

Neutral Zone Technique: Patient with a Severely Atrophic Mandibular Ridge

Syed Danial Ahmed¹, Alyzeh Hassan², Muhammad Aamir Ghafoor Chaudhary³, Maleeha Majid⁴

Received: 25 Jun 2023 / Revised: 15 Dec 2023 / Accepted: 21 Dec 2023 / Published online: 27 Jan 2024

Copyright © 2024 The Author(s). Published by Foundation University Journal of Dentistry.

ABSTRACT

One of the leading issues faced by prosthodontists today is making a prosthesis for a severely resorbed residual ridge. Ridge resorption is a multi-factorial process that is both irreversible and progressive. This condition causes a decrease in the occlusal vertical dimension, sulcular depth and an overall decrease in the lower facial height. To counter this issue, the neutral zone technique is used to construct a removable prosthesis. The aim is to strike a perfect balance between the forces of the lip, cheek, and buccal mucosa. The area where all these forces cancel out is called the neutral zone. Tooth placement is done in this region to achieve optimum stability of the prosthesis to aid in the lack of retention because of the resorbed residual ridge.

Keywords: Complete Denture, Neutral Zone, Atrophic Ridge, Denture Stability

^{1,2}House Officer, Islamic International Dental Hospital, Riphah International University, Islamabad, Pakistan

³Associate Professor and Head, Department of Prosthodontics, Islamic International Dental Hospital, Riphah International University, Islamabad, Pakistan

⁴Resident FCPS-II, Department of Prosthodontics, Islamic International Dental Hospital, Riphah International University, Islamabad, Pakistan

Corresponding author:

Syed Danial Ahmed, Department of Prosthodontics, Islamic International Dental College, Riphah International University, 7th Avenue, G-7/4, Islamabad, Pakistan. Email: syeddanialed@gmail.com

This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc/4.0/> sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. FUJD does not allow the commercial use of any published article. All articles published represent the view of the authors and do not reflect the official policy of FUJD.

How to cite this Article:

Ahmed SD, Hassan A, Chaudhary MAG, Majid M. Neutral Zone Technique: Patient with a Severely Atrophic Mandibular Ridge. Found Univ J Dent. 2024;4(1): 70-74

INTRODUCTION

Complete dentures aid in improving the quality of life. Losing teeth means losing the ability to masticate, encountering speech-related problems, and losing confidence in the overall facial looks.¹ Polymethyl methacrylate since its invention has been widely used in the fabrication of partial and complete dentures, occlusal splints, and implant overdentures.² Its ability to flow and adapt closely to a mold and replicate oral structures is what we need.

As deduced by various articles and reports on this subject, the prosthesis amalgamation relies on static, dynamic and hard and soft tissue factors with the distribution of forces among them.³ Muscular balance is

of utmost importance for achieving satisfactory masticatory function.⁴ For the success of a dental prosthesis, mechanics, aesthetics and speech, all play a significant role.³ Along with the associated structures, teeth volume, angulation and diameter are important parameters that aid in the balance of prosthesis.⁶ The only plausible solution is a biomechanical device made considering all these factors, that works in harmony with the associated structures.^{3,7-9}

A complex, biophysical process seen in edentulous patients with advancing age is residual ridge resorption.^{10,11} Loss of ridge structure means loss of retention, and to make up for this, the neutral zone technique is applied.^{10,11} A special impression is made

that closely replicates and captures the movements of the lip, cheek, tongue, and buccal mucosa thereby, highlighting a small area where all forces are nullified, called the neutral zone (NZ).¹¹ A diverse range of mediums are used to record the NZ, for example, impression compounds, soft wax, tissue conditioners and impression plaster.⁷ In this case report, an impression compound by Hiflex was used.

CASE REPORT

A 65-year-old male patient reported to the prosthodontics department of Islamic International Dental Hospital with the chief complaint of missing teeth and wanted an artificial replacement. On examination, the upper arch was dentate with only missing right molars, while the lower arch was edentulous with a severely resorbed ridge – Atwood classification Order 5 - low, well rounded (figure 1). Treatment options included conventional complete denture prosthesis and implant-supported prosthesis. However, the treatment plan finalized in this case was to construct a single conventional complete denture using the neutral zone technique.

After obtaining the consent, primary impressions were made in stock trays. Alginate was used for the upper arch and impression compound for the lower edentulous arch. Primary casts were made with dental stone. The custom tray with a handle was fabricated using self-curing acrylic, well adapted to the lower ridge. It was used for the border molding of the mandibular arch with the low-fusing impression compound – green stick. Zinc oxide eugenol was used to make the secondary impression. Master casts were poured in dental stone and the record base constructed with wax was processed with heat-cure acrylic to improve the record base stability. The wax occlusal rim was made on the heat-cured baseplate.

The mandibular record base was inserted in the patient's mouth, and various tongue movements were performed by the patient to assess the marginal extensions and stability.

Vertical jaw relation was performed by adjusting the occlusal surface of the mandibular rim. The patient was asked to sit in an upright position followed by marking two points on the patient's face – one point on the nose and one on the chin. The OVD was determined to be 50mm and RVD was set at 53mm with a freeway space

of 3mm. Labial fullness and other parameters defining facial aesthetics were kept in consideration while adjusting the rim and establishing the vertical relationship. At last, the lower rim was secured with the upper dentition in centric relation.

The cast of the upper arch and the lower baseplate were articulated on a semi-adjustable articulator at a recorded centric relation. The lower rim was removed from the baseplate and a wire framework was shaped projecting towards the upper arch, to help with the retention of low-fusing compound. Acrylic bite blocks were made at the molar region to maintain the vertical relation (figure 2a).

The type 1 – low-fusing impression compound was softened in a water bath and adapted to the wire framework. The baseplate was inserted in the patient's mouth and routine mandibular movements like swallowing, sucking of lips and pronouncing vowels were performed. This aided in molding the impression compound into the neutral zone space (figure 2b). The location of the NZ is not affected by the material used in recording it.¹²

The baseplate was mounted back on the articulator. Plaster indices surrounding the NZ impression were made on the cast. Three notches: two in posterior and one in anterior region were added (figure 2c). A separating media was applied on the cast, record base and over the NZ recorded. Dental plaster was poured up to the top of the compound margins and worked into the notches of the base. The plaster indices were divided into two buccal and one lingual segment to guide the removal and placement of these indices (figure 2d). The NZ record was then removed, and acrylic bite blocks were removed from the denture base. Indices were reassembled and wax was poured into the space representing the neutral zone. Finally, the mandibular teeth were arranged on the rim in between the indices while establishing an occlusion with the maxillary dentition (figure 2e).

A wax try-in was performed and record base stability, aesthetics, and intra-oral occlusion were evaluated. All movements done while recording the NZ were reperformed by the patient successfully (figure 2f). The trial dentures were then processed with a heat-cure acrylic resin and lightly polished.

The denture was inserted, and retention, stability, and



Figure 1 – Atrophic mandible



Figure 2A – wire framework and acrylic stops



Figure 2B– neutral zone recorded



Figure 2C – notches on base



Figure 2D– after boxing



Figure 2E – tooth setup in neutral zone



Figure 2F– wax try-in denture



Figure 3 – Denture insertion

occlusion were verified. High spots were trimmed off and the patient was comfortable with the prosthesis. Post-op instructions were given, and the patient was kept on follow-up to address any complaints about the use and function of the new prosthesis (figure 3).

DISCUSSION

Research has determined that NZ is a sensitive indicator of instability, thus, arranging denture teeth accordingly helps to achieve maximum stability of the prosthesis.¹³ Even forces also minimize the resorption of the residual alveolar ridge.¹⁴ The surrounding muscles that affect NZ are the buccinator, modiolus, orbicularis oris, mentalis, and tongue muscles.⁵ During the impression, the patient is asked to whistle, protrude their tongue, purse their lips, suck, and grin to effectively record all biomechanical movements.^{12,15}

Dentures, especially in patients with compromised ridges need to be fabricated in a manner that they do not interfere with the normal neuromuscular activity.^{5,16} This case report has documented the fabrication of a single complete removable denture for a patient with a severely resorbed mandibular ridge using the neutral zone technique. On delivery of the denture to the patient after processing and polishing, it showed adequate retention and stability due to a balanced muscular activity. The speech produced was also closer to the normal.¹⁷ It had a profound influence on the patient's masticatory function with enough tongue space and prevention of food impaction.¹⁸ This technique provides a solution for patients with highly resorbed ridges to function normally.

This case report uses conventional methods to record NZ. The use of CAD-CAM to construct record bases in clinical practice can make this approach more effective due to their close adaptation to the tissue surface and

result in fewer chances of human errors.⁵ The use of digital technologies like VR has also shown significant satisfaction among doctors in diagnosing and treatment planning of complex cases.¹⁹

CONCLUSION

The neutral zone technique is a relatively simpler method that adds just one extra clinical step but ensures a stable and long-term retentive prosthesis. However, incorporating advanced methods in recording NZ in clinical practice can further increase patient satisfaction.

DISCLAIMER

None.

CONFLICT OF INTEREST

None to declare.

ETHICAL STATEMENT

None.

FUNDING DISCLOSURE

The author received no financial support for the research, authorship, and/or publication of this article.

AUTHORS CONTRIBUTION

Conception and design of the study: S.D. Ahmed, A. Hassan

Acquisition of data: S.D. Ahmed, A. Hassan

Analysis and interpretation of data: S.D. Ahmed, A. Hassan, M. Majid

Drafting of the manuscript: S.D. Ahmed, A. Hassan

Critical review of the manuscript: S.D. Ahmed, A. Hassan, M. A. G. Chaudhary

Approval of the final version of the manuscript to be published: S.D. Ahmed, A. Hassan, M. A. G. Chaudhary, M. Majid

REFERENCES

1. Tasios T, Papageorgiou SN, Papadopoulos MA. Prevention of orthodontic enamel demineralization: a systematic review with meta-analyses. *Orthod Craniofac Res.* 2019;22(4):225–35.
2. Pango AD, Bucci R, Rongo R, Simeon V, D'Antó V, Valletta R. Impact of fixed orthodontic appliance and clear aligners on the periodontal health: a prospective clinical study. *Dent J (Basel).* 2020;8(1):1-8.

3. Toniazzo MP, Nodari D, Muniz FWMG, Weidlich P. Effect of mHealth in improving oral hygiene: A systematic review with meta-analysis. *J Clin Periodontol.* 2019;46(3):297-309.
4. Cozzani M, Ragazzini G, Delucchi A, Mutinelli S, Barreca C, Rinchuse DJ, et al. Oral hygiene compliance in orthodontic patients: a randomized controlled study on the effects of a post-treatment communication. *Prog Orthod.* 2016;17(1):17–41.
5. Loe H, Silness J. Periodontal disease in pregnancy. Prevalence and severity. *Acta Odont Scand.* 1963;21(6):533–51.
6. Bowen BT, Rinchuse DJ, Zullo T. The influence of text messaging on oral hygiene effectiveness. *Angle Orthod.* 2014;85(4):543–8.
7. Scribante A, Gallo S, Bertino K, Meles S, Gandini P, Sfondrini MF. The effect of chairside verbal instructions matched with instagram social media on oral hygiene of young orthodontic patients: a randomized clinical trial. *Appl Sci.* 2021;11(2):706.
8. Bianco A, Dalessandri D, Oliva B, Isola G, Tonni I, Bonetti S, et al. COVID-19 and Orthodontics: an approach for monitoring patients at home. *The Open Dent J.* 2021;15:87–96.
9. Benson PE, Parkin N, Dyer F, Millett DT, Germain P. Fluorides for preventing early tooth decay (demineralised lesions) during fixed brace treatment. *Cochrane Database Syst Rev.* 2019; 2019(11):CD003809.doi:10.1002/ 14651858. CD003809.pub4.
10. Mike C, Phillip M, Larry P, Reginald W, Peter H. Effect of automated messaging on oral hygiene in adolescent orthodontic patients: A randomized controlled trial. *Angle Orthod.* 2019;89(2):262-67.
11. Eppright M, Shroff B, Best AM, Barcoma E, Lindauer SJ. Influence of active reminders on oral hygiene compliance in orthodontic patients. *Angle Orthod.* 2014;84(2):208–13.
12. Ousehal L, Lazrak L, Es-Said R, Hamdoune H, Elquars F, Khadija A. Evaluation of dental plaque control in patients wearing fixed orthodontic appliances: a clinical study. *Int Orthod.* 2011;9(1):140-55.
13. Ariane H, Thomas S, Nicola K, Dirk W, Stephan H, Carsten L, et al. Effects of a Mechanical Interdental Cleaning Device on Oral Hygiene in Patients with Lingual Brackets. *Angle Orthod.* 2003;73(5): 579–87.
14. Hakan T, zgu R, Yesim B, Zuhul Y, Selcuk K, Suleyman O. Archwire Ligation Techniques, Microbial Colonization, and Periodontal Status in Orthodontically Treated Patients. *Angle Orthod* 2005;75(2):231–36.
15. Crocombe L, Brennan D, Slade G, Loc D. Is self interdental cleaning associated with dental plaque levels, dental calculus, gingivitis and periodontal disease? *J Periodont Res* 2011;47(2)188-97.
16. Rewal H, Sapawat P, Modi P, Aggarwal S. Psychological impact of orthodontic treatment on quality of life – a longitudinal study. *Int Orthod.* 2019;17(2):269–76.
17. Tervonen -M-M, Pirttiniemi P, Lahti S. Development of a measure for orthodontists to evaluate patient compliance. *Am J Orthod Dentofacial Orthop.* 2011;139(6):791–96.
18. Petrauskiene S, Wanczewska N, Slabsinskiene E, Zengulyte G. Self-reported changes in oral hygiene habits among adolescents receiving orthodontic treatment. *Dent J.* 2019;7(4):96–107.
19. Aljohani SR, Alsaggaf DH. Adherence to Dietary Advice and Oral Hygiene Practices Among Orthodontic Patients. *Patient Prefer Adherence.* 2020;14(1):1991-2000.