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## Hollow Dentures and the Neutral Zone: Enhancing Denture Stability and Function

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### Abstract

Conventional complete denture therapy for patients with severe residual ridge resorption is challenging, thus, the neutral zone technique is an important alternative approach for improving denture support, retention, and stability for patients with severe residual ridge resorption, especially when implant therapy is not feasible. Various materials can be used for recording the neutral zone, each with its own advantages and disadvantages.

Keywords: Complete denture, Neutral zone, Admix impression, Residual ridge resorption, Hollow Denture

### Introduction

The fabrication of complete removable dentures has evolved noticeably over the years with the advent of new materials, techniques and a better understanding of the surrounding functional structures necessary to fabricate the complete dentures. “While planning for a smile, it demands the synergistic actions of the tongue, lips, cheeks and floor of the mouth that are very complex and highly individual. Failure to recognize the cardinal significance of tooth position and flange form and contour often results in dentures which are unstable and disappointing, although they are skilfully designed. The coordination of complete dentures with the correct neuromuscular perform is that the solely foundation to victorious and stable denture” (1)

The lower denture commonly presents with residual ridge resorption, less stability and retention. Hence, residual ridge resorption becomes a challenging sketch for a clinician during fabrication of complete dentures. The neutral zone concept plays a substantial role in overcoming these challenges. According to GPT-10 “The neutral zone is the area in the mouth where the tongue's outward forces are neutralized by the lips and cheeks' inward forces. This area is the space between the tongue and the lips and cheeks, where the opposing forces from the surrounding muscles are equal.”

The goal of this technique is to place the teeth such that the forces exerted by the tongue and the cheek muscles are nullified, and the teeth remain in a safe, protected zone. Traditionally, the arrangement of teeth is based on the principles of teeth arrangement. (2) However, in the neutral zone technique, the placement of teeth is dictated by the oral musculature that varies from one patient to another.

Hollow dentures are lightweight dentures. They are fabricated specifically for atrophic maxilla with large interridge distance.

Hollow dentures can help to:

- Improve retention and stability
- Protect underlying tissues and bone
- Prevent transmission of detrimental forces
- Increase interridge space in edentulous ridges

### Principle Muscles

The major muscles involved are:- (3)

- a) Buccinator
- b) Orbicularis Oris
- c) Modiolus
- d) Tongue muscles

#### A) Buccinator

This muscle has a large role in determining the neutral zone. It extends anteriorly from the pterygomandibular raphe, from above the maxillary molars and below the mandibular molars to converge, with other muscles, at the modiolus. Some fibres pass through the modiolus to terminate in the orbicularis oris. The role of the buccinator during function is to position food on the occlusal surfaces of the teeth. This action is coordinated with the tongue to maintain the food in this position.

#### B) Orbicularis Oris

The orbicularis oris and the mentalis in the highly atrophic, mandible positioning of the anterior teeth can be problematic. The movement and interaction of the lip and the tongue determines the position of the lower anterior teeth. If they are positioned too far labially the contraction of the lip will displace the denture posteriorly. The ridge can also resorb to such an extent that the mentalis muscle displaces the neutral zone lingually and anterior tooth position becomes even more vital for the success of the denture. The Neutral Zone technique provides the correct tooth position to allow for the balancing of these muscular forces during function.

#### C) Modiolus

The modiolus is a strong knot of muscle that alters the position of the angle of the mouth. The main muscles that converge at the modiolus are the buccinator, orbicularis oris, zygomaticus major, and the levator and depressor anguli oris. Free movement of this knot of muscle must be ensured if the lower denture is to be stable. The modiolus determines the position of the premolar teeth and the shape of the polished surface in that region. This produces a narrowing of the denture so that the polished surface does not hinder the movements of the modiolus during function.

#### D) Tongue muscles

The tongue is a powerful group of muscles and it is in constant contact with the denture at rest and during function. During rest the two critical areas for the tongue

are the anterior lingual flange and posterior to the molar teeth. The polished surfaces must be correctly shaped to allow for the tongue to lie unhindered in these areas. During function the position of the anterior and posterior teeth are critical. If the anterior or posterior teeth are set lingually the tongue will be cramped and the denture will be displaced during function. There must be sufficient tongue space to allow for movement. The occlusal plane is also important for stability. It should not be too high as to 'wall in' the tongue but should allow it to lie on the occlusal surface during rest.

### Indications Of Neutral Zone Technique

This technique is found to be used in the following clinical situations:

- 1) Severely atrophic mandibular ridge. (4)
- 2) Patients with prominent and highly attached mentalis muscle, lateral spreading of tongue as a result of poor transition from dentate to edentulous state and severe resorption. (4)
- 3) Patients with atypical shape or consistency of oral and perioral structures. For example, patients who have scleroderma, marginal or segmental mandibulectomy and partial glossectomy.(4)
- 4) Patients with diminished neuromuscular control such as those with a history of stroke, Parkinson's disease or patients with impaired motor innervation to oral and facial muscles as a result of brain surgery(5)

### Case Report

A 75-year-old male patient reported to the Department of Prosthodontics and Crown & Bridge with chief complaint of inability to chew food since 2 weeks. On intra-oral examination, the patient had completely edentulous maxillary and mandibular arches (Fig I and II). Maxillary ridge had low well rounded ridge and mandibular ridge showed excessive residual ridge resorption. Medical history revealed that the patient was diabetic and under medication for same since 15 years. With early symptoms of Parkinson, dental history given by patient was of total extractions done 10 years ago, followed by denture fabrication and placement. On evaluation, the previous denture was ill-fitting and had attrited acrylic teeth, that caused excessive ridge resorption. After clinical examination, it was concluded that patient had severe residual ridge resorption in both the arches, thus complete denture fabrication was planned utilising neutral zone recording technique for mandibular arch and fabricating a hollow denture for maxillary arch.

### Procedure

Maxillary and mandibular primary impressions were made in stock trays using impression compound and irreversible hydrocolloid respectively and poured in dental plaster and dental stone. On the primary casts obtained, custom trays were fabricated in autopolymerising resin for selective pressure impression technique. Mandibular custom tray was designed using a double spacer to provide space for admix impression material.(6) Border moulding for maxillary arch was done using low fusing green stick compound and final impression was made using Zinc Oxide Eugenol impression paste. McCord and Tyson admix impression technique for mandibular arch was done by using combination of impression compound and low fusing green stick compound in the ratio of 3:7, allowing ease in manipulation by oral musculature, better flow and accurate impression. A wash impression was then made on the recorded impression with the help of Zinc Oxide Eugenol impression paste. Master casts were obtained in dental stone on which record bases and occlusal rims were fabricated.

Jaw relation was recorded and then transferred to a mean value articulator. Mandibular neutral zone impression was recorded using McCord and Tyson impression technique.(7) In

this technique, mandibular wax rim was removed and two acrylic pillars were fabricated in premolar region of both the sides measuring 3 mm labio-lingually and 6 mm mesiodistally. The height of these acrylic pillars was fabricated according to the established vertical dimension (Figure III). Admix mixture of impression compound and low fusing green stick compound was kneaded and adapted to mandibular record base. Maxillary record base was placed in the patient's mouth followed by mandibular record base with softened admix compound. The patient was instructed to perform functional movements like smiling, sucking, swallowing, licking the lips, whistling, pronouncing vowels and count from 60 to 70 (3). Excess compound is trimmed and the material was resoftened till satisfactory recording of neutral zone was achieved (Fig IV).

The recorded neutral zone was placed back on the articulator and indexes were made in mandibular cast to reorient the index. A putty index was formed using addition silicone in putty consistency (Fig V). Recorded neutral zone was then removed and a wax rim was fabricated in this neutral zone with the help of putty index (Fig VI). Teeth arrangement was first done for mandibular arch (Fig VII) ensuring to arrange the teeth within neutral zone to enhance stability. Maxillary teeth arrangement was done, followed by try-in (Fig VIII).

Two-flask technique, described by Fattore et al was used for maxillary hollow denture acrylization (8).

After flasking and dewaxing of maxillary denture, a wax record base was made on the maxillary cast and acrylised in heat polymerising acrylic resin. Fit of the first dewaxed flask (with acrylic teeth) was checked on this record base and then packing was done by incorporating salt in the alveolar ridge region to fabricate hollow denture (Fig IX). After acrylisation, finishing and polishing, two holes were made in maxillary tuberosity region and salt was flushed out with the help of water. When complete removal of salt was achieved, the holes were closed using self-cure acrylic resin.

Denture insertion was done and patient was recalled after 24 hours, 48 hours and 1 week following insertion (Fig X).

### **Competency Stages for recording a neutral zone procedure**

Ensure the patient in sat upright with the head supported. This allows the actions of swallowing and speaking to be more natural.
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Assess the base plate — checking that it is stable and does not hinder muscular function.
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Instruct the patient to perform repeated actions:
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Swallow and take frequent sips of water.
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Talk aloud, pronouncing the vowels and count from 60 to 70.
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Smile, grin, lick their lips and purse their lips
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### **Discussion**

Providing stable and retentive dentures for patients with severe mandibular ridge resorption is challenging. One solution is fabricating dentures that conform to the neutral zone - the area of minimal muscular interference from the tongue, cheeks, and floor of the mouth. The neutral zone technique aims to construct a denture in harmony with surrounding muscle forces for optimal stability, retention, and comfort.(4) A denture shaped by this technique allows the musculature to function more effectively, harnessing their stabilizing potential.

Various materials have been recommended for recording the neutral zone. In this article the admix material is used which is made up by mixing of a low-fusing compound with the impression compound results in a low viscosity material allowing for ease in manipulation of the oral musculature. The admix material have sufficient body allowed better flow and an accurate impression.(2)

Beresin and Schiesser recommended technique involves building two occlusal pillars with self-cured acrylic resin on the mandibular arch, shaped and adjusted with green stick to the 3mm freeway space(1). An alternative presented here uses two vertical pillars of low-fusing compound in the first molar regions on an additional denture base with retentive anterior wire loops, opposing the maxillary occlusal rim at the determined vertical height. This provides comfort, prevents mandibular overclosure during neutral zone recording, and reduces chair time.

#### Different Materials Used For Recording Neutral Zone Technique

Name	Merits	Demerits
Impression Plaster	Has good flow, thus will record the neutral zone well	Risk to swallow
Impression waxes	Can be added incrementally till operator's satisfaction	Brittle, time consuming
Impression compound	Sufficient body	Time consuming, fracture risks, difficult to manipulate
Tissue Conditioner	Good flow, less fracture risks	Lack sufficient body making them difficult to use
Soft Liner and hard liner	Good flow, no fracture or swallowing risk, easy to use	Lack sufficient body making them difficult to use
Polyether	The material of choice as it has good flow, sufficient body, is easy to use, less time-consuming, and avoids fracturing or swallowing risks	Messy to use

#### Conclusion

Neutral zone is a consequential technique for the construction of complete dentures on highly atrophic ridges. It is especially useful in cases where dental implants are not possible. The aim of the neutral zone is to construct a denture in muscle balance, as muscular control will be the main stabilizing and factor during function. The technique is relatively simple but there is increased chair time and laboratory costs.

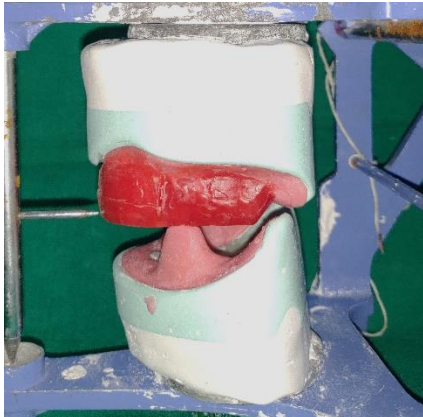
The neutral zone technique for denture fabrication has an advantage that it stabilizes the denture with the surrounding soft tissues, instead of being dislodged by them and stability of dentures are greatly improved, especially in the severely atrophic ridges.



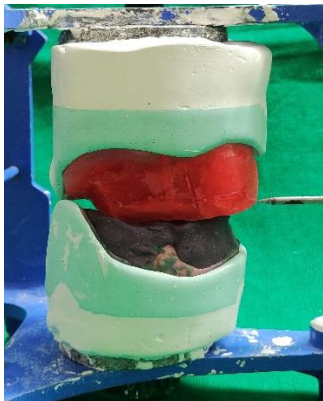
Fig I: Maxillary arch



**Fig II: Mandibular arch**



**Fig III: Record base with acrylic pillars**



**Fig IV: Recorded neutral zone**



**Fig V: Putty index on neutral zone**



**Fig VI: Putty index with wax occlusal rim**



**Fig VII: Mandibular teeth arrangement according to putty index**



**Fig VIII: Denture packing for maxillary hollow denture**



**Fig IX: Denture insertion**

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