

Case Report

PROSTHODONTIC MANAGEMENT OF RESORBED MANDIBULAR RIDGE USING NEUTRAL ZONE IMPRESSION TECHNIQUE : A CASE REPORT

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Abstract :

One of the most commonly faced problems among long term denture wearers is the reduction in the denture foundation. Prosthetic rehabilitation of a patient with severely resorbed ridge is the most challenging therapy a prosthodontist can undertake. In order to have a favourable prognosis for the denture therapy, impression technique selected should be based on the present state of the basal tissue support. This article presents the application of neutral zone concept being incorporated in impression making to achieve successful complete denture therapy.

Keywords : Neutral Zone Concept, Resorbed Mandibular Ridge, Complete Denture Prosthesis, Functional Moulding Technique.

Introduction :

According to the Glossary of Prosthodontic Terms (2005) neutral zone is "the potential space between the lips and the cheeks on one side and the tongue on the other; that area or position where the forces between the tongue and cheeks or lips are equal."¹

The eruption of the teeth in the oral cavity is influenced by the forces exerted by tongue, cheeks and lips. These muscular forces collectively determine the final dental arch form and position of the tooth in the oral cavity. This muscular environment continues throughout life, even after teeth have been lost and greatly influences this potential space. It is one of the major determining factors for any prosthesis that will be placed in the oral cavity to replace these missing teeth.²

This potential space is known as neutral zone, which is bounded by the tongue medially, and the lips and cheeks laterally. The success of denture prosthesis depends on the proper positioning of the artificial teeth within the neutral zone. Failure to

recognize the importance of tooth position, flange form and contour often results in dentures which are unstable and unsatisfactory. Dental implants placed with neutral zone technique stabilize the denture fabricated over atrophic mandibular ridge. However, there may be certain medical, surgical or economical conditions when it is not possible to provide implants. In such complex cases the neutral zone impression technique is the only option available for the stabilization of the complete denture.²

Case Report :

Diagnostic Impression:

A female patient aged 76 years reported to the Department of Prosthodontics, A B Shetty Memorial Institute of Dental Sciences Mangalore. The patient was completely edentulous and complained of loose dentures which she was wearing since eight years, and desired a new prosthesis. On extraoral examination, an obviously collapsed vertical dimension was detected. Intraoral examination revealed a complete denture prosthesis with severely Abraded teeth. The mandibular residual ridge was found to be severely atrophied (fig 1.) while maxillary ridge was satisfactory. Patient needed a new set of prosthesis and it was decided to implement Neutral Zone concept to fabricate the new prosthesis.

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The primary impression was made with impression compound (Y-DENTS, MDM corporation, India) using stock tray for the mandibular arch and alginate for the maxillary arch. Both impressions were poured with dental stone. A custom tray was fabricated on the maxillary cast and an acrylic record base was made on the mandibular cast. While the acrylic was still soft, stapler pins were incorporated on the mandibular base , one anteriorly and two posteriorly.

In the next appointment a secondary impression was obtained for the maxillary arch alone using Zinc Oxide Eugenol impression paste (DPI, India). A master cast was poured for the maxillary arch and a conventional occlusal rim was fabricated.

Next, impression compound and greenstick compound(DPI Pinnacle tracing sticks) were combined in a ratio of 7:3 and moulded into a roll. It was then attached to the mandibular acrylic base with retentive loops and adapted according to the arch to form an occlusal rim. (fig 2.)

Registration of Tentative Jaw Relations:

The occlusal rim of compound was softened in water bath and firmly seated, the patient was asked to perform a series of actions like swallowing, speaking, sucking, pursing lips, pronouncing vowels and slightly protruding the tongue several times which simulated physiological functioning (fig2.).

After the rim was moulded and cooled for few minutes, the upper rim was tried and vertical height was recorded and registered accordingly. The height of the lower compound rim was maintained to desired level using a sharp knife(BP blade no 15). The registration was mounted on a semi adjustable articulator.

The plaster index was sectioned in anterior and posterior regions to give two buccal and one lingual segments . (fig .3). Then the compound rim was removed and replaced with modelling wax to the form determined by the plaster index.

Teeth arrangement was done with non-anatomic teeth

with care taken to accommodate them within the space created by neutral zone. Wherever required the artificial teeth were modified without changing their basic anatomic form. Minimal amount of wax was used to seal them to the base and maxillary teeth were arranged in a conventional manner.

Esthetic Try In and Verification of Jaw Relations:

Patient was made to sit upright and a try in was carried out for checking esthetics and to verify the accuracy of jaw relation recorded. Once it was satisfactory, the maxillary trial denture was removed from the mouth. The extensions of the trial denture was checked, and wherever it was found to be underextended and short of the sulcus, greenstick compound was applied and border moulding was done. A secondary impression was made with Zinc Oxide Eugenol Impression Paste with maxillary and mandibular trial dentures in occlusion (functional impression).

Zinc Oxide Eugenol Impression Paste was applied on the buccal and labial aspects of the lower trial denture and was placed in the mouth. Functional movements, like pursing the lips, grinning, and sucking movements were asked to do by the patient. Excess material was trimmed off to the neck of the teeth and carving was done. Next Zinc Oxide Eugenol Impression paste was applied to the lingual surface of trial denture, and was placed in the mouth. Patient was asked to make swallowing, sucking and other functional movements.^{2,3} (fig.4)

The dentures were acrylized in a conventional way and were inserted into the patient's mouth. (fig.5 and 6)

Discussion :

Among the three surfaces of the denture -the polished surface is bounded by the tongue and the cheeks. These are involved in normal physiologic movements such as speech, mastication, swallowing, smiling, and laughing. Hence, the fabrication of the denture must be in harmony with these functions because a physiologically unacceptable denture is responsible for poor prosthesis stability and retention , insufficient facial tissue support,

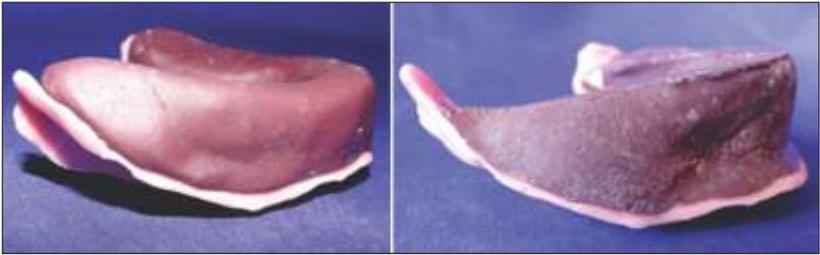
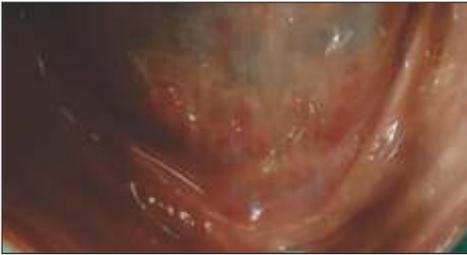


Fig. 1 : Severely atrophied mandibular alveolar ridge Fig. 2 : Impression compound occlusal rims before and after functional moulding

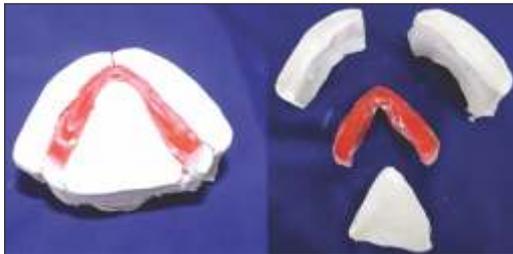


Fig. 3 : Plaster index to maintain neutral zone



Fig. 4 : Functionally moulded buccal and lingual surfaces

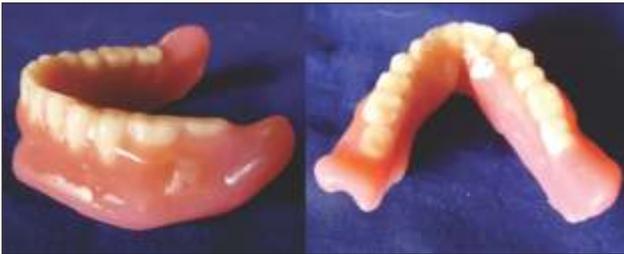


Fig. 5 : Finished and polished denture



Fig. 5 : Patient wearing the new denture

less tongue space and compromised phonetics . Denture fabricated over a severely resorbed mandibular ridge by neutral zone impression technique will ensure that the muscular forces aid in the retention and stabilization of the denture rather than dislodging the denture during function. The dentures will also have other advantages such as reduced food lodgement, good esthetics due to facial support, proper positioning of the posterior teeth which allows sufficient tongue space.

Clinicians must identify and record the neuromuscular dynamics of the oral tissues and this should be applied in the construction of the definitive prosthesis that will exist within the stabilizing boundary conditions of the neutral zone area.

When we discuss about the factors important in complete denture retention ⁴ one of the most important factors is surface tension⁵. An attempt to withdraw the denture

generates a narrow, highly negatively-curved saliva surface at its periphery. There is therefore a lowered pressure in the liquid-filled space and a retentive force is experienced. Next important factor would be the viscosity of saliva⁶ . Another factor which we must consider is the duration of application of force⁷ . Another significant factor is the adaptation of the denture base ⁸ , as the fit must be uniformly good over the entire tissue surface . The significance of border seal⁹ cannot be emphasized enough. Attention should be drawn under surface tension to the fact that along most of the border of a denture there is double contact of acrylic and soft tissue such that displacing the denture in the separation sense does not open a gap along that border. The seating force used to place the denture in the patient's mouth also influences the denture stability. It has been suggested that when a denture is placed, a firm seating force be applied as this aids retention. With regards to the soft tissue, more closer

the adaptation of the denture base to the soft tissue, better would be the retention. And also better seal achieved at the periphery, better will be the retention.¹⁰

In contrast to the conventional retentive factors discussed above, in neutral zone concept it is the muscular force around the denture prosthesis which plays a major role in retention. This takes into consideration a zone of equilibrium that lies between the lingual and facial muscles when in action. This potential space is utilized to be occupied by the prosthesis which will experience equal and opposing force from both sides thereby attaining retention.

To record this neutral zone, many materials and methods have been tried and tested over the years. Initially a pliable and mouldable material is used as an occlusal rim instead of the conventional modelling wax. It has been suggested to use modelling plastic impression compound¹¹. Although this advice is widely followed, other materials such as tissue conditioner, wax, zinc oxide eugenol impression material, silicone material, chairside relining material, and acrylic resin are also described for this technique. These materials are either used for the initial recording of the neutral zone or at the evaluation appointment. In this case we used a combination of greenstick and impression compound to get an ideally pliable and workable moulding material. The mixture makes the compound low fusing which can be adequately handled once it has been softened in a bath of water at temperature of 60° C.¹²

The techniques most commonly used for recording the neutral zone were found to be swallowing^{13,14} and phonetics^{1,15,16}. However, other techniques such as sipping water¹⁵, licking¹⁴, smiling, pursing the lips^{1,17,16}, sucking, masticating, mouth exercises (including tongue movements, blowing, protruding of the tongue, exercise movements of the lips, cheek, and tongue, facial expression, opening and closing)¹ and whistling have also been reported. Here function of the lips, cheeks, and the tongue, the forces exerted on the soft compound moulds it into the shape of the neutral zone.

During these functional movements, the muscles¹⁸ are called into action in the oral and perioral area and they play a key role in seating or unseating the denture. The buccinator is a thin, flat muscle composed of three bands. The combined width of the three bands covers the entire outer surface of the dento alveolar structures, that is the teeth, alveolar process and gingival tissues. The muscles of the lips include orbicularis oris, canine muscle, risorius, mentalis etc. Orbicularis oris forms a great extent of the lips. It plays a major role in chewing, smiling and swallowing, it exerts force against the teeth and denture flanges, which is counteracted by the tongue. Canine muscle pulls the lower lip up and helps to pull the lips forward during swallowing and sucking, thus exerting forces on the teeth and labial denture flange. The risorius muscle retracts the corner of the mouth. The mentalis muscle turns the lower lip outward and makes the lower labial vestibule shallow during contraction. The triangular muscle contracts during sucking to exert pressure on the teeth and the denture flanges. The tongue is composed of intrinsic muscles that lie within the tongue and extrinsic muscles that insert into the tongue. The function of the extrinsic muscles the styloglossus, palatoglossus, hyoglossus, and genioglossus is to move the tongue into various positions. The tongue is capable of many shapes and positions during speech, mastication, and swallowing and during all these functions remains in constant contact with the lingual surface of the teeth, the lingual flange of the lower denture and the palatal surface of the upper denture. Because of this contact, the tongue is a dominant factor in establishing the neutral zone and therefore in the stability of the lower denture. Among the perioral muscles discussed above, some have been grouped as "fixing" muscles and some as "dislodging" muscles. The fixing muscles aid in retention by their seating force on the well constructed denture base. Hence their bulk facilitates the retentive capacity of the denture. Meanwhile the path of action of dislodging muscles is relieved while fabrication of the denture base, with the help of the functional movements, so as to ensure that the denture does not get displaced even when these set of muscles come into action.

After the teeth have been lost, muscle function greatly influences a complete denture that is placed in the mouth. It is therefore, extremely important that the teeth be placed in the mouth within the arch form that falls within the area that is compatible with muscular forces. Also by functional moulding we make a seating place for the buccinator to rest so that it further aides in denture stability. On the other hand, when the polished surface is properly formed, the retentive force of the buccinator muscle and tongue on the denture enables the patient to control his dentures.¹³

Once the neutral zone is recorded, the index is used to replicate it in wax and teeth are arranged in the confounded space. The teeth selected for this case were non anatomic teeth since the stability of the denture is not jeopardized during the lateral movements when the non vertical forces are applied on the teeth. Normally in this concept, the secondary impression is postponed to the "try in" appointment ; wherein a close mouth impression is made. Also the impression of the buccal and lingual surfaces were made using Zinc oxide eugenol impression

paste. This will facilitate contouring of cameo surface of prosthesis , which will enhance retention of the denture. The contouring of the denture base along these regions would help in applying a seating force by the mere presence of the bulk of fixing muscles.

Thus we see that neutral zone concept incorporates the features already present in the form of muscular structures, to compensate for the lost retentive features in case of resorbed ridges. This gives satisfactory results when retention is concerned even though the residual ridge condition is compromised.

Conclusion :

The neutral zone impression technique may be incorporated into fabrication of any complete denture prosthesis when the patient presents with highly resorbed mandibular ridge. This case report highlights one such case where a successful denture was fabricated using this type of impression technique. This procedure can be utilized to the maxillary residual alveolar ridge also whenever it is required.

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