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CASE SERIES

MANAGEMENT OF UNSTABLE DENTURES ON ATROPHIED MANDIBULAR RIDGES USING DIFFERENT IMPRESSION MATERIALS FOR RECORDING THE NEUTRAL ZONE: A CASE SERIES

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Abstract. *Patients presenting with highly resorbed residual ridges present a challenge during prosthodontic rehabilitation due to the lack of any anatomic features to provide retention or stability of the complete denture prosthesis. Prosthetic rehabilitation of atrophied residual ridges using removable complete denture prostheses with the implementation of the neutral zone technique of three patients has been described. The neutral zone was recorded using green stick compound, admix of medium-fusing and low-fusing impression compound, and soft liner respectively. The definitive prosthesis was fabricated using compression molding technique and the final prosthesis was delivered to the respective patients with instructions on usage and hygiene of the prosthesis. The prosthetic rehabilitation of severely resorbed mandibular residual ridges is challenging for a prosthodontist. Prostheses fabricated using the neutral zone technique provide better stability, speech, patient comfort, and satisfaction. The case series presents the clinical significance of neutral zone for artificial teeth arrangement and contouring of polished surfaces of complete dentures.*

Key words: *atrophic mandibular ridge, dead space, neutral zone technique, admix technique, tissue conditioner, zone of minimal conflict.*

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INTRODUCTION

The stability of complete dentures requires coordination of the dentures with neuromuscular function. The tongue, cheeks, and lips are the source of muscular forces that collectively specify the teeth positions and eventual dental arch form in the oral cavity. The effects of these muscular activities intensively influence the volume of the oral cavity space and continue throughout life even after tooth loss [1]. The neutral zone, also known as the potential denture space is the region where the outward pressing forces of the tongue are counterbalanced by the inwardly directed forces of the cheeks and lips.

These forces are muscular in origin and are associated with mastication, articulation, and deglutition and, hence, vary among individuals [2]. Consideration of the neutral zone is more important concerning the mandibular arch because the covered surface area is roughly half that of the maxillary arch [3]. A variety of materials have been used for recording the neutral zone like impression compounds, waxes, and soft liners [4]. This case series describes three cases where the neutral zone technique has been used to attain the above qualities of the denture with three different materials for recording the same.

CLINICAL CASE DESCRIPTIONS

Case 1

A 64-year-old male patient presented to the Department of Prosthodontics due to complaints of difficulty in chewing food with a previously fabricated dental prosthesis, which was found to have worn occlusal surfaces on examination. Extraoral examination revealed facial asymmetry and intraoral examination revealed the presence of a highly resorbed mandibular residual ridge (Figure 1A). The previous dentures showed a prominent cant in the occlusion.

Prosthetic rehabilitation of the patient employing a removable complete denture prosthesis with the recording of the neutral zone for the mandibular arch was planned. Primary impression was made using irreversible hydrocolloid impression material (Imprint, DPI Private Limited, Mumbai, India) followed by pouring of the primary casts in dental plaster (Kaldent, Kalabhai Karson Private Ltd, Mumbai, India). Sectional border molding for the maxillary arch was done using the low-fusing impression compound for the maxillary arch followed by the definitive impression using light body addition silicone impression material (Neopure, Orikam India Pvt Ltd, Gurugram, India). For the mandibular arch, the impression was recorded using all-green technique followed by a wash impression using light body addition silicone impression material (Figure 1, B-C). The definitive casts were poured for both arches using dental stone. A tentative maxillomandibular relation record was made. It was mounted on an articulator followed by the recording of the neutral using the low-fusing impression compound. This was done by adding low fusing impression compound to the mandibular temporary denture base and asking the patient to close the mouth in the prerecorded vertical dimension and perform functional movements such as puffing, blowing, whistling, licking, pursing the lips, smiling, and pronouncing the vowels. (Figure 1D). The neutral zone recorded was then replaced with modeling wax with the help of a putty index (Figure 1, E-F). The teeth arrangement was done using monoplane teeth for the posterior dentition. Try-in was carried out and denture processing was done using the compression molding technique. The dentures were finished, processed, polished, and delivered to the patient with instructions on masticating and maintenance of denture hygiene (Figure 2, A-B).

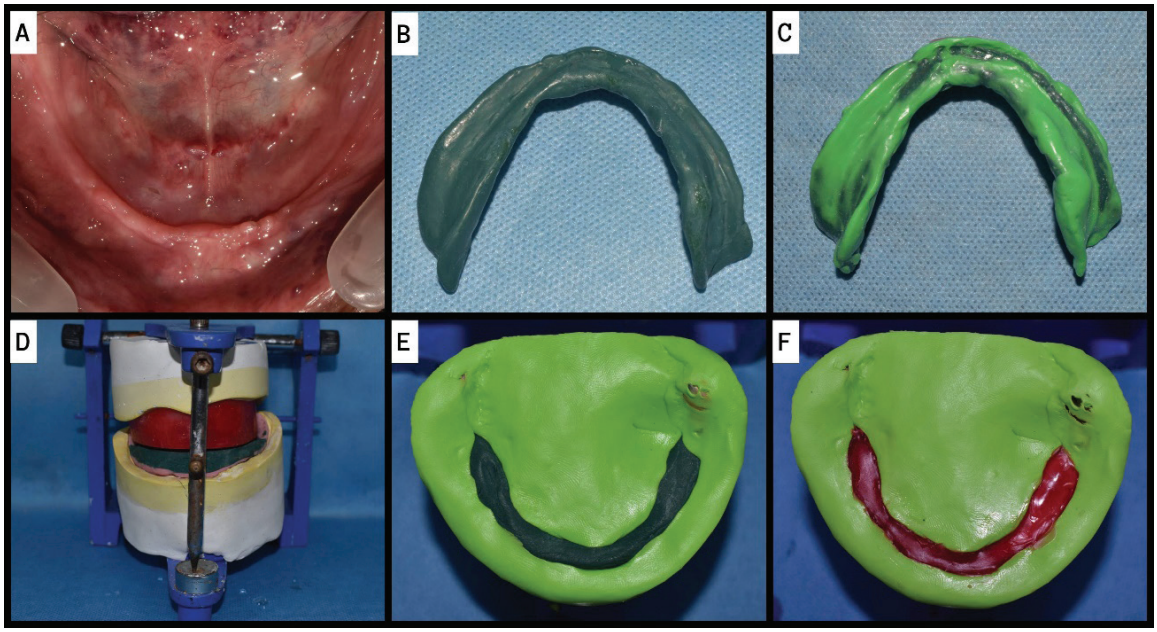

Fig. 1. A. Pre-rehabilitative view, **B-C.** Definitive impression making of mandibular arch using all green technique, **D.** Recording of neutral zone using green stick impression material, **E-F.** Fabrication of putty index and fabrication of wax occlusal rim

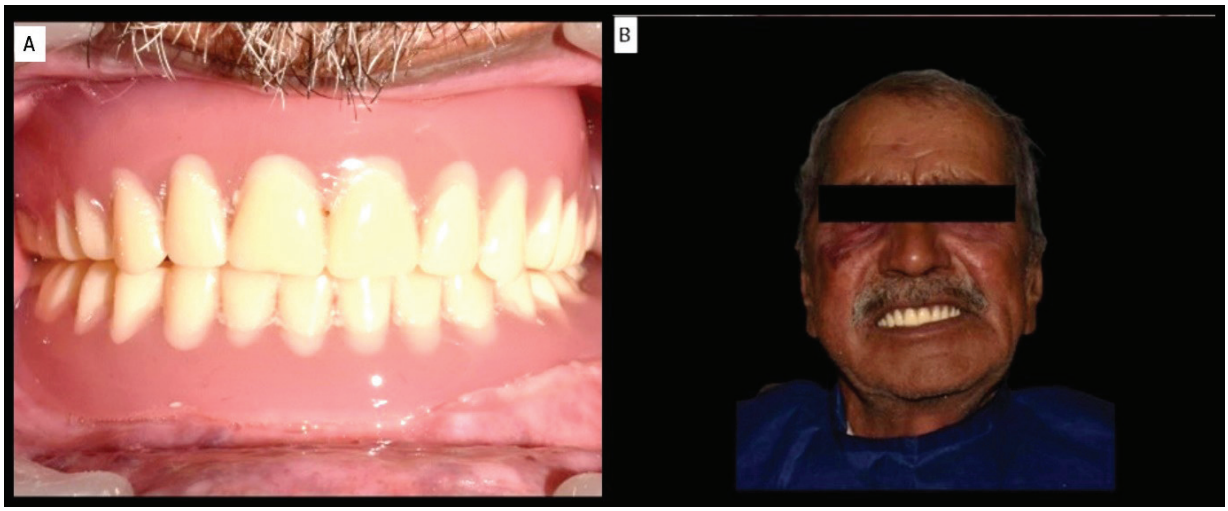

Fig. 2. A. Definitive prosthesis in-situ, **B.** Post-rehabilitative extraoral profile view

Case 2

A 59-year-old female patient presented to the Department of Prosthodontics due to complaints of difficulty in chewing food with the previous prostheses, which were loose. Intraoral examination revealed a highly resorbed mandibular residual ridge (Figure 3A).

Prosthetic rehabilitation of the patient utilizing removable complete denture prosthesis with the recording of the neutral zone for the mandibular arch, same as the previous case, was planned. Primary impression was made using impression compound (Pinnacle, DPI, Mumbai, India) (Figure 3B) followed by pouring of the primary cast in dental plaster. The definitive impressions and cast were made like in the previous case (Figure 3, C-D) and the maxillomandibular relation record was similarly mounted. The neutral zone was recorded using the admix technique. Admix was prepared by manipulating medium-fusing and low-fusing impression compounds in the ratio of 3:7 by weight, which was then placed on the mandibular temporary denture base. The neutral zone was recorded in a manner as described previously and then replaced with modeling wax with the help of a putty index (Figure 3, E-F). The remainder of the procedures were carried out similarly as in the previous case (Figure 4).

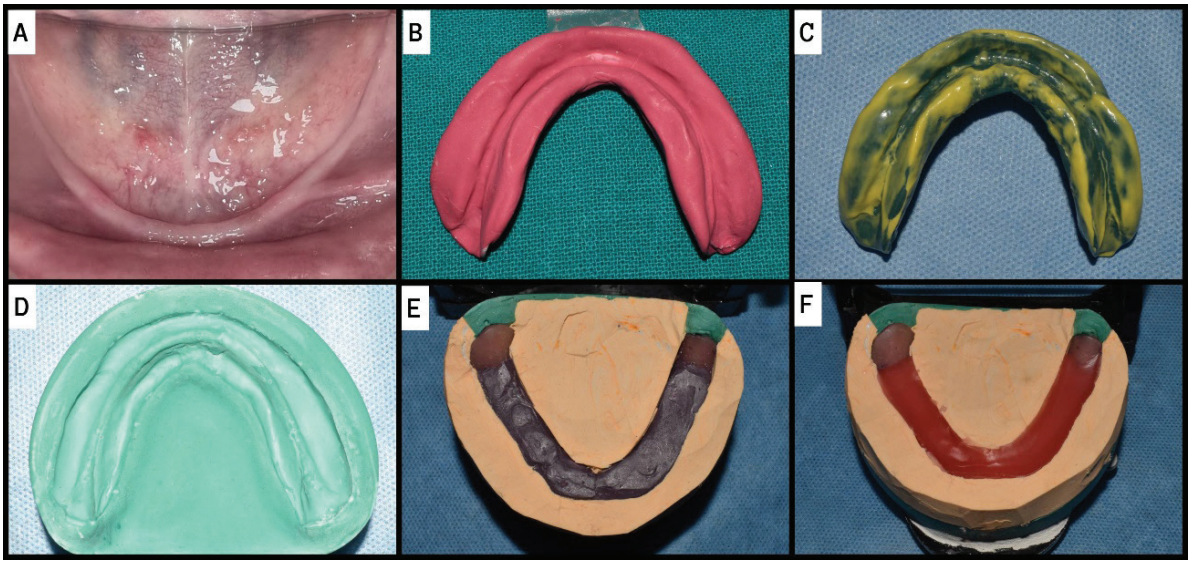

Fig. 3. A. Pre-rehabilitative intraoral view **B.** Primary impression of mandibular arch; **C.** Definitive impression of mandibular arch using all green technique followed by recording neutral zone with admixed technique, **D.** Definitive mandibular cast **E-F.** Fabrication of putty index and fabrication of wax occlusal rim

Fig. 4. A-B. Pre-rehabilitative and post-rehabilitative smile view

Case 3

A 65-year-old female patient presented to the Department of Prosthodontics due to complaints of difficulty in chewing with the previous dentures, which had become loose over time. Intraoral examination revealed an atrophic mandibular ridge similar to the previous two cases (Figure 5A).

Prosthetic rehabilitation of the patient was planned using a removable complete denture prosthesis with the application of the neutral zone technique. A diagnostic impression of the mandibular arch was made on which a custom tray was fabricated. Border molding was done using all green technique (Figure 5B) and a primary impression was made using light body vinyl polysiloxane impression material and the primary cast was poured. A primary cast for the maxillary arch was poured from a primary impression made from an irreversible hydrocolloid.

The making of definitive impressions (Figure 5C), pouring of definitive casts, and mounting of maxillomandibular records were similar to the previously described cases. The neutral zone for the mandibular arch was recorded using tissue conditioning material. Tissue conditioner was applied on the mandibular denture base and the neutral zone was recorded in the manner previously described (Figure 5 D-F). The remainder of the procedures were carried out similarly as in the previous case (Figure 6).

All three patients were asked to present for follow-up after a month and they reported much greater satisfaction in chewing and speaking with the newer prostheses.

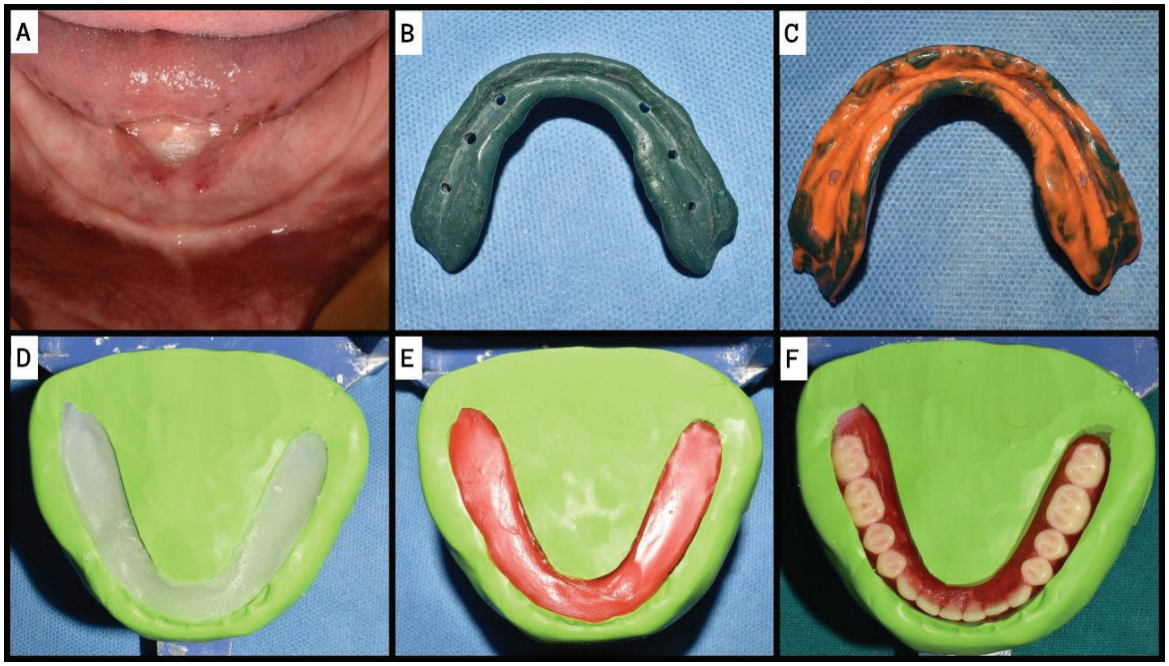

Fig. 5. A. Pre-rehabilitative intraoral view, **B.** Border molding done using all green technique, **C.** Definitive impression of mandibular arch, **D.** Neutral zone was recorded using soft liner material, **E.** Fabrication of wax occlusal rim, **F.** Teeth arrangement

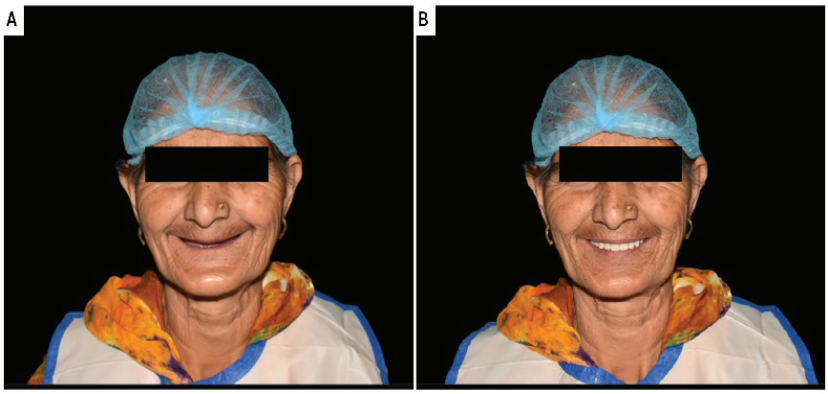

Fig. 6. A-B: Pre-rehabilitative and post-rehabilitative smile view

DISCUSSION

The extent of resorption of the residual ridge compromises the stability and retention of the denture. Greater ridge resorption leads to a smaller denture base area with the lesser influence of the intaglio surface on denture stability and retention. The increased inter-ridge distance causes increased height and weight of the prosthesis, generating increased leverage and stresses in the denture supporting area. The role of the cameo surface then assumes a greater significance in providing clinically acceptable retention and stability [2, 5].

Prosthetic rehabilitation in such cases may be approached by resorting to pre-prosthetic surgical procedures like ridge correction, ridge augmentation, and ridge extension [6]. Prosthetic rehabilitation using dental implants may also be considered in these cases but all these surgical methods have various limitations and contraindications in the form of any pre-existing co-morbidities or financial constraints. The neutral zone technique in such cases can be a superior option. This technique can result in providing dentures with greater stability and retention during functional movements and better facial support and esthetics [7].

The material utilized to record the neutral zone should be soft enough to be easily molded by the movements of the tongue and circumoral muscles and have sufficient working time. Presently, no consensus exists on the superiority of one material over the other [8].

In the first case, a low-fusing impression compound has been used to record the neutral zone as it is an easily moldable material and can be corrected readily and provide an accurate extent of the neutral zone. However, the material may lack sufficient body when heated and tend to distort as the temporary denture base is repeatedly placed intraorally to record the neutral zone [9, 10].

In the second case, an admix of medium-fusing and low-fusing impression compounds was used. The addition of a comparatively viscous medium-fusing impression compound to the low-fusing compound improves the handling properties of the material. It also smoothens away creases in the soft tissue overlying the residual ridge, eliminating potential discomfort that may arise from the entrapment of the creased mucosa between the denture base and the mandibular bone [11, 12]. Furthermore, it requires less chair-side time and is economical as compared to tissue conditioner or reline material [9]. However, the uniform softening of the material is critical for recording full functional movements, and if not done properly, can result in an inaccurate recording of the neutral zone [13].

In the third case, the tissue conditioner technique as described originally by Ohkubo was utilized [14]. Tissue conditioners are visco-elastic materials and exhibit plasticity after mixing the powder and liquid to form a viscous, flexible, sponge-like thick solid. The material offers the advantages of being mucostatic, odorless, and tasteless. The lengthy setting time of the material also permits the execution of all the muscle movements to record the neutral zone with precision [8, 15]. However, tissue conditioners do not possess sufficient body and may be tedious to use even when supported by wire loops or acrylic stops [13].

In our case series, all three patients reported satisfactory outcomes concerning mastication and articulation with the prostheses fabricated by the neutral zone technique, regardless of the material used to record it [16, 17]. Fabrication of the dentures using the neutral zone technique leads to prostheses with the cameo surface contoured and designed to conform to the shape of the tongue, lips, and cheeks [18, 19, 20]. The teeth are arranged such that they are in harmony with the surrounding musculature during rest and function. This results in prostheses that display better stability and eliminate cheek and tongue biting, leading to a more comfortable experience for the denture-wearer [21, 22, 23].

CONCLUSION

The prosthetic rehabilitation of severely resorbed mandibular residual ridges is a challenge for a prosthodontist. Prostheses fabricated using the neutral zone technique provide for better stability, speech,

patient comfort, and satisfaction. The article presents the clinical significance of neutral zone for artificial teeth arrangement and contouring of polished surfaces of complete dentures.

Clinical Significance: The use of the neutral zone technique in patients with highly resorbed ridges can serve as a simpler, cost-effective solution to restore the masticatory ability, phonetics, esthetics, and overall quality of life without resorting to implants, which are associated with more invasive procedures.

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Ethical statement: *This study has been performed in accordance with the ethical standards as laid down in the Declaration of Helsinki.*

Informed Consent for a Clinical Case: *Written informed consent was obtained from the patient(s) for the publication of this case report, including any accompanying images.*

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