

## Fabrication Of Total Prosthesis Using Neutral Zone Concept: A Case Report

### Nötral Bölge Konsepti İle Total Protez Üretimi: Bir Olgu Sunumu

#### ABSTRACT

In patients with severe residual ridge resorption and where implant treatment is not possible, traditional complete prosthesis construction becomes difficult. The neutral zone concept can be applied to increase the stability and compatibility of the prosthesis. The neutral zone concept significantly improves stabilization, especially in patients with advanced bone resorption, by placing an artificial tooth on the prosthesis in a neutral area where functional forces are removed.

**Conclusion:** This case report aims to show the traditional full prosthesis production, which is produced by determining the neutral area for the patient with advanced bone destruction where implant treatment is not possible.

**Key Words:** Neutral Zone, Total Prosthesis, Stabilization.

#### ÖZ

Şiddetli rezidüel kret rezorpsiyonu olan ve implant tedavisinin mümkün olmadığı hastalarda geleneksel total protez yapımı zorlaşmaktadır. Protezin stabilitesini ve uyumluluğunu artırmak için nötr bölge konsepti uygulanabilmektedir. Nötral alan konsepti, özellikle ileri kemik yıkımı olan hastalarda, fonksiyonel kuvvetlerin ortadan kaldırıldığı nötral bir alanda protez üzerine yapay diş yerleştirilmesi nedeniyle stabilizasyonu önemli ölçüde iyileştirmektedir.

**Sonuç:** Bu olgu sunumu, implant tedavisinin mümkün olmadığı ileri derece kemik harabiyeti olan hastada nötral alan belirlenerek geleneksel tam protez üretimini göstermeyi amaçlamaktadır.

**Anahtar Kelimeler:** Nötral Alan, Total Protez, Stabilizasyon.

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## INTRODUCTION

For complete denture to be successful and increase patient satisfaction, retention, stabilization, and support depend on many factors. It is more difficult to achieve this success in mandibular prostheses than in maxillary prostheses. This is because the mandibular area takes up less space than the maxillary area and undergoes more bone resorption (1). Although residual ridge resorption is the leading cause of loss of retention and stabilization, especially in mandibular prostheses, advanced resorption of maxillary and mandibular bones will cause collapsed cheeks and unstable complete prostheses with pain (2).

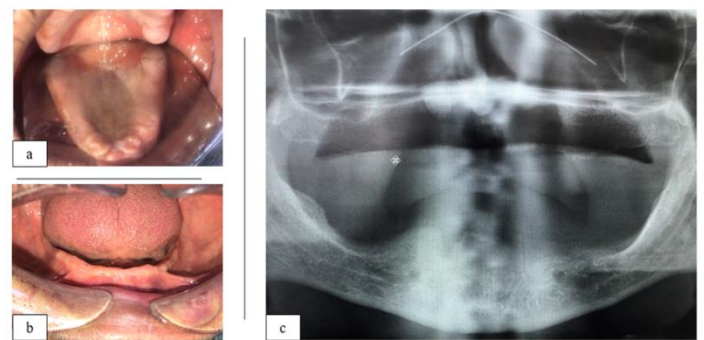
Although residual ridge resorption that occurs with tooth loss is a biological process, the more severe bone loss occurs in the first year after tooth extraction, and it continues slowly but progressively in the following years (3). Therefore, constructing a successful complete denture becomes difficult (2). Filling the recessed edentulous ridges with the teeth that come to the complete denture become difficult due to the changes that occur with edentulism and the functional forces in the oral environment. (4). Oral structures interact with functional movements such as speaking, swallowing, chewing, laughing, and smiling, and synergistic movements that interact with the tongue, cheek, lip, and floor of the mouth, which vary individually. The oral cavity is essentially an arrangement in which the forces generated by the orbicularis oris and buccinator muscles are balanced by the forces generated by the tongue and cheeks (5). For complete denture, not only the occlusion parameters should be paid attention to, but also the future location of the teeth in the cavity of the dentures (6). With the loss of teeth, a cavity area is formed in the mouth. In order to make the prosthesis compatible with the surrounding tissues, it must be shaped according to the functional forces created by the intraoral muscles. Beresin and Schiesser defined the neutral area as the area where the lips and cheeks on one side and the tongue and lips on the other side are neutralized (6,7). The neutral area is also called by many names, such as dead space and minimum conflict zone. It will be possible to increase the success rate of the prostheses to be made by shaping the polished surfaces according to functional movements by preventing the wrong area of teeth in complete denture to be made by determining the neutral area. Determination of the neutral area increases patient satisfaction, especially in patients with flattened and concave resorbed crests. The logic of determining the neutral area is based on the

principle of shaping soft viscous materials in the oral environment buccolingually according to the functional movements of the patient, such as swallowing, smiling, and sucking (7). Although neutral zone determination is usually indicated in the construction of atrophic jaw prostheses, it may be advantageous for constructing many complete dentures (7). It is crucial to determine the neutral zone not only in the presence of atrophic crests but also in patients with partial glossectomy, mandibular resection, or motor nerve damage to the tongue, as the stabilization of prostheses may affect the determination of the neutral site (8).

As a result of the resorption of the jawbones, the measured surface area decreases, and the area of the base where the prosthesis will come from decreases, affecting the stability and retention of prostheses negatively (9). At the same time, since activities such as chewing, swallowing, and speaking occur with the contraction of the muscles during the function, they can cause the existing prostheses to become dislodged or destabilized (10). In order that this problem can be solved, dental implants make it possible to make the prostheses more stable, especially for the resorbed lower crests. However, it is not always possible to use implants due to medical, surgical, and economic reasons (8). In this case report, the neutral zone concept was applied to increase the stabilization and chewing efficiency of the complete denture to be applied to the patient for whom implant application was unsuitable.

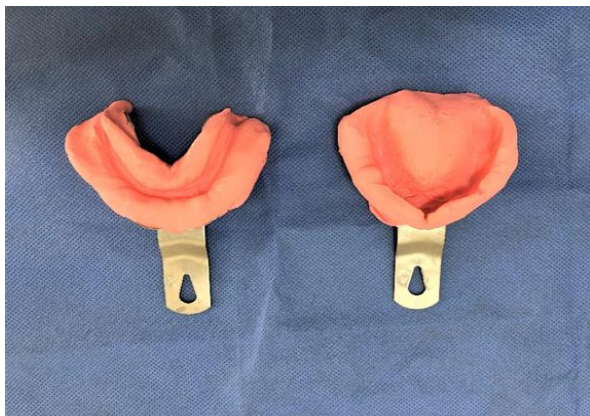
## CASE REPORT

A 60-year-old male patient applied to our clinic with the complaint of total edentulism. In the anamnesis of our patient, it was found out that he had used removable prostheses in the upper and lower jaws and later lost his supporting teeth. In addition, our patient stated that he wanted to play the flute. Intraoral and radiographic examinations revealed severe bone resorption, especially in the lower jaw (Figure. 1).



**Figure 1.** (a) Intraoral view of the maxilla; (b) intraoral view of the lower jaw; (c) radiographic view of the mandible and maxilla.

The patient was recommended to apply implants to the lower jaw so that the prosthesis could be more stable. However, it was found out in the tomography images that there was not enough bone for implant application unless advanced surgical methods were applied. Since our patient did not accept advanced surgical methods, it was decided to construct a traditional complete denture with the neutral zone detection method. The consent form was obtained from the patient. First, the maxillar and mandibular crest were impressions with prefabricated trays with alginate impression material (Cavex®, CA37, Netherlands) to fabricated personal impression trays (Figure. 2).

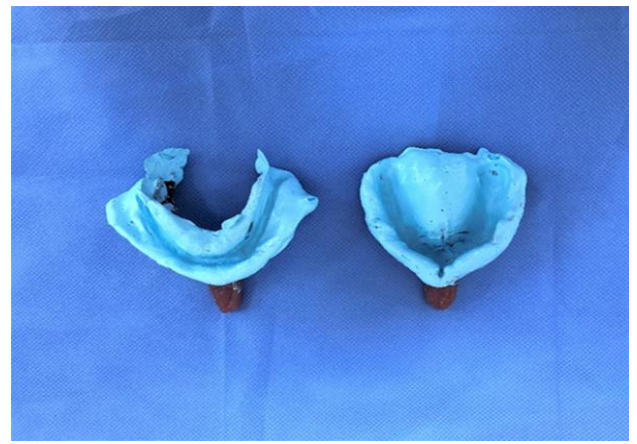


**Figure 2.** The image of the primary impression taken from the lower and upper jaws.

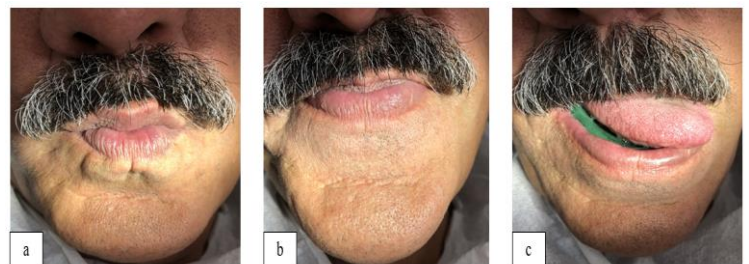
After the primary impressions were taken, the border moulding of the personal impression trays prepared from acrylic (Imicry®, Self-Cure, Turkey) was shaped in the mouth according to mucostatic principles with impression compound material (KERR®, Impression Compound, USA). After this process, the second impression process was completed after keeping it in the mouth for 3-4 minutes with a low-viscosity zinc oxide eugenol impression paste (Cavex®, Outline, Netherlands) in line with the manufacturer's curing time (Figure. 3).

Definite models were obtained using Type IV plaster from the impressions sent to the laboratory. To determine the neutral zone on the prepared models, an acrylic (Imibase®, Dental Base Plate, Turkey) base was prepared from cold cure acrylic resin. After softening in a 65 °C water bath, the modelling plastic impression compound (KERR®, Impression Compound, USA) was rolled and placed on an acrylic base. The template, which was reheated in a water bath, was placed in the mouth. The patient was asked to perform functional movements such as smiling, swallowing, pursing lips, sucking, uttering vowels, and sticking out the tongue slightly to record the area

where neuromuscular forces are neutralized (Figure. 4).

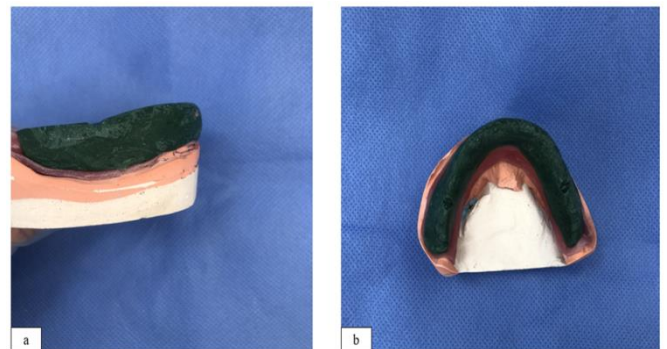


**Figure 3.** The image of the final impression taken from the lower and upper jaws.

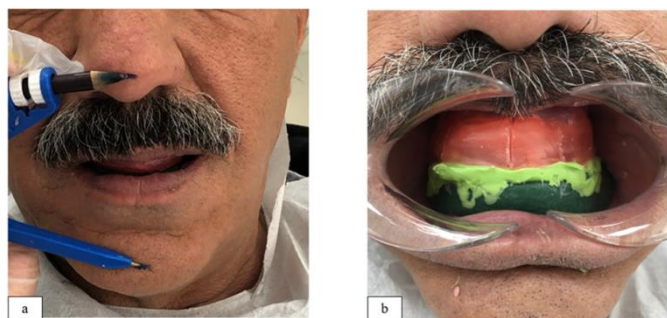


**Figure 4.** (a) Suction to the patient; (b) swallowing; (c) image of lip-licking functional movements.

Modelling plastic impression compound shaped by muscle movements was checked. Notches were created for interocclusal recording (Figure. 5). Occlusal vertical dimension was measured between two points determined in line with the Niswonger's method. Wax template (Jawax®, Modelling Wax, Turkey) on the upper jaw and modelling plastic impression compound shaped by muscle movements on the lower jaw were adjusted according to the occlusal vertical dimension values (Figure. 6).



**Figure 5.** (a) Modeling plastic impression compound shaped in the mouth with functional movements from the side; (b) top view.



**Figure 6.** (a) Checking the occlusal vertical dimension of the patient; (b) acquisition of an image of the interocclusal recording.

Notches were created in the created templates and interocclusal recording was taken with an additional type of silicone material (light body) (Elite HD<sup>+</sup>, Zhermack, Italy). Buccal and lingual indexes were made from a type of silicone material (heavy body) (Elite HD<sup>+</sup>, Zhermack, Italy) in the main model with a modelling plastic impression compound shaped by mandibular muscle movements, in which the neutral area is recorded (Figure. 7).



**Figure 7.** Labial and lingual indexes images of the neutral zone recording prepared with condensation silicone.

After the labial and lingual indexes were made, the permanent models were transferred to the semi-adjustable articulator (Bioart<sup>®</sup>, A7 Plus, Brazil). The modelling made for the neutral zone recording was removed from the plastic recording base material; after the wax was placed in the space area, the acrylic teeth (Major Dent<sup>®</sup>, Major Prodotti Dentari, Italy) were arranged according to the neutral area by taking the indexes as a reference. Occlusal vertical dimension, aesthetics, phonation, and centric relationship records were checked at the rehearsal of the teeth. The complete denture was fabricated using the traditional technique and polished. Intraoral views of the fabricated complete denture are shown in the picture (Figure 8, 9).



**Figure 8.** (a) Intraoral of the final prosthesis; (b) its external appearance; (c) from the left; (d) right view.



**Figure 9.** (a) Intraoral of the final prosthesis; (b) its external appearance; (c) from the left; (d) right view.

## DISCUSSION

Complete denture construction in patients with excessively resorbed ridges has always been difficult in terms of stabilization and retention (11). The primary purpose of prosthetic dental treatment is to place the prosthesis in the biometric space so that the muscle forces can be in harmony to stabilize the prosthesis while restoring lost function and aesthetics (12). Prosthetic rehabilitation of an unstable lower jaw is difficult for the dentist. Determination of the neutral area is a suitable method for patients with low retention and stabilization. This method aims to ensure that the teeth are arranged in the area where the forces applied by the tongue and cheek are neutralized, and it also aims to increase the stabilization with a prosthesis suitable for the functional movements of the patient (13,14). However, the neutral zone technique can increase patient comfort in cases where the harmony and stability of the surrounding tissues of the prosthesis need to be increased, the presence of severe bone loss, patients undergoing mandibular surgical reconstruction, advanced neurological disorders, and patients undergoing glossectomy (11,15-18). Traditionally, zinc oxide eugenol impression materials, wax, modelling compounds and soft impression materials can be used to determine the neutral space

(19-21). Shanker et al. hydrocolloid impression material and Kurşaoğlu et al. used dynamic impression material to determine the neutral area in their study. Agrawal et al. in their study, they used silicone impression material to shape the polished surfaces of the prosthesis (22-24). Romero et al. used wax material to determine the neutral area in the case report they presented and completed the recording process by using a thin-base wax material because the thickness of the wax material affects phonetics (25). For Ohkubo et al., after completing the registration of the neutral area with the piezographic method, they completed the construction of maxillary and mandibular complete denture with CAD/CAM (26). In our study, the recording of functional movements of the patient, such as laughing, sucking, and whistling, by using plastic impression material was completed with heat-softened material, and the area where the teeth would be arranged was determined. The neutral zone can be determined using different methods. Conditions to be considered while taking neutral registration, taking the recording at the determined vertical size, and taking it slowly enough for the material used for recording to be shaped in the appropriate contour and size. In various studies, when complete denture fabricated using traditional methods and neutral zone are compared, it has been observed that the prostheses fabricated with the neutral zone technique are more stable than the traditionally fabricated prostheses, increasing the comfort and function of the patients and therefore have fewer problems (27,28). Gupta et al. presented a study in which they used a vertical stop so that the vertical dimension would not change when determining the neutral area in the resorbed mandibular crest (29). In addition, Cagna et al. presented a modern technique for determining tooth positions and prosthetic borders in their study in which they determined the neutral area and stated that clinicians could add this method to routine treatment procedures for edentulous patients (19). Raja et al. reported that the determination of the neutral area in prostheses to be made for patients who have been edentulous for a long time has more successful results and success (30). Choi et al. reported a case report for atrophic crests, in which they fabricated a complete denture with CAD/CAM-supported neutral zone. They reported that CAD/CAM recording methods might be more effective for clinical applications due to their good adaptation to oral tissues to determine the neutral zone. However, due to the expensiveness of CAD/CAM applications, the neutral zone concept determined by clinical methods is a more applicable technique (31). Al-Magaleh et al., in their study investigating patient satisfaction in complete denture made with the neutral zone concept, reported that

patient satisfaction increased significantly in all functional properties, such as retention, stability, speech and chewing, compared to complete denture fabricated with the traditional method (32). Rehmann et al. applied the modified neutral zone method, applied acrylic resin base thermoplastic denture adhesive with posterior occlusal border and transferred it to the base acrylic resin complete denture two days after wear. They reported that this method is a suitable application, especially for lower jaw prostheses in patients for whom implant application is not suitable (33).

The most common problem faced by complete denture patients is loose and unstable lower complete dentures. One of the methods applied to solve this problem is to determine the neutral area. The neutral area is the area where the lips, tongue and cheeks are in balance, and natural teeth are located in this area. Artificial teeth should be placed in this area in the prosthesis to be made. This region where the conflict is minimum can be determined by determining the neutral area (34). In our case report, to prevent the stabilization problem and increase patient satisfaction in our patient for whom implant application was not appropriate, we fabricated a complete denture fabricated by determining the neutral zone so that the vertical dimension was kept constant with the softened impression material.

In dentistry, neutral zone determination is an important application for conventional complete denture, especially in cases where implant treatment is not possible, and stabilization will not be good. In this neutral zone concept, the neutral zone was determined by thermoforming of the plastic material, and we think that the neutral zone concept is a suitable method for clinical practice in applications of complete denture where stabilization is difficult.

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