NEUTRAL ZONE APPROACH TO COMPLETE DENTURE FABRICATION FOR HIGHLY RESORBED RIDGE: A CASE SERIES

Dr. Madhuri Vijayakumar¹, Dr. Sindhu Sudhakar Kumararama², Dr. Pankaj Gandhi³, Dr Shwetha Poovani⁴, Dr. Shetty Hardik Santosh⁵

¹MDS, Assistant Professor, Department of Prosthodontics, crown and bridge
RajaRajeswari Dental College and Hospital, Kumbalgodu, Mysore road, Benagaluru- 560074
madhurigargeya@gmail.com

²MDS, Assistant Professor, Department of Prosthodontics, crown and bridge
RajaRajeswari Dental College and Hospital, Kumbalgodu, Mysore road, Benagaluru- 560074
sindhuami@gmail.com

³MDS, Assistant Professor, Department of Prosthodontics, crown, bridge and implantology
Uttaranchal Dental And Medical Research Institute, Dehradun(Uttarakhand)-248140
pankajgandhi90@gmail.com

⁴MDS, Professor and Head, Department of Prosthodontics, crown and bridge
RajaRajeswari Dental College and Hospital, Kumbalgodu, Mysore road, Benagaluru- 560074
drhswetapoovani@yahoo.com

⁵MDS, Consultant, Oral & Maxillofacial Surgeon, K.L.E Society's Institute of Dental Sciences &
Hospital, drhardikshetty@gmail.com

ABSTRACT

Elderly patients frequently present with advanced ridge atrophy, especially seen among those who are suffering from diabetes, osteoporosis or long-time complete denture wearers and sometimes, it is an inevitable consequence of tooth loss which is associated with atrophy of the musculature of the cheeks and lips. It is hence difficult for these individuals to obtain the neuromuscular skills needed for the efficacious wearing of dentures. This article presents a case series demonstrating the recording of neutral zone in three different techniques while using materials obtainable in the dental office. It also demonstrates certain modifications in the technique for recording the neutral zone to accomplish greatest stability, comfort and functional features in the complete denture.

Keywords: Dead space, stable zone, zone of least interference, potential denture space, anthropoidal pouch, neutral zone, Piezograph technique.

I. INTRODUCTION

While designing the complete denture, consideration should be given not only to occlusion, but also the positioning of the teeth in the denture space. The synonyms of neutral zone; dead space, stable zone, zone of least interference, zone of equilibrium, biometric denture space, denture space, and potential denture space are mentioned in the literature.¹ In each individual oral cavity lies a zone between the tongue, cheek and lips called the Neutral Zone. It is at this zone where the forces of the tongue that are pushing outwards are neutralized by the forces of the cheek and lip which are pushing inwards. In an edentulous oral cavity, at this specific zone the function of the musculature will not unseat the denture thereby, aiding in stabilizing the denture in severely resorbed alveolar ridge patients.

II. MUSCULAR CONTRIBUTION IN MODIFYING THE NEUTRAL ZONE

Complete denture is a mechanical device which needs to function harmoniously with the neuromuscular function. Recording the neutral zone helps in construction of a complete denture in muscle balance and hence provides optimum stability, retention and comfort. The main muscles involved are: Buccinators, Orbicularis oris, Mentalis, Modiolus and significantly the Tongue.
The Buccinator:
This muscle plays a large role in determining the neutral zone. Its primary function is to push the food on to the occlusal surfaces of the posterior teeth. In coordination with the tongue, the buccinators helps to retain the food in position during mastication.

Orbicularis Oris:
Is the primary anatomical composition of the lip which determines the position of the anterior teeth, also the contraction of the lip can displace the denture posteriorly.

Mentalis:
In an highly resorbed ridge, the mentalis muscle can displace the neutral zone lingually and the placement of anterior teeth becomes vital for the success of the denture.

The Modiolus:
Modiolus is a chiasma of muscles (orbicularis oris, buccinator, levator anguli oris, depressor anguli oris, zygomaticus major, risorius, quadratus labii superioris, quadratus labii inferioris) which alters the position of the angle of the mouth and for a stable denture, the free movement of this knot of muscles is indicated. The polished surface of the denture in this region should not hinder the movement of Modiolus during function.\(^{2,3,4}\)

The tongue:
The tongue contains a group of powerful muscles which are in constant contact with the denture at rest and in function there by playing a prime role in fabricating a stable denture.

Apart from the muscles, the occlusal plane is also an important factor that influences the stability of a denture. A highly placed occlusal plane results in ‘wall in’ of the tongue when it tries to push the food for mastication, resulting in loss of stability in a denture.

III. MATERIALS AND METHODS
The procedure for recording is documented and is referred to as; The Anthropoidal Pouch Technique, denture form impression technique, muscle formed mandibular denture technique, Piezograph technique and border molding technique.

As described by Sir Wilfred Fish in 1931, the influence of the polished cameo surfaces of complete dentures can alter the retention and stability of the prosthesis. He also explained how dentures should be fabricated with in the ‘dead space’, which later became known as the neutral zone.\(^9,14\)

The positioning of artificial teeth in Neutral Zone has two objectives:

1. Teeth does not intervene with normal muscle function; and
2. The dynamism of muscles against the denture is more favorable for retention and stability.

Below is the case series of three completely edentulous cases who presented with severe resorption of mandibular alveolar ridge. For all the cases, the conventional procedure of fabrication of complete denture was followed till tentative jaw relation and articulation. The Steps involved were: Detailed case history recording, diagnostic cast fabrication , pre-prosthetic analysis and treatment planning, fabrication of master cast ,tentative jaw relation, face bow transfer and articulation on a semi-adjustable articulator.

Case 1: Low fusing Impression compound used to record neutral zone:

A 60 year old female patient visited the Department of Prosthodontics with the chief complaint of missing teeth and desired replacement. On examination, the maxillary and mandibular arches were completely edentulous and the mandibular ridge was completely resorbed (Fig 1). After final impression, the denture bases were checked for retention and stability and jaw relations were recorded in conventional method.
IV. FIG 2: INTRAORAL MOLDING OF IMPRESSION COMPOUND

After articulation of the recorded jaw relation, the lower wax rim was removed and was replaced with low fusing impression compound. The compound was then molded (Fig 2). Putty index was then made and the new rim according to the neutral zone was fabricated with wax (Fig 3). Teeth arrangement was done followed by try in. Dentures were processed in the conventional manner and final insertion was done (Fig 4).
Case 2: Female Patient aged around 58 years presented with completely resorbed mandibular ridge. In this case, after the conventional jaw relation procedure and articulation, the lower wax rim was removed and wire spurs were attached to the denture base and stops made of low fusing compound was fabricated to maintain the vertical dimension (Fig5). Rubber base impression material in Putty consistency was then used to replace the wax rims and intra oral molding was done (Fig6). Dentures were processed in the conventional manner and final insertion was done (Fig7).

Figure 5: wire spurs were attached to the denture base and stops made of low fusing compound
Case 3: A 66 year old male patient with completely resorbed mandibular ridge. In this case the lower wax rim was removed and was replaced with admixed low fusing impression compound in 1:1 ratio to modify the viscosity of the material. After intraoral molding of the material, it was trimmed to reduce the bucco lingual width, over this soft tissue liner was applied and re-molded intra orally (Fig 8). Putty index of the molded compound was made and then the compound was replaced with wax to form the rim in accordance with the neutral zone. Teeth arrangement was done followed by try in. In the same appointment the polished surfaces of try in denture was recorded with soft tissue lining material to confirm the authenticity of the previously recorded neutral zone (Fig 9). Dentures were then processed in the conventional manner and final insertion was done (Fig 10).
V. DISCUSSION

The shape of the polished cameo surface will determine whether the muscular forces will stabilize or dislodge the denture.\textsuperscript{11} Long periods of edentulism modify the position of the neutral zone and that the duration of edentulism influences residual ridge resorption as well.\textsuperscript{17} Lingual positioning of the neutral zone may result because of facial changes due to age. Prolonged periods of edentulism may result in sagging of the facial musculature. In the mandibular molar area, adjacent buccinators muscle fibers run horizontally downwards and forwards. Edentulism eliminates the tooth and alveolar bone support of the buccinators fibers.

While recording neutral zone, two factors cannot be ignored:

a) The neutral zone should be recorded at an established occlusal vertical dimension,

b) Material used for recording should be reasonably slow setting so that oral musculature shapes it into proper contour and dimension.

VI. CONCLUSION

In this article three variations in recording neutral zone using different materials and techniques have been demonstrated. Under the limitations of this case series, we can conclude that, amongst the methods discussed, the third method provided desirable results due to the viscosity of the soft-liner material and admixed low fusing
impression material used in this technique. When compared with the conventional methods, where either impression compound or only soft-liner impression material is used, this modification provided a cost-effective and improved alternative as it also limits the use of expensive soft liner material for recording the Neutral zone.

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