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RESEARCH ARTICLE

ESTABLISHING STABILITY IN ATROPHIED MANDIBULAR RIDGE WITH A SIMPLIFIED NEUTRAL ZONE APPROACH-A CASE REPORT.

Sanath Kumar Shetty¹, Mallika Shetty² and Afsar Mulla³.

1. Professor and Head of Department of Prosthodontics, Yenepoya dental college.
2. Reader, Department of Prosthodontics, Yenepoya Dental College.
3. Post graduate student, Department of Prosthodontics, Yenepoya Dental College.

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Abstract

Alveolar ridge resorption is a chronic, progressive, irreversible, and cumulative multifactorial and biomechanical disease which leads to decreased sulcular depth, reduced vertical dimension and reduced lower facial height. Some neurological, hormonal, and metabolic disorders can often lead to difficulties in impression-making, mastication, and swallowing, which in turn leads to loss of retention, stability and adaptability of complete dentures. Thus residual ridge resorption becomes a challenging scenario for a dentist during fabrication of complete dentures. The neutral zone concept can often be a technique used to overcome these challenges. It can be an effective way to obtain denture stability in a highly atrophic ridge. This technique can be a valuable one by constructing a denture that is shaped by muscle function and in harmony with the surrounding oral structures. This technique is rarely used because of the extra clinical step involved and the complexity of the technique. This clinical report describes a neutral zone technique and compares the function, retention and stability of complete dentures between the conventional denture technique and the neutral zone technique.

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Introduction:-

The potential space between the lips and cheeks on one side and the tongue on the other side that forms an area or position where the forces between the tongue and cheeks or lips are equal is referred to as the neutral zone.¹ It is also defined as where the forces of the tongue pressing outward are neutralized by forces of the cheeks and lips pressing inward.²

Wilfred Fish was the first person who described neutral zone. He reported the influence of the polished surfaces on retention and stability of complete dentures in 1931. He stated that the polishing surface contour should conform to the shape of the tongue, lips, and cheeks. These tissues, in function or at rest, would exert an elastic pressure on the dentures, and retain them in place rather than dislodging them.³

Corresponding Author:- Dr.Afsar Mulla

Address:- Post graduate student, Department of Prosthodontics, Yenepoya Dental College.

Several other authors have worked on neutral zone concept. Few to name among them are Russell Tench,⁴ Perry and the Detroit Dental Clinic Club, who have helped to advance and develop both the theoretical basis and practical procedures.⁵⁻¹³

The stability of complete dentures is influenced by the surrounding neuromuscular system in the oral cavity. Oral functions, such as speech, mastication, swallowing, smiling, and laughing, involve the synergistic actions of the tongue, lips, cheeks, and floor of the mouth that are very complex and highly individual.²

Neuromuscular control is the key for the stability of dentures. Size and position of denture teeth and the contours of polished surface play a crucial role in denture's stability as they are subjected to destabilizing forces from the tongue, lips, and cheeks if they interfere with the function of oral structures.¹⁴

The retention and stability of complete denture becomes unfavorable when ridge resorption gets more severe, especially in the mandible. Implant overdenture can provide long-term prognosis and more stable outcome compared with conventional complete dentures.¹⁵

However, for some medically compromised, financially constrained patients, this therapy may not be a superior choice to new conventional dentures.^{16,17}

Therefore, techniques to improve retention and stability in severely atrophic ridge cases must be considered for fabricating a denture in harmony with forces exerted by the tongue, lips, cheeks, and floor of the mouth. Thus this case report aims to present a neutral zone technique and compare the function, retention and stability of complete dentures between the conventional denture technique and neutral zone technique.

Case Report:-

A 60 year old female patient reported to the Department of Prosthodontics, Yenepoya dental college, with the chief complaint of difficulty in speech and chewing due to loose lower dentures. She had been edentulous since last 5 years. She was a denture wearer and was willing for a new set of dentures due to reduced retention. On clinical examination, the maxillary residual alveolar ridge was rounded and well formed, but the mandibular residual ridge was unfavorable due to a high degree of resorption (classified as Atwood's Order V - low and well-rounded)

Because of financial constraints, she could not undergo implant overdenture therapy. Thus it was decided to provide lower complete denture utilizing neutral zone impression technique. Intraorally, the upper arch form was ovoid with adequate height. However, the lower arch revealed severe ridge loss combined with a knife-edge form. The vestibule disappeared and movable tissues were extended onto the residual ridge. (Fig. 1a and Fig. 1b).



fig 1a.Pretreatment



fig 1b..Maxillary and Mandibular ridges

Objectives of treatment:-

The objectives of the treatment are rehabilitation with complete denture therapy in a patient with poor neuromuscular coordination using neutral zone technique to achieve maximum prosthesis stability, comfort, and function; locating the neutral zone and arranging the denture teeth accordingly; and minimizing the ongoing diminution of the residual alveolar ridges.

Clinical Procedure:-

Clinical visit 1:-

The preliminary impressions of maxillary and mandibular arches were made using irreversible hydrocolloid impression material (Zhernack tropicalgin). Custom trays were fabricated in autopolymerizing resin(DPI-RR cold cure resin) and border molding was carried out using low fusing impression compound(DPI tracing sticks)and final impression was made in zinc oxide eugenol impression paste(DPI impression paste)followed by beading and boxing to obtain the master cast . The master casts were poured with dental stone. Maxillary and mandibular master casts were duplicated using Agar reversible hydrocolloid impression material. Acrylic denture bases were made on the master casts.

Clinical visit 2:-

Recording of vertical dimension for conventional Jaw relation:-

It was recorded using conventional occlusal rims made of modelling wax(DPI modelling wax). Vertical dimension at rest was recorded by making facial measurements. Two marks were placed, one on the tip of the nose and other on the chin using adhesive tape. The patient was instructed to repeatedly say letter 'm'. The lips meet when letter 'm' is pronounced and the patient was instructed to stop all jaw movements. Measurement was made between the two points of reference, which gave vertical dimension at rest. The upper record base with wax rim made with modelling wax was inserted. The occlusal plane, visibility, phonetics, and lip support were checked, followed by insertion of lower occlusal rims. Following this, the vertical dimension at occlusion (VDO) was verified. It was then articulated on mean value articulator.

The additional maxillary and mandibular denture bases were fabricated on the duplicated master casts. The occlusal rim was fabricated on maxillary denture base. The mandibular record base was placed in the patient's mouth and checked for extension and stability by guiding the patient to perform mandibular movements. Once the mandibular record base was stabilized, the vertical jaw relation was determined.

Recording the vertical dimension for neutral zone record base:-

The patient was made to sit in an upright position and two prominent points were marked on the patient's face - one on the nose and one on the chin. The vertical dimension at rest (VDR) was checked same as the conventional. Vertical dimension at occlusion (VDO) was determined with the help of retentive wire stops fabricated on the mandibular record base. Retentive loops made of thin orthodontic wire were attached in the centre and on both the posterior ends of denture base. (fig 2a) Two vertical pillars made of greenstick compound were placed in first molar region (fig 2b) onto the retentive wire stops to determine VDO. The patient was instructed to bite on the retentive wire stops, this was visualized and VDO was measured with the help of the divider and 12- inch ruler. It was ensured that loops and vertical pillars do not interfere with muscle movements during function.²².



Fig 2a:-retentive wire loops



Fig 2b:-retentive wire loops with greenstick compound

To record the neutral zone, the patient was instructed to sit in a comfortable, upright position with the upper wax rim inserted. Neutral zone was recorded with an admix material – three parts by weight of impression compound and seven parts by weight of greenstick compound. The admix material was placed over the mandibular base and inserted in the mouth and the patient was instructed to perform all the functional movements such as licking lips, sucking, puckering, smiling, grinning, swallowing, pronouncing words such as, exaggerated ‘EEE’ and ‘OOO’ sounds or combination of these. These actions were repeated until the material had set. Care was taken to see that the final record was perfectly stable in the mouth (Fig.3a and fig 3b).



Fig 3a:-Recording jaw relation with admix material



Fig 3b:-Recorded movements of the patient in neutral zone

The neutral zone record obtained is placed over the mandibular master cast. Index was made using impression plaster, both lingually and buccally. Lingually plaster is placed into the tongue space of the neutral zone record such that it is in level of occlusal plane of record and extends over the posterior land area of cast. Likewise facial index was developed along the facial contours of the neutral zone record. The indices were shaped to the exact height of lower occlusal plane, which was established in the mouth. This preserves the height of lower occlusal rim. While the plaster sets, cuts were made with BP blade and plaster indices were sectioned into a labial and buccal index and a lingual index in order to guide the easy removal and placement of these indices. Once the plaster had set, hot water was poured into the impression compound and it was removed. Wax was poured in the space representing the neutral zone, forming the new occlusal rim on the mandibular record base.(Fig.4a and fig 4b).



Fig 4a:-Molten wax poured into the index



Fig 4b:-New occlusal rim obtained

The artificial teeth were positioned within the indices. Zero degree teeth were chosen. The mandibular teeth were arranged following the index, and the maxillary teeth were arranged following the mandibular teeth arrangement.(Fig.5). In order to preserve the contours established by the plaster indices in the neutral zone, no additional wax was added to the denture flanges. Vertical dimension, centric relation, esthetics, and phonetics were rechecked during wax denture try-in appointment.



Fig 5:-Teeth arrangement in neutral zone

Clinical visit 3:-

A wax try-in was performed to evaluate mandibular record base stability, esthetics, and intraoral occlusion. The patient successfully performed all the movements mentioned earlier. The trial dentures, both conventional and neutral zone were processed with heat-cure acrylic resin. The dentures were polished so that the customized contours remained unaltered.

Clinical Visit 4:-

The mandibular denture was again evaluated with the plaster index prior to denture insertion. Both the dentures was inserted and verified for retention, stability, and occlusion (Fig.6). When the patient was asked which denture she preferred, she said that she was comfortable with the complete denture prosthesis with neutral zone as compared to conventional denture.



Fig 6:-Post insertion

The new definitive complete dentures successfully improved stability, comfort, and function for the patient . Periodic recall visits were scheduled to verify the retention, comfort, and function. These dentures were followed up for more than 1 year.

Discussion:-

In the field of oral rehabilitation, particularly in geriatric Prosthodontics, many factors contribute to the overall performance of complete dentures. It's a general experience that the lower denture is relatively less stable than the upper one with increasing life expectancy, age related reduction in adaptability, and progressive severe mandibular resorption. The lower denture commonly presents difficulties with pain and looseness .²³This is because mandible

atrophies at a greater rate than maxilla and has less residual support for retention and support. With the increase in resorption rate, the influence of impression surface on denture retention and stability decreases.²⁶

One of the philosophies being introduced to overcome the challenge of unstable dentures in clinics is the concept of the neutral zone.

The neutral zone technique was used with few modifications to achieve retention and stability in such atrophic mandibular ridges. An implant-supported overdenture is another viable treatment option but was not pursued considering the cost, duration, and the patient's age. The technique used here differs from the conventional technique by minimizing the number of patient visits and offers the added advantage of recording the physiological dynamics of oral and perioral muscle function in a simplified manner. Our main motive was to do comparison between the conventional complete denture and denture fabricated using neutral zone technique, and to check for stability and retention.

Two complete dentures were fabricated, one in conventional manner and other using neutral zone technique. Retentive wire stops with greenstick compound was used to judge the VDO, and the neutral zone was recorded using the swallowing technique.

Admix material was used for recording the neutral zone. It is a combination of impression compound and green stick compound in the ratio of 3:7. The 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 allowed better flow and an accurate impression. Teeth were placed as dictated by the musculature rather than over the crest of ridge. The influence of tooth position and flange contour on denture stability is equal to or greater than any other factor.²

Stability and retention becomes more dependent on correct position of teeth and the contours of external or polished surface of the dentures. Therefore these surfaces should be so contoured that horizontally directed forces applied by perioral muscles should act to seat the denture in the well balanced muscular zone. Neutral zone technique is the most effective way for patients who have unstable and unretentive dentures.²⁷

Conclusion:-

The greater the residual alveolar ridge loss, the more important the neutral zone concept. With this technique the denture was found to have improved stability, retention and due to the adequate facial support, the overall appearance of the patient was esthetically pleasing. The posterior teeth allowed sufficient tongue space. It also reduced food trapping adjacent to the molar teeth.

Limitation:-

The technique is relatively simple but there is an increased chair time.

Conflict Of Interests:-

No conflict of interests exist

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