of retention over time.^{15,17,18,20,21}

Considering the patient's preference for a simple, single-piece prosthesis, a fixed cheek plumper was selected. However, incorporation of additional acrylic resin increases prosthesis weight and may adversely affect retention of the maxillary denture. To overcome this limitation, a hollow cheek plumper was fabricated using the lost salt technique. This method reduced the weight of the prosthesis while maintaining adequate buccal support and required only inexpensive materials readily available in routine dental practice. Colvenkar et al. similarly reported favorable clinical outcomes using a hollow fixed cheek plumper, demonstrating improved facial esthetics without compromising patient comfort.²² In the present case, the reduced prosthesis weight contributed to satisfactory retention, and the patient reported no evidence of muscle fatigue or discomfort during the one-year follow-up period.

Occlusal considerations were equally important in the successful outcome of this case. Because of the severely resorbed mandibular ridge, non-anatomic acrylic teeth arranged in a monoplane occlusal scheme were selected. Elimination of cusp inclines reduces horizontal and lateral occlusal forces transmitted to the supporting tissues, thereby minimizing denture tipping during function. Current evidence indicates that simplified occlusal schemes provide clinical outcomes comparable to more complex occlusal concepts in complete denture therapy while improving patient comfort in compromised ridges.^{12,13} The combination of monoplane occlusion with neutral zone-guided tooth arrangement further enhanced denture stability by ensuring that occlusal forces remained centered over the supporting tissues within the patient's functional muscular envelope.

Evaluation of the patient's previous dentures revealed reduced vertical dimension of occlusion, underextended borders, poor retention, inadequate polished surface contour, and insufficient cheek support. Correction of these deficiencies through appropriate impression procedures, restoration of the vertical dimension, accurate maxillomandibular relationship, neutral zone-guided tooth arrangement, and incorporation of a hollow cheek plumper resulted in significant improvements in masticatory efficiency, speech, facial esthetics, and overall patient satisfaction. The favorable clinical outcome observed during the one-year recall period highlights the importance of integrating established prosthodontic principles with conservative esthetic modifications when managing complex edentulous patients.

Although this report describes the successful rehabilitation of a single patient, the findings should be interpreted with caution because long-term clinical performance cannot be generalized from an individual case. Future prospective studies with larger patient cohorts are warranted to compare different cheek plumper designs, hollow fabrication techniques, and digital neutral zone recording methods with respect to patient-reported outcomes, prosthesis longevity, and maintenance requirements. Nevertheless, the present technique offers a simple, economical, and minimally invasive treatment option that can be readily incorporated into routine complete denture practice for patients presenting with severe ridge resorption and loss of facial support.

IV. Conclusion

The combination of the neutral zone technique with a hollow fixed cheek plumper provided a predictable and conservative approach for rehabilitating a completely edentulous patient with severe residual ridge resorption and sunken cheeks. Recording the neutral zone facilitated physiologic positioning of the denture teeth and polished surfaces, resulting in improved denture stability, retention, phonetics, and masticatory function. Incorporation of a hollow cheek plumper fabricated using the lost salt technique restored facial fullness while minimizing the additional weight of the prosthesis, thereby preserving maxillary denture retention. At the one-year follow-up, the patient demonstrated satisfactory functional adaptation, enhanced facial esthetics, and high overall treatment satisfaction. This technique represents a simple, economical, and minimally invasive option that can be readily incorporated into routine complete denture practice for selected patients requiring simultaneous functional rehabilitation and facial esthetic enhancement

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