

Prosthetic Rehabilitation of Edentulous Atrophied Mandibular Ridge Using Piezographic Technique: A Case Report

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Abstract:

The goal of any prosthodontic operation is to restore the patient's natural shape, speech, function, appearance, and general health. However, obtaining the best possible denture stability in conventional full dentures continues to be difficult, especially when there is resorption of the mandibular ridges. A method for enhancing mandibular full denture retention in patients with significantly resorbed ridges is presented in this article. Patients who suffer from ill-fitting mandibular dentures, due to reduced denture foundation area and flat residual ridge, usually require alternative modalities to overcome their complaints. The mandibular ridge was found to be poorly resorbed after a thorough clinical examination. Prosthetic rehabilitation using the neutral zone approach was scheduled following a comprehensive examination. When compared to the patient's prior dentures, the final full denture showed much better stability, functionality, and appearance. Recognizing the benefits of the neutral zone approach and applying it to clinical practice is critical for physicians. With this method, the patient is guaranteed to receive a prosthesis that meets their functional, physiological, and psychological needs. Using this approach, practitioners can give patients prostheses that fulfill their demands and enhance their quality of life.

Key words: Complete denture, Resorbed ridge, Neuromuscular incoordination, Piezography, Monoplane teeth.

1. Introduction

Denture stability poses a significant concern, especially in cases involving mandibular completedenturesduringdentalrehabilitation. The lower denture is more frequently impacted by several factors, including inadequate tissue coverage, poor occlusion, vertical bone height, misaligned teeth, and behavioral

problems [1]. To guarantee that dentures fit the patient's mouth cavity harmoniously and comfortably, the neutral zone idea was created in response to this issue [2]. The neutral zone can be recorded using a variety of materials, including tissue conditioner, silicone, and soft wax. For individuals who have had extended durations of edentulousness and severely resorbed lower ridges, piezography is a technique that can help create a prosthesis that is more stable and retentive [3]. It can be said this technique utilizes a material that can be moulded in the mouth utilizing various functional muscle tensions. One of the functions that may be selected as a variable in this manner is speech [4].

2. Case report

A 60-year-old male visited the Department of Prosthodontics, expressing concerns about his lower denture becoming loose, which has resulted in difficulty chewing and speaking.



Figure1. 1a. Extraoral frontal view 1b. Intraoral maxillary arch view 1c. Intraoral mandibular arch view

Upon examination, patient's extraoral features showed a symmetrical square-

shaped face form, with depressed cheeks due to the absence of all teeth in both the upper and lower arch (Figure 1a). The patient had shown good medical fit and was not taking any medications. Upon intraoral inspection, there was no tooth present in the maxillary or mandibular arches. The maxillary arch had a U-shaped arch structure and was modest in size. The ridge has a well-rounded shape (Figure 1b). The mandibular arch is a V-shaped arch with a significant ridge resorption (Figure 1c). There were no tori or bony undercuts visible. The mucosa was in good condition, the tongue was normal in size, and had good coordination and motility. The patient's treatment plan included creating a mandibular denture using conventional methods, but the researcher ultimately chose to handle the case utilizing the admix method and piezographic technique to help increase the lower denture's stability and retention. Following the clinical examination and case history, the patient was given a thorough explanation of the process, and his consent was taken.

3. Procedure

Irreversible hydrocolloid material (Algitex DPI, India) was used to make the diagnostic impression, and type III gypsum product (Ultrastone dental plaster; Kalabhai Karson Pvt Ltd.) was used to pour the impression. The researcher used autopolymerizing resin (DPI selfcure, India) to create unique custom trays for mandibular arch (Figure 2a). To ensure the correct vertical positioning of the impression tray and management of the impression material thickness, tissue stops were incorporated into the fabrication of the mandibular custom tray. Primary impression was made using impression compound (Pinnacle DPI, India) and the impression was poured type II gypsum product (dental plaster; Kalabhai Karson Pvt Ltd) (Figures 2b&c). Maxillary border molding and final impression was made using green stick compound (DPI, India) and light body consistency additional silicone (Neopure A-silicone Impression

Material Orikam Healthcare India Pvt. Ltd) (Figure 2d) and master cast poured by die stone type IV gypsum material (Die stone, Kalabhai Karson Pvt Ltd). When the mandibular ridge was created utilizing the admix procedure, it combines impression compound with green stick compound in a 3:7 ratio. When a low-fusing compound and an impression compound are combined, the resultant substance has a low viscosity, making it easier to manipulate the mouth muscles (Figure 2e). Several functional actions, such as sucking cheeks, licking lips, and swallowing, were used to capture the impression in its functional state, and the master cast was poured using die stone type IV gypsum material (Figure 2f).

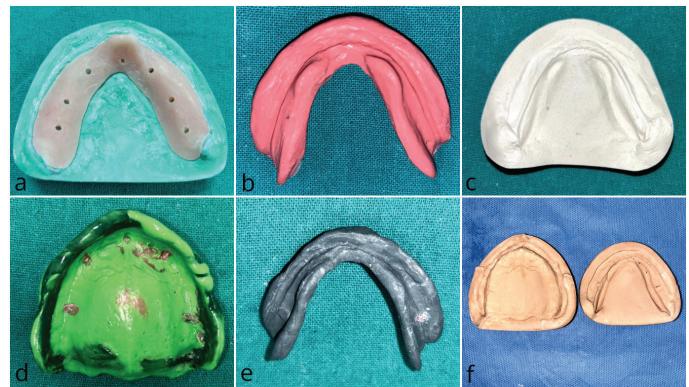


Figure 2: 2a. Mandibular custom tray 2b. Primary impression 2c. Primary cast 2d. Maxillary final impression using light body silicone 2e. Mandibular final impression using admix material 2f. Master casts

Modeling wax (MAARC dental, modeling wax, Indian) was used to create the occlusal rims. For optimal performance, the upper rim was precisely set to produce a 2mm visibility parallel to the Camper's line. For the patient's comfort, a freeway gap of 2 mm was kept while the vertical dimension was carefully measured both at occlusion and at rest. After arranging the maxillary teeth and cleaning the mandibular denture foundation of modeling wax, the outside surface was grooved to let the moldable material stick to the acrylic, and stainless steel wire inserts were positioned at the level of the occlusal plane.



Figure 3: 3a. Recording jaw relation 3b. Maxillary teeth arrangement with monoplane tooth 3c&d. Maxillary try-in done 3e. After removing the mandibular occlusal rim grooves created 3f. Acrylic rest and Spurs made of a stainless steel wire were adapted to the denture base

From this point on, the piezographic technique was used. Before the procedure was carried out, the patient was required to practice pronouncing certain phonemes because the approach was based on phonetics. The prosthodontic gap was created in the mouth by using the speech exercise to shape the tissue conditioner material (Ashvin, soft liners, India). He had his upper teeth arrangement adjusted to help him pronounce phonemes more clearly when speaking. Instructing the patient to enunciate the phonemes after the soft liner was initially inserted. Following the setting of the material, the piezographic record was examined. This technique yielded the precise neutral zone space. A silicon index was created over the mandibular cast with the primary goal of converting this record into a tooth-arranging area that could be used. To allow for the index to be moved, grooves were made in the land area. A mixture of silicon putty (Neopure A-silicone Impression Material Orikam Healthcare India Pvt. Ltd) was used, and the piezograph's inner and outer edges were adapted to make the index. Melted wax was poured into the space left by the removed dam to create a fresh wax rim. After being positioned in the articulator, the wax rim was adjusted to the specified vertical dimension. In the newly acquired space, the mandibular teeth were now positioned.

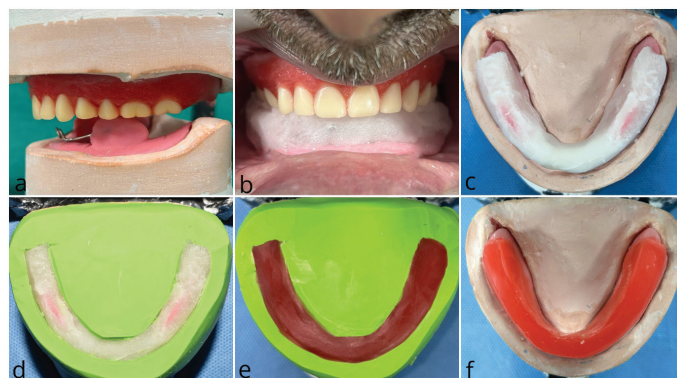


Figure 4. 4a. Acrylic rest at the level of occlusion 4b. Recording of piezography zone with tissue conditioner 4c. Final dam kept on the mandibular cast and excess removed with a knife 4d. Putty index corresponding to the piezography zone 4e. Wax was melted and added in the space provided by the admixed material. 4f. New occlusal rim according to the putty index

The tooth arrangement with wax-up was completed. During the try-in session, the patient was satisfied with the dentures' stability, function, phonetics, and looks.



Figure 5: 5a. Try-in 5b. Final prosthesis 5c. Post-insertion intraoral view

In a conventional method, polymethyl methacrylate resin was used to process the denture prosthesis. Finishing and polishing of dentures was done. After the denture was inserted, post-insertion instructions were provided. The patient was satisfied with the denture's appearance, functionality, and stability.



Figure 6: 6a. Extra oral pre operative view 6b. Extra oral post operative view

4. Discussion

Retention, stability, and support are the three characteristics that make full dentures successful. Because of physical restrictions, mandibular dentures might be more difficult to use. Denture retention can be affected by several variables, including occlusion, oral-facial musculature, cohesion, adhesion, viscosity, and air pressure. A complicated biomechanical disorder known as mandibular ridge resorption causes long-term, gradual, cumulative, and irreversible alterations in the structure of the bone, which severely impairs prosthesis fit and function [5]. Under functional loads, a denture that is not strong, stable, or continuous is prone to dislocation. The neutral zone approach, when compared to traditional complete dentures, can give patients far superior stability, usefulness, and attractiveness [6]. The following conditions can benefit from the use of the neutral zone approach in prosthodontic treatment: atrophic mandibular ridge; prominent and highly attached mentalis muscle; lateral spreading of the tongue as a result of a poor dentate to edentulous state; severe resorption; abnormal shape or consistency of oral and perioral structures; scleroderma; or patients who have had marginal or segmental mandibulectomy treatments. Several authors have proposed modified impression approaches, including cocktail, admixed, functional, and all-green methods. Maximum control over coverage, ease of correction, precise measurement of mucobuccal reflections, and targeted pressure on the load-bearing region [5,7,8]. Piezography is a pressure-based shape recording technology used to record a patient's denture space in

relation to oral function. To enable distinctive molding by diverse functional muscle forces, a moldable substance is introduced into the mouth. The registration of the denture space is accomplished by this approach using speech. Monoplane teeth are better than anatomical teeth for residual resorption ridge cases because they eliminate harmful horizontal forces and provide the patient with a sense of freedom. This is due to their zero-degree angle, which does not lock the mandible in one position. The best option for people who wish to make their ill-fitting dentures fit and perform better before replacing them is to use tissue conditioners [8]. These temporary soft liners, which are made of a polymer powder and liquid plasticizer combination, can also be used to heal damaged mucosal tissues brought on by improperly fitting acrylic dentures. They also come highly suggested for creating impressions that are functional. Tissue conditioner's viscoelastic quality and progressive injection capabilities throughout a variety of applications make it a useful tool for piezography. Patients benefit from this technique's enhanced stability and retention, clear speaking, and superior cleanliness [9]. To better comprehend and examine oral function when pronouncing phonemes, patients can even practice before the impression is obtained. It is crucial to remember that piezography may cause the anterior teeth to be pushed lingually, which might somewhat reduce the mandibular denture's visual appeal for patients with significantly resorbed lower ridges and extended periods of edentulousness. Hence, all things considered, tissue conditioner for piezography, is a reasonable strategy for improving denture retention and oral function [10].

5. Conclusion

When examining treatment options for patients with unstable mandibular complete dentures, it is crucial to take the neutral zone concept into account, particularly in cases where implant therapy is not practical. When dental implants are not an option, an alternate method called the neutral zone approach can be utilized to build a mandibular full denture on severely atrophic ridges. The benefit of utilizing the piezographic approach to record the neutral zone is that it yields precise and

accurate measurements, which maximizes patient's comfort and denture stability. Proper management of the neutral zone is critical to the success of denture treatment as it allows for a stable foundation for the prosthesis. By understanding the principles of the neutral zone, dental professionals can achieve optimal results in restorative dentistry and improve the quality of life for their patients.

References

1. Ghosh S, Bhattacharyya J, Goel P, Das S. Piezography: An Innovative Technique in Complete Denture Fabrication. *Journal of Contemporary Dentistry*. 2012;2(3).
2. Rathee M et al. Prosthetic Rehabilitation of an Unemployed Mandibular Ridge in Completely Edentulous Patient Using Neutral Zone Technique. 2023.
3. K S Naveen SL, Viswambaran CM. Complete denture fabrication using piezography concept—a case report. *RGUHS Journal of Dental Sciences*. 2018;10(2).
4. Chaturvedi S, Abdelmonem AM, Haralur S, Suleman G, Majeed MI, Alfarsi MA. An in vivo study to compare location of neutral zone recorded with two materials. *Journal of Contemporary Dental Practice*. 2019;20(2).
5. Wilson T, Ravichandran R, Kumar K H, V Nair V. Prosthetic management of severely resorbed mandibular ridge using neutral zone technique in complete dentures: a case report. *International Journal of Dental Materials*. 2022;04(03).
6. Avci M, Aslan Y. Measuring pressures under maxillary complete dentures during swallowing at various occlusal vertical dimensions. Part II: Swallowing pressures. *J Prosthet Dent*. 1991;65(6).
7. Pathania N, Noor SU, Agnihotri A, Nagpal A, Gupta R, Nanda A. Stability is success: Rehabilitation of an atrophic mandibular ridge employing neutral zone technique – A case report. *International Dental Journal of Student's Research*. 2022;10(1).
8. Rathee M & AM & MS & DK. Rehabilitation of a Completely Edentulous Patient with an Atrophic Mandibular Ridge using Neutral Zone Technique. *Asia Pacific Dental Journal*. 2023;10(4):18–21.
9. Ade N KSMKRVMTU. Orthodontic wires: a newer approach for impression making and neutral zone in severely resorbed mandibular ridge. *Int J Oral Health Dent*. 2023;9(4):298–302.
10. Wilson T RRHKKNV. Prosthetic management of severely resorbed mandibular ridge using neutral zone technique in complete dentures. *Int J Dent Mater*. 2022;4(3):73–7.