Case Report

Managing the imbalance forces with zone of minimal conflict
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Abstract

The complex biophysical process that commonly occurs following extraction is residual ridge resorption. In a highly resorbed ridge, the retention and stability of the denture are more dependent on the position of the tooth and contour of the external denture surface. It becomes challenging to make a denture that is shaped by muscle function and is in harmony with the surrounding oral musculature. The objective of a prosthodontist is to restore form, function, and esthetics in coordination with the neuromuscular function to obtain a stable denture. This is a case report on a patient with a completely edentulous, severely resorbed mandibular residual ridge who has been treated by neutral zone technique.

Keywords:
Admix technique, Neuromuscular control, Resorbed ridge, Zone of minimal conflict

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Introduction

The greatest challenge in prosthetic rehabilitation is to provide a satisfactory denture which is in harmony with normal muscular function. The complex biophysical process that commonly occurs following extraction is residual ridge resorption. Residual ridge resorption is a progressive, chronic, irreversible, and disabling disease of multifactorial origin which varies from individual to individual. Ridge resorption results in esthetic, psychologic, functional, and mucosal changes in an edentulous patient. Loss of teeth leads to imbalance in the synergistic action between the oral function and the oral musculature. This change is highly complex and individualized. For many years, it has always been a difficult task for the management of resorbed ridges. In such situations, only if certain anatomic and physiologic facts are considered the treatment with complete dentures would be successful. A neutral zone is that area where the forces of the tongue pressing outward are neutralized by the forces of the cheeks and lips pressing inward. This case report highlights such a case of rehabilitation of severely atrophied mandibular residual ridge with finding the zone of minimal conflict using neutral zone technique and providing neurometric occlusion.

Case Report

A 74-year-old male patient reported to the Department of Prosthodontics, Indira Gandhi Institute of Dental Sciences, Pondicherry, with the chief complaint of difficulty in chewing. The patient is a known denture wearer for the last 20 years and was not satisfied with his previous dentures. The patient is a known diabetic and is under medication. Intraoral examination revealed resorbed order V maxillary and mandibular ridge (Atwood, 1963) [Figure 1].

Primary irreversible hydrocolloid impression was made (Neocolloid, Zhermack, New Delhi, India) and cast poured (Type II gypsum). Custom tray was fabricated using autopolymerizing resin. (DPI-RR Cold Cure) Conventional border molding was done for maxilla with low fusing compound (green stick) (DPI Pinnacle Tracing Sticks, the Bombay Burmah Trading Corporation, India) and zinc oxide eugenol (DPI Impression Paste, the Bombay Burmah Trading Corporation, Mumbai) secondary wash impression was made.

Mandibular border molding was done using admix technique consisting of seven parts of low fusing compound and three parts of high fusing compound followed by zinc oxide eugenol wash impression. Master casts were obtained for maxilla and mandible.
Tentative jaw relation was performed with freeway space of 2 mm. Facebow transfer was made for maxilla with spring bow and articulated on a semi-adjustable articulator (Hanau Wide Vue, Teledyne Water Pik, Fort Collins, Colorado, USA). The wax occlusal rim on the mandible was removed and retentive wire loops were fabricated with 19 gauge stainless steel wire. The retentive wire loops were adapted on the denture base that acts as a skeleton for the impression compound and also helps in maintaining the recorded vertical dimension [3] [Figure 2].

Low fusing impression compound (green stick) (DPI Pinnacle Tracing Sticks, the Bombay Burmah Trading Corporation, Mumbai, India) was adapted on the mandibular denture base at the recorded vertical dimension. Neutral zone was recorded by placing the softened admix material over the retentive loops and the patient asked to perform functional movements such as licking the lips, puckering, swallowing, and pronunciation of vowels, for example, aaa, eee, iii, ooo, and uuu. [2] Neutral zone acts as a primary impression for polished surface; thus, secondary impression of polished surface for detail recording was done with zinc oxide eugenol impression paste [Figure 3]. An asymmetry was observed in the mounted casts in centric relation. A possible explanation to this could be the difference in masseter muscle thickness.

An index around the recorded neutral zone was made with elastomeric impression material. [2,3] The recorded neutral zone in admix was removed and replaced with modeling wax. Non-anatomical teeth were arranged within the confined neutral zone using the putty index as a guide [Figure 4]. The symmetry on the left side of the patient posed challenge in teeth arrangement. Hence, utmost care was taken to arrange the non-anatomic teeth in neutrocentric occlusion well within the confines of the recorded neutral zone.

Wax try-in done to assess patient’s esthetics, phonetic, lip support, occlusion, and the denture was processed using heat-activated acrylic resin. (DPI Heat cure, Bombay Burmah Trading Corporation, Mumbai) [Figure 5]. Processed denture was delivered to the patient after careful selective grinding to establish occlusal equilibrium. Follow-up after 4 months revealed an improvement in his confidentiality in speech, mastication, and comfort [Figure 6].

**Discussion**

The three basic properties on which the success of complete denture relies on are retention, stability, and support. It is the skill of prosthodontics to apply these principles efficiently. The presence of anatomic limitations poses added challenge to the dentist in fabricating a successful denture. [4] Various authors have suggested a number of modified impression techniques for
the management of resorbed mandibular ridges such as admixed, functional, all green, cocktail, and neutral zone technique.\(^5\) In general, for patients with severe resorbed ridges, surgical therapy to augment the ridge is advocated. However, it might not always be possible to provide such treatment options such as ridge augmentation and implant procedures due to various patient-related factors.\(^9\) Neutral zone is an age-old technique and various authors have successfully rehabilitated edentulous patients with mandibular resorbed ridges with this technique \([\text{Table 1}]\). A review of the previous studies on neutral zone technique is enumerated in Table 1. There is a lack in evidence regarding comparative studies on this neutral zone technique. Hence, comparative studies on this technique would help generate evidence on the effectiveness of neutral zone technique. In this case report, asymmetry seen on the left side of the patient. Literature evidence also showed changes in the thickness of masseter muscle in edentulous and prosthetically rehabilitated patients \([\text{Table 2}]\). The available studies supported the assumption of asymmetry due to differences in muscle thickness in edentulous patients. However, no studies were found correlating prosthetic rehabilitation with muscular asymmetry management with neutral zone technique. Hence, further studies should be

| Table 1: Previous studies on neutral zone concept |
|-----------------------------------------------|
| **Author**                                   |
| Ohkubo et al.                                |
| Alfano and Leupold                           |
| Porwal et al.                                |
| Chandra Gupta and Agarwal                   |
| Jain et al.                                  |
| Asnani et al.                                |
| Bhat et al.                                  |
| Sadighpour et al.                            |
| Patil et al.                                 |
| Rashid et al.                                |
| Lynch and Allen                              |
| Bagul and Khandagale                         |
| **Study**                                    |
| Presented a neutral zone approach for denture fabrication for a partial glossectomy patient\(^10\) |
| Presented a technique for obtaining maxillomandibular registration for complete denture patients using neutral zone\(^11\) |
| Presented the application of neutral zone concept to achieve successful complete denture therapy for rehabilitation of severely atrophic ridge\(^12\) |
| Has used neutral zone concept in prosthodontic treatment of a patient with brain surgery\(^22\) |
| Has used neutral zone technique to overcome unstable mandibular denture and thereby enhance denture stability for complete denture rehabilitation in atrophied ridge\(^13\) |
| Presented the management of Atwood’s class V and VI resorbed ridge with neutral zone technique\(^22\) |

| Table 2: Evidence related to changes in muscle thickness |
|-------------------------------------------------------|
| **Author**                                           |
| Miralles et al. (1989)                               |
| Kiliaridis and Kålebo (1991)                         |
| Newton et al. (1993)                                 |
| Slagte et al. (1993)                                 |
| Raustia et al. (1996)                                |
| Raadsheer et al. (1999)                              |
| Koca-Ceylan et al. (2003)                            |
| Bhoyar et al. (2011)                                 |
| Tetsuka et al. (2012)                                |
| Sathasivamubramanian et al. (2017)                   |
| **Study**                                            |
| Comparative electromyographic study of elevator muscles in patients with complete dentures and natural dentition |
| Masseter muscle thickness measured by ultrasonography and its relation to facial morphology |
| Changes in human jaw muscles with age and dental state |
| Human jaw-elevator muscle activity and food comminution in the dentate and edentulous state |
| Evaluation of masticatory muscles of edentulous patients by computed tomography and electromyography |
| Contribution of jaw muscle size and craniofacial morphology to human bite force magnitude |
| The effect of unilateral partial edentulism to muscle thickness |
| Effect of complete edentulism on masseter muscle thickness and changes after complete denture rehabilitation: An ultrasonographic study |
| Relationship between masseter muscle form and occlusal supports of remaining teeth |
| Masseter muscle thickness in unilateral partial edentulism: An ultrasonographic study |
| **Conclusion**                                       |
| Maximal voluntary clenching was significantly lower in patients with complete dentures than in subjects with natural dentition |
| The thickness of the masseter muscle was found to be related to the facial morphology, mainly in women, but not in men; the women with a thin masseter had a proportionally longer face |
| Changes in the cross-sectional area and density of masseter and medial pterygoid muscles were consistent with a general age-related change of muscle tissue in the body. Thus, indicating a reduction in masticatory forces |
| The masticatory performance and chewing efficiency depend on relations between the activities of the elevator muscles. Hence, mastication and maximal voluntary clenching of elevator muscle was less in denture wearers |
| The thickness of the masseter muscle correlated significantly with bite force magnitude |
| No statistically significant relationship was seen among muscle thickness, unilateral chewing habits, and age of the patient. Atrophic changes in the muscles could become significant after 45 years of age |
| There is a decrease in masseter muscle thickness in edentulous individuals, and there are subsequent changes occurring in muscle thickness after rehabilitation with complete dentures in the form of increased muscle thickness |
| When there is regional support loss, the thickness of muscle fiber and density is decreased. This causes a decrease in muscle thickness and volume resulting in muscle atrophy |
| Disuse atrophy of the masseter muscle in the edentulous side. The correlation between the duration of edentulism and muscle thickness was found to be statistically insignificant |
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conducted to check for effectiveness of neutral zone technique in the management of the patient with a difference in muscular thickness due to a long period of edentulism.

Conclusion

Modification in treatment procedure should be considered for a patient with residual ridge resorption and imbalance in muscular forces so as to fulfill the patient’s functional and esthetic demands. The neutral zone concept implies acquired muscle control, especially by tongue, lips, and cheeks, toward the denture stability. Advocates of the neutral zone concept agree that a lack of favorable leverage is observed when teeth are positioned directly over the ridge. By employing the neutral zone concept, the dislodging muscle energy can easily become a retentive and stabilizing force. Neutral zone is the best alternative impression technique which exhibits better retention and overall satisfaction of the patient.

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Figure 5: Teeth arranged in neutrocentric occlusion

Figure 6: Patient before and after denture delivery
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