Using a Modified Neutral Zone Technique to Obtain Maxillary and Mandibular Impressions in 1 Stage for Construction of a Denture for a Mandibular Defect Patient: A Technical Report

SUMMARY

Fabrication of a complete denture for the post-surgical intraoral carcinoma patient can be difficult because of the severe limitation in the oral opening. The neutral zone concept can be used for such cases. The purpose of this case report is to describe a modified neutral zone impression technique designed to obtain maxillary and mandibular impressions in one stage in preparation for construction of a mandibular denture when insertion of fabricated impression trays is impossible due to the partial resection of the mandible. This technique reduces the total chair time during construction of the dentures.

Keywords: Neutral Zone Impression; Mandibular Defect

Introduction

The neutral zone is the potential space between the lips and checks on one side and tongue on the other, in which natural or artificial teeth are subjected to equal opposing forces from the surrounding musculature.

Conventional complete dentures and dentures made by using the neutral zone were compared by Fahmy and Kharat. They suggested that comfort and speech performance were better with the neutral zone dentures. Alfano and Leupold used this technique to obtain maxillo-mandibular registration for complete dentures and concluded that denture stability can be obtained with this technique. Ohkuba et al described a similar procedure for making a mandibular complete denture for a partial glossectomy patient and reached the same conclusion.

Many patients experience severe limitation of mouth opening after mandibulectomy. The limitation of opening may, in fact, become more severe as fibrosis progresses during normal healing. Because sufficient mouth opening is required for making impressions, a common problem during dental treatment for such patients is the insertion and removal of the stock impression tray. Several techniques have been described for taking impressions of such patients. This case report describes a modified neutral zone impression technique designed to obtain maxillary and mandibular impressions together, in 1 stage, for the purpose of constructing a denture prosthesis for a mandibular defect patient for whom the insertion of the fabricated impression trays was impossible due to severe limitation of mouth opening.

Technique

The clinical and radiographic examinations of a 51-year-old female patient revealed a mandibular defect. Salivary glands and left mandible had been resected 3 years earlier following diagnosis of a carcinoma. A plastic and reconstructive surgeon had reconstructed the resulting defect using a fibular free flap. A dentate maxilla except for the right first maxillary molar and an edentulous mandible were observed in the clinical and radiographic examination. The tongue was only partially mobile because part of it had been used to close the surgical wound. The mandibular mucosa and the mandibular lip were oedematous as a result of continuous irritation by the maxillary anterior teeth. Remarkable limitation in oral opening (2.3 cm) and space between the commissures measuring 3.6 cm were noticed. As a result, taking
impressions of the maxillary and mandibular arches using stock impression trays was impossible. Therefore, an altered neutral zone impression technique was planned in order to fabricate a mandibular denture.

**Impression Procedure**

An orthodontic 0.9 mm stainless steel wire was prepared and adapted along the centre of the patient’s mandibular alveolar ridge to support silicone impression material during construction of a neutral zone impression. A silicone impression material with medium viscosity (Speedex, Coltene, Whaledent Inc, New Jersey) was injected on this wire using a 5 cc dental injector while the patient was at the rest position. Then, the patient was instructed to make functional movements for several minutes as the silicon impression material was setting. Functional movements included: pronouncing words with “S” sounds, taking frequent sips of water and swallowing to activate the floor of the mouth, pursing the lips to activate the tongue, and whistling to contract the muscles around the lips. The forces exerted during functioning of the lips, cheeks, and tongue shaped the neutral zone. When the setting time for the first injection was completed, a second injection of the same material was placed onto the first set impression material and the patient was again instructed to make functional movements.
At the end of the second setting time, a wire-supported silicone impression had been obtained, and was removed from the patient’s mouth, examined extraorally and excess silicone removed. The wire supported silicone impression was placed again into the mouth and a third injection was performed using the same material. The patient was asked to make functional movements again while the material was setting. The same procedure was repeated several times until the occlusal print of the upper teeth was seen on the top of the wire-supported silicone. The impression must exhibit a typical neutral zone (NZ) impression with the characteristic shape produced by the oral musculature. The impression surface and the polished surface of this neutral zone impression were controlled to implement further laboratory procedures (Fig. 3a-d).

**Laboratory Stage**

The NZ impression was cast for fabrication of master models. First, to obtain a maxillary master cast from the print of the maxillary teeth, the upper part of the NZ impression was poured with plaster. After the plaster had set, the NZ impression was removed and cleaned. To obtain a mandibular master cast, 2 wax rolls were adjusted to the posterior part of the NZ impression. The purpose of the wax rolls was to provide a path of insertion for flowing liquid acrylic resin and melted wax to construct the recording base and the occlusion rim, respectively. A silicone putty index was placed around the NZ impression (Fig. 4). The NZ impression and the wax rolls were removed when the putty silicone index had set. The index preserves the space of the neutral zone impression. First, the impression surface of the NZ impression was converted to a recording base by pouring liquid acrylic resin into the related negative space. After acrylic resin polymerization was completed, the polished surface of the NZ impression was converted to an occlusion rim by pouring melted wax into the related negative space. After the melted wax had cooled and solidified, the putty silicone index was removed. The mandibular recording base and the mandibular occlusion rim were obtained.

The mandibular recording base and the occlusion rim were placed into the mouth. Vertical dimension was determined to support aesthetics, phonetics factors and physiologic rest position tests. The face bow transfer was performed. Centric relation was recorded and the jaw relationship transferred to a semi-adjustable articulator (Artex, Girbach Dental GmbH, Pforzheim, Germany). Another silicone index was prepared around the occlusion rim to preserve the neutral zone space during the tooth arrangement stage. Tooth arrangement was completed using the prepared silicone index (Fig 5, a and b) and controlled at the try-in stage and, finally, the denture was processed and finished (Fig 6, a and b).
Discussion

The neutral zone denture functionally contours all the polishing surfaces of the denture and this may be an important contributing factor to better speech and comfort\(^1\). The most critical stage for the rehabilitation of the maxillofacial prosthodontic patient is the impression procedure. Because this patient’s oral topographies had been changed as a result of surgical procedures, taking impressions presents, sometimes, severe difficulties. The technique described here offers an alternative impression technique for the situation in which the conventional impression technique cannot be used.

In the case presented here, the patient’s tongue location had been changed to obtain primary closure of the surgical area. The patient’s mandibular opening was limited due to the surgical resection. In addition, cicatrized tissue was found near the site of the surgery. All of these factors had negative effects on the possibility of taking accurate impressions using conventional methods.

Using the neutral zone impression technique as described in this case report allowed the clinician to obtain maxillary and mandibular models, mandibular recording base and occlusion rim at only one visit. At the second appointment, vertical dimension and centric relation were determined. The vertical dimension of occlusion was reduced to ensure sufficient inter-occlusal space for mastication and improved speech with the finished denture. The try-in stage was performed at the third appointment. Thus, the time required to construct the mandibular denture was decreased.

As the lower incisor teeth were arranged with silicone index, the continuous trauma caused by the maxillary incisors was prevented.

The technique presented allows the dentist to construct a more stable record base. Although the technique is relatively simple for the dentist who uses the neutral zone technique in general practice, it is more time consuming. Another disadvantage of the technique is the necessity for increased laboratory time. The laboratory technician must be trained to support all the laboratory procedures.

Conventionally, the tongue provides support for lower denture stability, but in the case presented here, because the patient’s tongue had been used to close the surgical area, lower denture stability was provided by the patient’s surrounding tissues including the lips, cheek and tongue.
Conclusion

The neutral zone approach can be easily used for limited oral opening cases. It offers an alternative technique for patients with partially resected mandible for whom the insertion of conventional impression trays is impossible.

References


Correspondence and request for offprints to:
Dr. Ş. Begüm Türker
Marmara Üniversitesi
Diş Hekimliği Fakultesi
34365 Nisantasi, Istanbul
Turkey
E-mail: begumturker@hotmail.com