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Prosthodontic Management of Compromised Mandibular Ridge Using Modified Functional Impression Technique Combined With Neutral Zone Concept- A Case Report.

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Abstract: *The purpose of prosthetic rehabilitation is to restore patient's normal function, contour, esthetics, speech and health. The loose and unstable lower complete denture is one of the most common problems faced by the denture patients. Optimum denture stability is difficult to achieve using conventional methods, especially in case of resorbed mandibular ridge, neuromuscular deficit and in old debilitated patients. A wide variety of techniques have been described to improve the denture foundation. This case report describes combination of neutral zone concept and modified functional impression technique. The neutral zone concept aims to construct a denture that is shaped by muscle function and is in harmony with surrounding oral structures. Modified functional impression technique involves the use of a removable hollow acrylic resin tray handle that can be easily attached to custom impression tray to produce an improved peripheral seal. This device is indicated to develop functional impressions for complete dentures using the patient-conducted muscular motion technique. The removable handle is simple to use, is reusable, can be adapted to any individual acrylic resin tray and allows accurate registration of the border tissues.*

Key words: *resorbed mandibular ridge, functional impression, removable hollow acrylic tray handle, neutral zone.*

I. Introduction

If the teeth are lost despite of all the efforts to save them, a re-establishment should be made in such a manner so that it functions efficiently in harmony with the stomatognathic system [1]. Stability of lower complete denture has been a challenged to dentists and patients alike [2]. This is because mandible atrophies at a greater rate than maxilla and has less residual ridge for retention and support [3]. The neutral zone philosophy is based on the concept that for each patient their exists within the denture space a specific region where the function of musculature will not unseat the denture and where the forces generated by the tongue are neutralized by the forces generated by lips and cheeks [4]. It is most effective for patients who have had numerous unstable mandibular dentures [5].

Neutral zone is defined as the potential space between the lips and cheek on one side and the tongue on the other; that area where the forces between the tongue and cheeks or lips are equal [6]. It is also known as dead zone [7], zone of minimum conflict [8], zone of equilibrium [9], zone of least interference [10], biometric denture space [11], and potential denture space [12].

A main requirement for final impression in complete dentures is developing the peripheral contours to accommodate normal muscular function and ensuring peripheral adaptation. Patient's lips and cheeks are pulled by the dentist to register the border areas, which usually provides satisfactory border sealing zone. In modified functional impression technique, muscular zone record is obtained with the patient's help, the patient is asked to make specific muscular movements of the lips, cheeks, tongue and jaws. The use of an individual tray is necessary for this technique.[2]

This case report describes management of severely resorbed mandibular ridge using neutral zone concept combined with modified functional impression technique. It also narrates in detail the construction and use of a removable functional acrylic resin handle that is attached to custom impression tray, allowing an excellent peripheral sealing zone impression using a patient conducted muscular and jaw motion technique.

II. Clinical Report

A 90 year old female patient came to the Department of Prosthodontics, MIDSR Dental College, Latur, with a chief complaint of loose, unstable dentures and wanted replacement for the same. (FIG 1). On intraoral examination it was found that patient had completely edentulous maxilla and mandible with resorbed

mandibular ridge. (FIG 2) Palpation showed that patient had fragile mucosa. On general examination it was observed that patient had fine tremors and was unable to maintain a constant jaw position. Patient also gave history of dissatisfaction with previous denture which she was wearing since last 25 yrs.
A treatment plan was made which included fabrication of maxillary and mandibular complete denture with incorporation of modified functional impression technique for mandibular arch followed by using neutral zone concept for construction of mandibular denture.

Primary impression of maxillary arch was made using modeling plastic impression compound. Primary impression for mandibular arch was made using Mc Cord and Tysons technique. (3:7 ratio of TYPE I AND TYPE II impression compound).The impressions were poured in dental plaster and primary cast were prepared. The maxillary custom tray was fabricated with tray material over the primary casts keeping the borders 2mm short of sulcus. Border moulding was done using low fusing impression compound and final impression was made with zinc oxide eugenol impression material.For mandibular final impression, a custom tray was made with centrally positioned removable functional acrylic resin handle.

Material and method: Functional tray handle can be used with any individual acrylic resin trays. The handle was made using a hollow L-shaped plastic stick (80 mm in length and 8 mm in diameter) (FIG 3). Tray material (acrylic resin) was moulded around the hollow stick keeping the hollow end open for air suction. The hollow handle was then finished and polished (FIG 4). An acrylic resin base of approximately 15 mm in height and 10 mm in diameter was prepared and fixed to the individual tray on the resorbed ridge at its midline. The functional handle was further attached to the upper central hole with a bolt that was 11 mm long and had a diameter of 2 mm(FIG 5).Two small holes were made on the sides of acrylic resin base for the air to pass through the custom tray for suction.

The adjustments on the custom impression tray were done based on its stability while seated in the patient's mouth. For lower lingual border molding, the functional handle was removed from the base by disconnecting the bolt, in such a way that the patient can move her tongue freely during the impression of the sublingual and lingual flanges. The acrylic resin molar supports at both sides of the tray were used to keep it in position during this phase of the impression procedure. During labial and buccal border moulding, the handle was reattached to the tray and patient was asked to perform a suction movement (FIG 6).The tray was then loaded with light body elastomeric impression material and gently seated into the patient's mouth. Once the tray was properly positioned with the material overflowing, the handle is removed again for recording the lingual and sublingual flanges. At this time, the tray is kept in position by pressing the resin molar supports while the patient performs tongue movements, for approximately 20 s. Finally, the handle is quickly reattached to the tray without removing the tray from the patient's mouth and the patient is asked to repeat the suction movements with the operator firmly holding onto the tray handle.

The mandibular functional final impression was then made with elastomeric impression material (FIG 7). The master cast was poured in dental stone. Record bases were prepared in self cure resin on master cast for recording jaw relation. The tentative vertical dimension of the patient was obtained. At the same time, new set of denture bases were also made with wire spurs projecting towards the opposite arches. After the jaw relation was established, these denture bases were adjusted to recorded vertical dimension with softened impression compound and green stick. The lower denture base with softened impression compound and green stick was placed in the patient's mouth; this tray was very carefully adjusted so that it was not overextended and remained stable. The patient was then asked to talk, swallow, drink some water, whistling, pursuing the lips etc. After 5 min, the set impression compound was removed from the mouth and examined. In doing so, reciprocating pressure is exerted upon the compound, which had gradually molded into a state of neutral balance. An occlusal plane was established for the lower arch by placing the upper wax rim and lower compound rim and guiding the patient to the centric relation. The same procedure was performed for upper arch with lower wax rim and upper softened compound rim.The occlusal plane in the compound was thus established for both arches at the determined vertical dimension and centric relation. The plaster index was then made for both upper and lower compound rims to recover the occlusal rims in wax (FIG 8). The impression compound was now destroyed down to the bare acrylic resin. The red baseplate wax was slowly melted in an enamel bowl and poured into the index through the space between the labial and lingual indices on the occlusal surface. When the index was opened, a hard wax duplicate of the low fusing compound had formed. Thus, both upper and lower wax occlusal rims were formed. According to the neutral zone space recorded, maxillary and mandibular teeth were arranged. Monoplane posterior teeth were used. Teeth arrangement was done exactly following the index. Try in was done to evaluate esthetics, phonetics and occlusion. The dentures were processed in the conventional manner with the heat cure acrylic resin. They were finished, polished and inserted into patient's mouth. Patient was recalled after 24 hrs, 1 week and 3 months for follow up. Patient was satisfied with her new dentures and reported increased retention and stability of mandibular. (FIG 9)

III. Discussion

The accuracy of complete denture impression techniques has been a topic of debate for many years. Because each patient has his/her own distinct muscular strength and anatomy, it is important to individualize peripheral sealing zone impression[13]. The functional handle was designed to effectively solve this problem. Unlike other border molding techniques, which use manual traction of soft tissues, the functional handle permits muscular movements during the final impression, i.e., the patient can freely move the muscles, cheeks, lips and tongue without interference of the tray handle or the dentist's fingers[14]. For individuals with an accentuated bone resorption, it is difficult to obtain good retention and stability of the complete denture due to the presence of muscular insertions near the ridge crest or border, which causes muscule-induced displacement of the denture. In such cases, this functional technique is highly recommended [15]. The functional removable acrylic resin handle described above offers a good support for correct positioning of the custom tray in the patient's mouth causing neither displacement of area of interest for impression nor dislodgement of the tray. The handle works as a suctioning device for the patient and has the advantage of being removable on lower trays, facilitating the full and accurate impression of the sub-lingual flange region [16]. In addition, the lateral supports can provide an ideal pressure distribution during the impression procedure and an unrestricted tongue access to most areas of interest. By sucking on the handle, the patient contributes to settle the final border design, delineating the location of individual muscle insertions [17]. Manual border molding is guided by extrinsic forces that may hide traces or not reproduce some functional movements when excessive manual force is applied, which will over-shorten the flange height [19]. Removable functional acrylic handle is easy-handling, rapidly produced, readily attached to custom impression acrylic trays, less costly and available for all dentists in daily practice [16].

The neutral zone approach to complete denture construction is neither new nor original but, rather constitutes the bringing together the concepts and ideas of many men into a viable and practical approach [4]. When the residual ridges have resorbed significantly, denture stability and retention are more dependent on correct position of teeth and contour of the external surface of dentures [18]. Arranging artificial teeth in neutral zone achieves two more objectives: 1. Prosthetic teeth do not interfere with normal muscle function; and 2. Normal oral and perioral muscle activity imparts force against the complete denture that serves to stabilize and retain the prosthesis rather than cause denture displacement. Using the neutral zone to arrange posterior teeth takes the advantage of the stabilizing potential of existing muscle conditions [4].

IV. Conclusion

A thorough understanding of the anatomy and physiology of structures for sound complete denture fabrication and function is important for successful treatment of edentulous patients. Use of neutral zone method and modifying the impression technique can have a large impact on the success of management of atrophic ridges in completely edentulous patients.

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Figure 1 – Pretreatment Extraoral Photograph

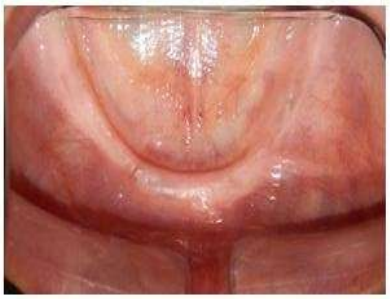

Figure 2 - Resorbed mandibular alveolar ridge

Figure 3 – Functional removable hollow acrylic resin handle, individual impression tray with lateral supports in the area corresponding to premolars.

Figure 5 – Hollow Functional removable acrylic handle

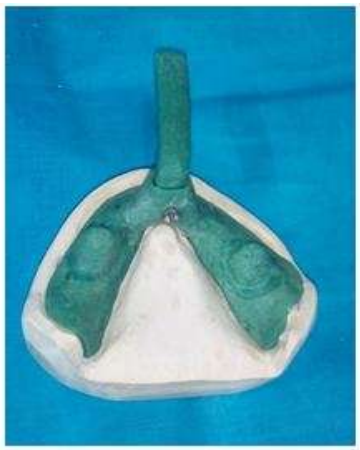

Figure 4 - Functional removable acrylic handle fixed with the bolt to the central hole at the midline of the mandibular impression tray.

Figure 6 - Vestibular peripheral sealing zone record (labial and buccal flanges), with the mandibular individual impression tray in position. Note the patient sucking on the functional handle during the impression procedure.

Figure 7 - Mandibular functional final impression

Figure 8- Plaster index of the recorded Neutral zone

Figure 9 - Final smile after denture insertion.