

MANAGEMENT OF RESORBED MANDIBULAR RIDGE BY HARMONIZING THE MUSCULAR FORCES AROUND A COMPLETE DENTURE – NEUTRAL ZONE TECHNIQUE**Dr. Tanya Grover¹, Dr. Shivam Katyal^{2*} and Dr. Akrant Mehra³**^{1,2}Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Inderprastha Dental College and Hospital, Ghaziabad.³Senior Lecturer, Department of Prosthodontics and Crown & Bridge, Inderprastha Dental College and Hospital, Ghaziabad.***Corresponding Author: Dr. Shivam Katyal**

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ABSTRACT

Residual Ridge Resorption (RRR) is an unavoidable, progressive condition pertaining mostly to edentulous mandible. Dental implants might not be a possible treatment option for every patient for improved retention and stability of the prosthesis. Therefore, rehabilitation with conventional complete denture therapy becomes of great importance. The neutral-zone technique in complete denture construction is not new but involves the use of various basic principles of science, that makes the treatment outcome a great success. The technique helps to improve stability, comfort, and function for the patient having severe mandibular ridge resorption.

KEYWORDS: Neutral zone, Resorbed ridge, Complete denture, RRR.**INTRODUCTION**

Residual ridge resorption (RRR) is a chronic, progressive, irreversible and disabling disease, of multifactorial origin.^[1] Changes of the internal osseous structures after teeth extraction, results in external changes in the shape of the ridges in accordance with the Wolff's law.^[2] With progressing age and increased atrophy of the ridges, muscular function also decreases to protect the bony structures of the ridges, especially in the mandible.^[3] Therefore, rehabilitation of mandibular edentulous arch with a complete denture having optimum stability is of great importance.

Since, dentures are made to function in the oral cavity as an integral part of it, they must be constructed in harmony with the physiologic neuromuscular functions. All oral functions such as speech, mastication, swallowing, smiling and laughing, involves the synergistic actions of the tongue, lips, cheeks and floor of the mouth.^[4] The importance of tooth position, flange form and contour must be recognized, failure to which may result in unstable and unsatisfactory dentures.

“Neutral zone” is that region where the forces of the tongue pressing outward are neutralized by forces of the cheeks and lips pressing inward.^[5] Since these forces occurs through muscular contraction during the various functions of chewing, speaking and swallowing, they vary in magnitude and direction in different individuals.

It was first described by Wilfred Fish who 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 pressure on the dentures and retain them in place rather than dislodge them.^[6]

The present case-report presents the use of neutral zone technique to construct a mandibular complete denture for a patient presenting with resorbed alveolar ridge in mandible.

CASE REPORT

A 71-year-old male patient reported to the Department of Prosthodontics and Crown & Bridge, Inderprastha Dental College and Hospital, Ghaziabad, having a chief complaint of loose and worn out upper and lower dentures. The patient had undergone his last extraction 13 years back. His lower complete denture was fabricated multiple times but he was not satisfied with it. All possible treatment options were explained to the patient. Because of financial constraints and his positive medical history of diabetes, the implants supported prosthesis was ruled out from treatment plan. On intraoral examination, the upper arch form was square with adequate ridge height. However, the examination of lower arch revealed severe ridge loss with a knife-edge

form (Figure 1 and 2). The vestibule was shallow and movable tissues were extended onto the residual ridge.



Fig. 1- Maxillary edentulous ridge.

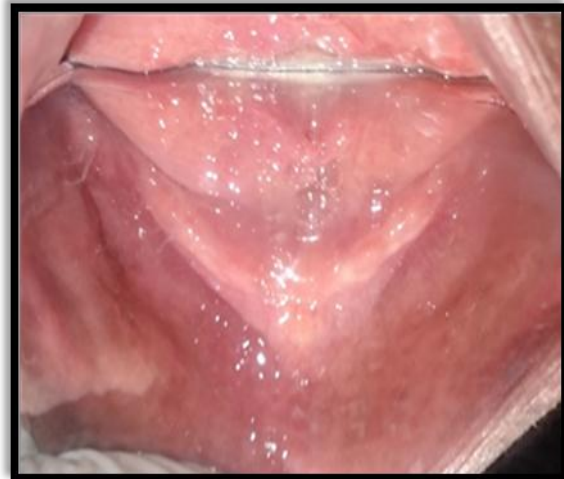


Fig. 2- Mandibular edentulous ridge.

CLINICAL PROCEDURE

CLINICAL VISIT 1

A preliminary impression of the maxillary arch was made using impression compound and mandibular impression was made using the McCord Tyson's

technique (Figure 3 and 4).^[7] The impressions were immediately poured in dental plaster to obtain primary casts. Wax spacer of relevant design was adapted over the maxillary and mandibular casts and custom trays were fabricated with self cure acrylic resin.

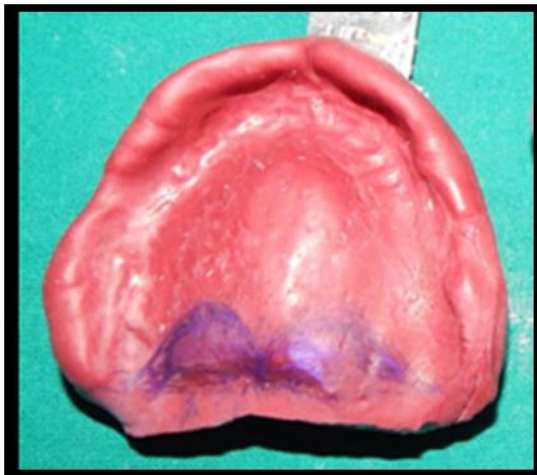


Figure 3 - maxillary primary impression using conventional technique.



Figure 4 - mandibular primary impression using McCord Tyson's technique.

CLINICAL VISIT 2

Border molding for the maxillary and mandibular arch was done by the incremental technique using green stick compound. Secondary impressions were made using light body impression material (Figure 5). Impressions were poured after beading and boxing in dental stone and mater casts were obtained. Record bases were fabricated with self-cure acrylic resin for the maxillary and mandibular casts and another record base was fabricated with light cure acrylic resin for the mandibular cast for better adaptability. Wax occlusal rim was fabricated for

the maxillary arch and on the self-cure record base for the mandibular arch (Figure 6).

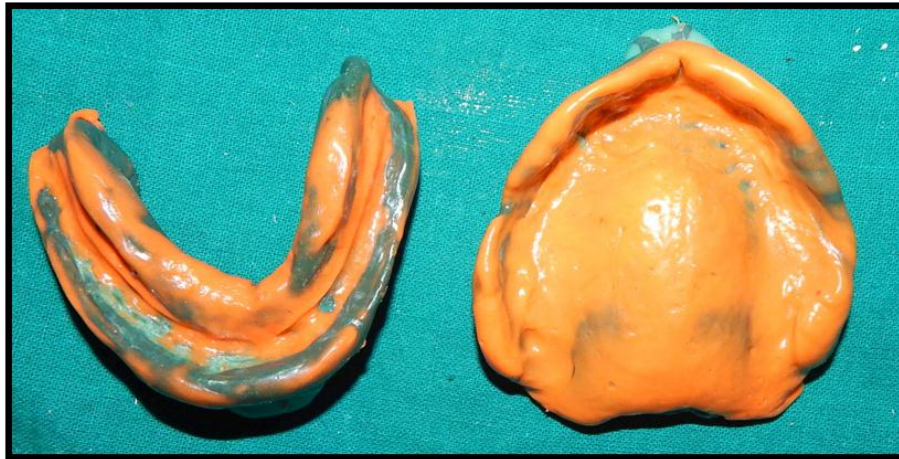


Fig. 5 - Secondary impressions.

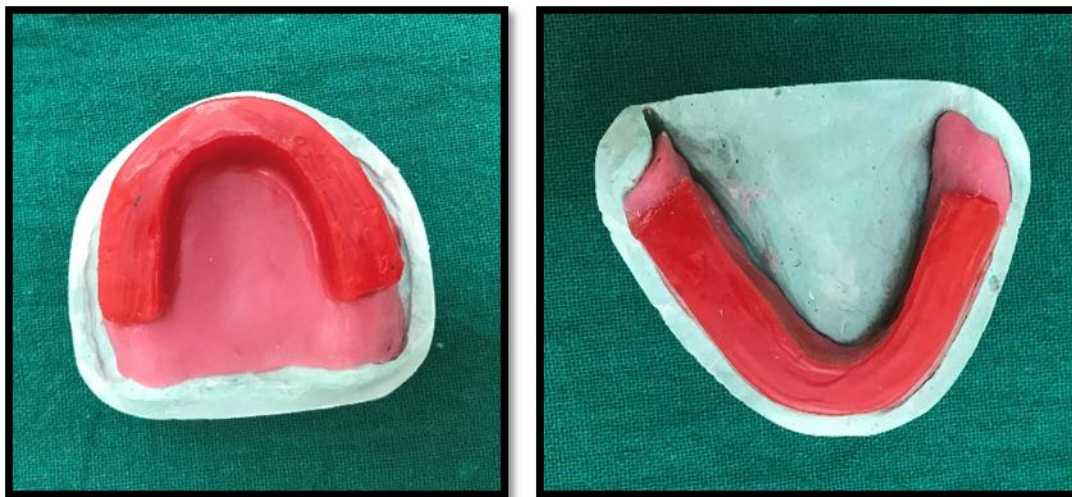


Fig. 6- Maxillary and Mandibular wax occlusal rims.

CLINICAL VISIT 3

The vertical dimension at rest (VDR) was determined which was 7.1 mm.

For determining the vertical dimension at occlusion (VDO), a tentative Jaw relation was recorded with the maxillary and mandibular occlusal rims. The established VDO was 6.8 mm.

The maxillary and the mandibular rims were sealed in centric relation (Figure 7) and was carefully removed from the mouth and then articulated over a mean value articulator (Figure 8).

Self-cure acrylic stops (3 mm × 8 mm) were fabricated on the light cure mandibular record base on either side of the canine-premolar region and a wire loop made with 18-gauge orthodontic wire was attached in the anterior region between the two acrylic stops. The articulator was closed on the acrylic stops as it reached the early dough stage along with the maxillary occlusal rim with even contact (Figure 9).

For recording the neutral zone, PMMA soft liner was adapted on the light cure mandibular record base covering the acrylic stops and the wire loop. The patient was instructed to perform functional movements (including licking lips, sucking, puckering, smiling, grinning, swallowing, pronouncing vowels) before the material sets, which aided in molding the material in confines of neutral zone space. The procedure of recording neutral zone is completed when a sharp curvature is observed in the region of premolar, which corresponds to the action of modiolus over the mandibular occlusal rim (Figure 10).

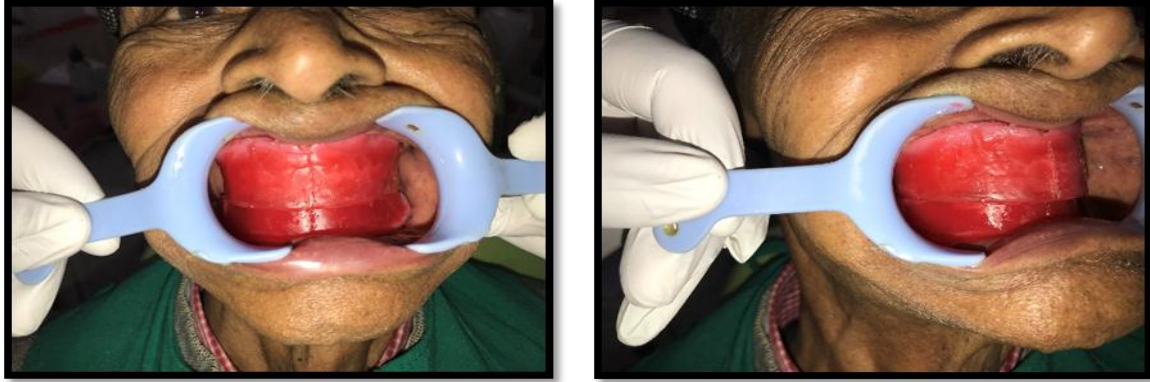


Fig. 7 – Tentative Jaw relation.

For making the index around recorded neutral zone, undercuts were blocked on the cast and boxing was done around the mandibular cast to form a mold. After applying separating media, impression plaster was poured around the recorded neutral zone and sectioned into a labial and buccal index and a lingual index to guide the removal and placement of these indices (Figure 11). After fabricating the plaster index, the record base with neutral zone was removed and replaced by the self-

cure record base. Separating medium was applied on the inner surfaces of the indices which were then reassembled. Wax was poured in the space, forming the new occlusal rim on the mandibular record base (Figure 12). Artificial mandibular teeth were arranged following the index and the maxillary teeth following the mandibular teeth arrangement (Figure 13). While developing the occlusion, even contacts were ensured in maximum intercuspal position.

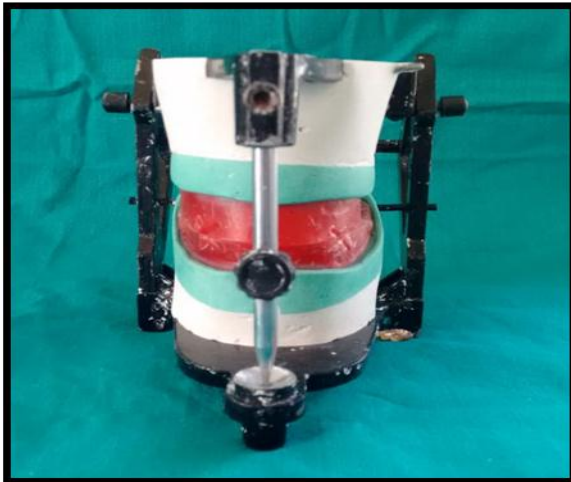


Fig. 8- Articulation with tentative Jaw relation.

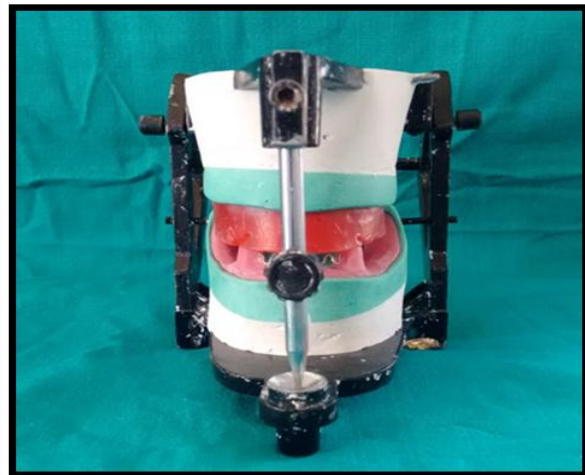


Fig. 9- Mandibular record base with acrylic stops and wire loop.

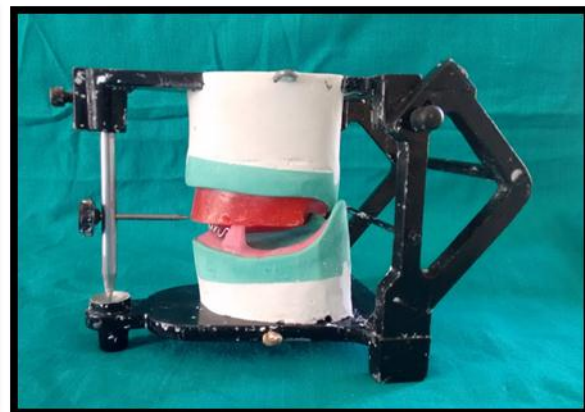
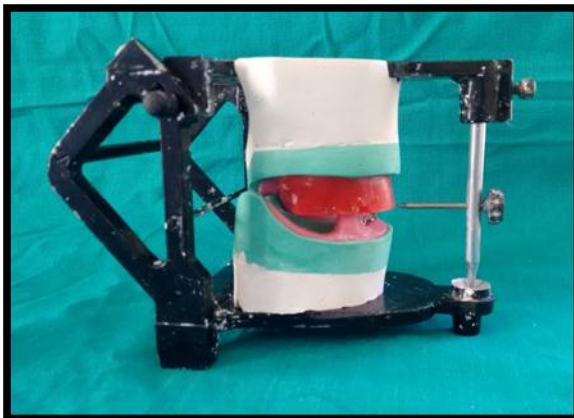


Fig. 9- Mandibular record base with acrylic stops and wire loop.

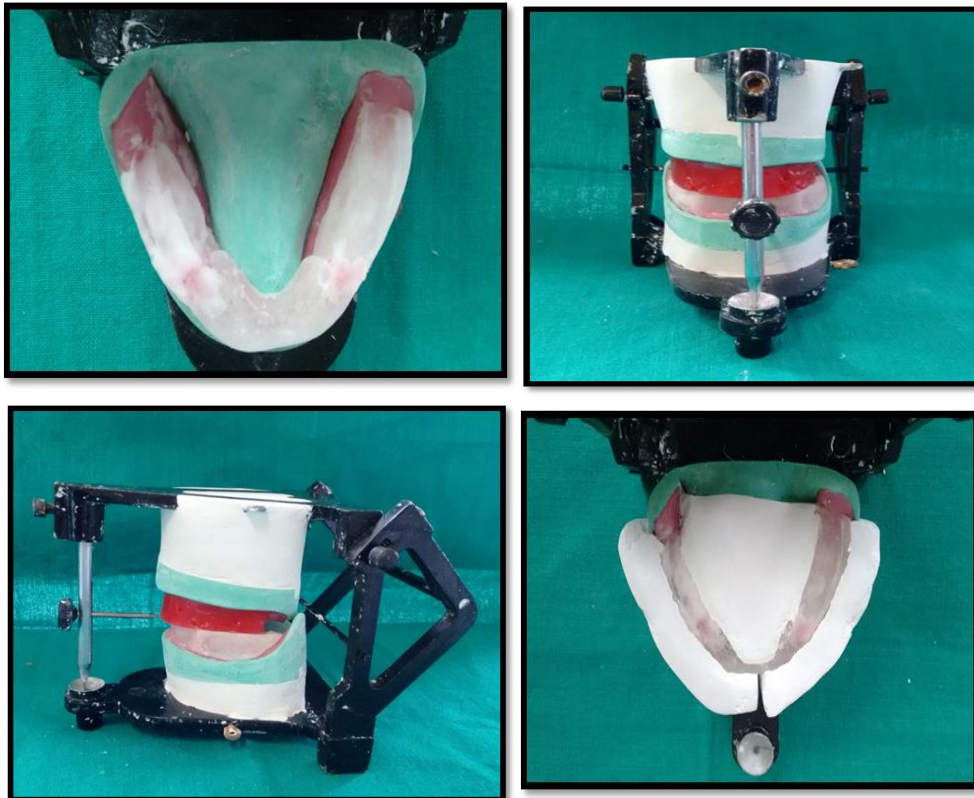


Fig. 10- Neutral zone recorded with PMMA soft liner.

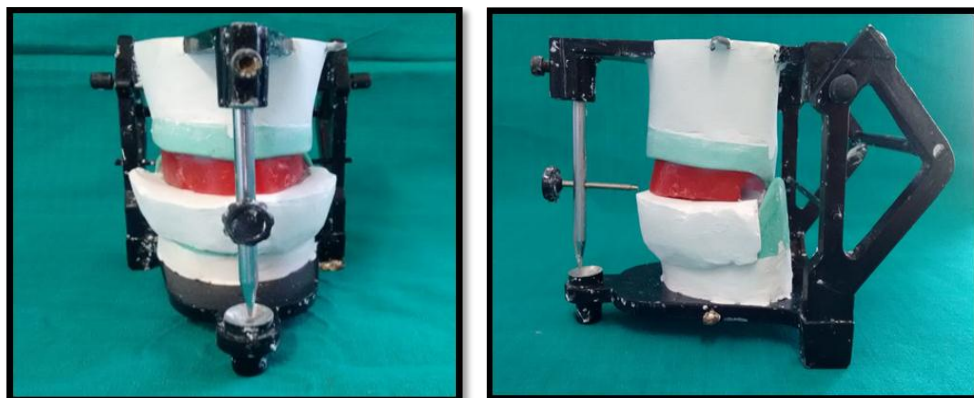


Fig. 11- Plaster index to preserve Neutral zone.

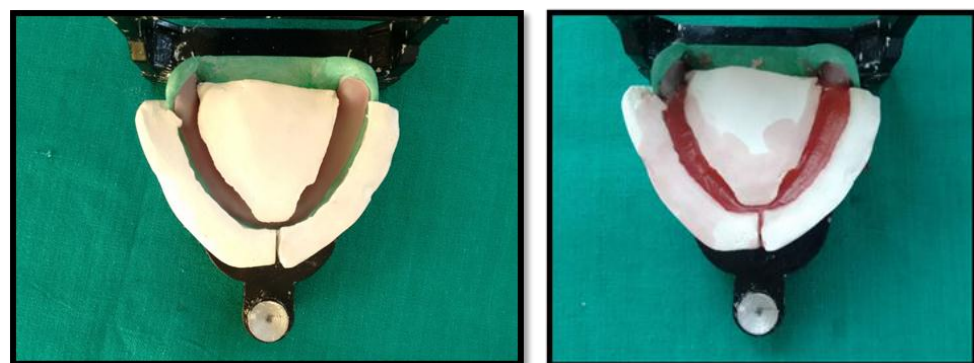


Fig. 12- Wax poured into the neutral zone space to form a new occlusal rim.

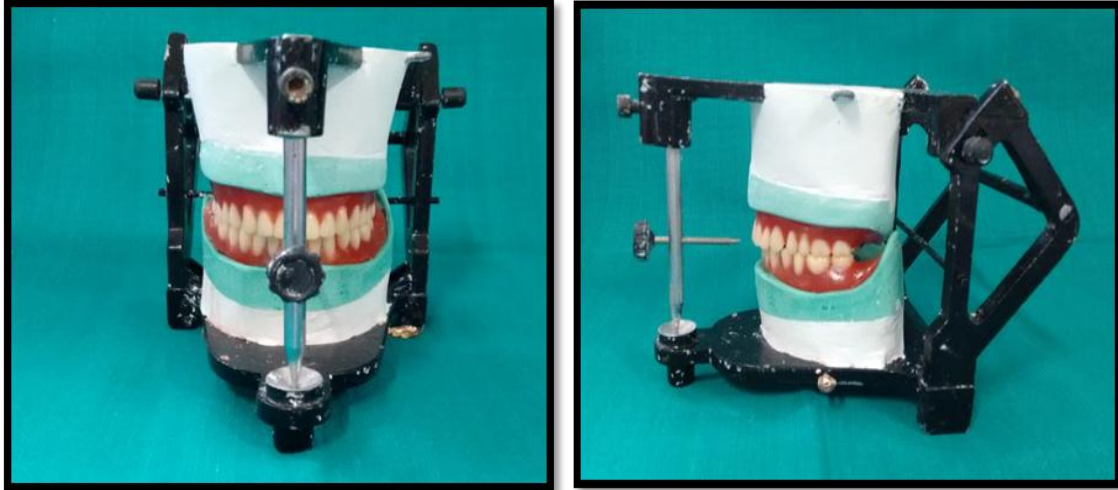


Fig. 13 – Teeth arrangement following the neutral zone.

CLINICAL VISIT 4

A wax try-in was performed to evaluate the vertical dimension, centric relation, esthetics and phonetics (Figure 14). The trial dentures were processed with heat-cure acrylic resin using compression molding technique (Figure 15).

CLINICAL VISIT 5

The mandibular denture was again evaluated with the putty index prior to denture insertion. The denture was inserted and verified again for stability, retention, intercusp relation, esthetics and phonetics (Figure 16). Occlusal interferences were relieved in Centric relation and patient was recalled for relieving of any kind of post-insertion symptoms.



Fig. 14- Wax try-in.



Fig. 15 - Processing of maxillary and mandibular dentures.



Fig. 16- Pre and post-operative view.

DISCUSSION

Long term edentulism affects muscle function and activity which greatly influence the complete dentures that are placed in the mouth. Therefore, it is necessary that the artificial teeth should be placed in a position such that it balances the muscular forces exerted over it.^[8] The forces generated by the orofacial musculature should be neutralized and the denture should be in a state of equilibrium. Lower denture is relatively less stable when compared to upper one due to increased rate of resorption.^[9] This approach helps to overcome the challenge of enhancing stability in mandibular CD up to a certain extent.

Various modifications have been made over time in the techniques, impression materials, functional movements and record base designs used for recording the neutral zone. Materials like impression compound, impression plaster, waxes, tissue conditioners and polyether have been used to record the neutral zone. High viscosity of impression compound may restrict accurate oral movements. Impression plaster is difficult to control and there is a risk of patient swallowing a piece of set plaster while movements. Complete wax rims, if not softened uniformly, may result in inaccurate recording of the neutral zone. Polyether impression material sets via an irreversible chemical reaction, hence, it is not possible to further manipulate it or re-use it once it is set.^[10] Thus, there is no ideal material that can be used to record the "Neutral Zone".

In this case, for recording the neutral zone, PMMA soft liner was used. It showed the advantage of having sufficient body so that it can be manipulated accurately by peri-oral musculature.

In some techniques, the neutral zone is recorded using impression compound as an occlusal rim before the final impression is made. This is done without inserting the maxillary recording base.^[11] The secondary impression is made with the same record base on which the neutral zone is recorded.^[12] a few techniques are also discussed in which the polished surface is relined using PMMA after fabrication of CD.^[13] Instead of acrylic resin stops, only wire loops can also be used for retention of recording material.^[14]

The present case focuses on use of McCord Tyson technique for the making the mandibular primary impression. Green stick material when added to impression compound (7:3) helps to increase its flow.

The width, shape and position of the recorded neutral zone may be affected by a variety of conditions, such as, type of impression material, range functional movements, various techniques, varying vertical dimensions, different muscle tones and the period of edentulism.^[11, 16, 17, 18]

CONCLUSION

It is a well-known fact, that retention in a mandibular denture is challenging. With the progression in resorption of residual alveolar ridge, it becomes even more difficult to achieve. Retention is necessary for the psychological satisfaction of the patient, but stability has an essential role in maintaining physiologic harmony with the surrounding structures. Thus, this case report describes the use of Neutral zone technique in severe atrophic ridges to enhance the stability of the denture, that will ultimately prolong the prognosis of complete denture treatment, help achieve treatment goals and improve the patient's overall experience.

REFERENCES

1. Singh OP, Kaur R, Nanda SM, Sethi E. Residual ridge resorption: A major oral disease entity in relation to bone density. *Indian J Oral Sci.*, 2016; 7(1): 3-6.
2. Lam RV. Contour change of the alveolar process following extractions. *J Prosthet Dent*, 1960; 10: 26-8.
3. Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: A mixed-longitudinal study covering 25 years. *J Prosthet Dent*, 1972; 27(2): 120-32.
4. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. *J Prosthet Dent*, 1976; 36(4): 356-67.
5. The glossary of prosthodontic terms. *J Prosthet Dent*, 2005; 94(1): 10-92.
6. Fish EW. An analysis of the stabilising factors in full denture construction. *Br Dent J.*, 1931; 52: 559-70.
7. McCord JF, Grant AA. Impression making. *Br Dent J.*, 2000; 188(9): 484-92.
8. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. *J Prosthet Dent*, 2005; 95(2): 93-100.
9. Saravanakumar P, Thangarajan ST, Mani U, Kumar VA. Improved Neutral Zone Technique in a Completely Edentulous Patient with an Atrophic Mandibular Ridge and Neuromuscular Incoordination: A Clinical Tip. *Cureus*, 2017; 9(4): 1189.
10. Salinas TJ. Treatment of edentulism: optimizing outcomes with tissue management and impression techniques. *J Prosthodont*, 2009; 18(2): 97-105.
11. Alfano SG, Leupold RJ. Using the neutral zone to obtain maxillomandibular relationship records for complete denture patients. *J Prosthet Dent*, 2001; 85(6): 621-3.
12. Yeh YL, Pan YH, Chen YY. Neutral zone approach to denture fabrication for a severe mandibular ridge resorption patient: Systematic review and modern technique. *Journal of Dental Sciences*, 2013; 8(4): 432-38.
13. Ohkubo C, Hanatani S, Hosoi T, Mizuno Y. Neutral zone approach for denture fabrication for a partial glossectomy patient: a clinical report. *J Prosthet Dent.*, 2000; 84(4): 390-3.
14. Agarwal S, Gangadhar P, Ahmad N, Bhardwaj A. A Simplified Approach for Recording Neutral Zone. *J Indian Prosthodont Soc.*, 2010; 10(2): 102-104.
15. Karlsson S, Hedegard B. A study of the reproducibility of the functional denture space with a dynamic impression technique. *J Prosthet Dent.*, 1979; 41(1): 21-5.
16. Khamis M, Razeq A, Abdalla F. Two-dimensional study of the neutral zone at different occlusal vertical heights. *J Prosthet Dent*, 1981; 46(5): 484-9.
17. Fahmi FM. The position of the neutral zone in relation to the alveolar ridge. *J Prosthet Dent*, 1992; 67(6): 805-9.
18. Lynch CD, Allen PF. Overcoming the unstable mandibular complete denture: the neutral zone impression technique. *Dent Update*, 2006; 33(1): 21-2, 24-6.