

Case report

Using neutral zone concept in prosthodontic treatment of a patient with brain surgery: A clinical report

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Abstract

The prosthodontic treatment of a patient who had undergone brain surgery to resect a brain stem astrocytoma has been described. Since the motor innervation to the oral muscles was impaired, the new neutral zone was recorded by using a tissue conditioner material. The teeth and polished surfaces of the mandibular partial denture fitted to the functional cheek anatomy of the surrounding tissue helped in the stability of the denture and to avoid the end tongue biting.

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1. Introduction

The neutral zone has been defined as the area in the mouth where the inwards forces exerted by cheeks and lips neutralize the forces of the tongue pressing outwards during function [1]. These forces are of different magnitude and direction in different individuals. Removable prostheses should comply with neuromuscular function to harmoniously function in the oral cavity [2,3]. Poor tooth position and/or flange contour will most probably result in denture instability and patient will be most likely to also complain of cheek and tongue biting [4,5]. The present case study describes the prosthodontic management of a partially edentulous patient who had recently undergone brain surgery.

2. Clinical report

A 21-year-old white man willing to replace his missing teeth was presented to Department of Prosthodontics. He had undergone a brain surgery at the age nine during which an

astrocytoma tumor was resected from his brain stem. Because of the surgery his verbal skills as well as his walking ability were impaired. His speech, however, was understandable. His dexterity proved to be sufficient to keep satisfactory oral hygiene. Extra-oral examinations revealed facial asymmetry due to the left side ptosis and hypomotility (Fig. 1). Temporomandibular joints were normal in terms of sound, normal opening and the absence of pain. There was, however, a left side deviation at mouth opening. Excursive movements were not evaluated due to the missing teeth. The existing dentition was composed of right lateral incisor, canine, second premolar, third molar and left third molar in the maxilla and right canine, lateral and central incisors, left canine and central incisor in the mandible (Fig. 2). All teeth except for maxillary third molars had extensive fillings, caries or access cavities (Fig. 3A and B). Radiographic evaluations revealed that maxillary right lateral incisor and all mandibular teeth had acceptable root canal therapies. The preliminary treatment plan included caries removal, scaling and prophylaxis, oral hygiene instructions, root canal therapy for maxillary right canine and second premolar, fixed full crown coverage for the remaining teeth except maxillary third molars and removable partial dentures for both jaws to replace the missing dentition. Implant therapy was proposed, though patient showed no interest because of financial burden. The patient and his father agreed to the treatment plan and signed informed consent. Primary

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Fig. 1. Pretreatment extra-oral view.



Fig. 2. Frontal view of remaining teeth in habitual occlusion.

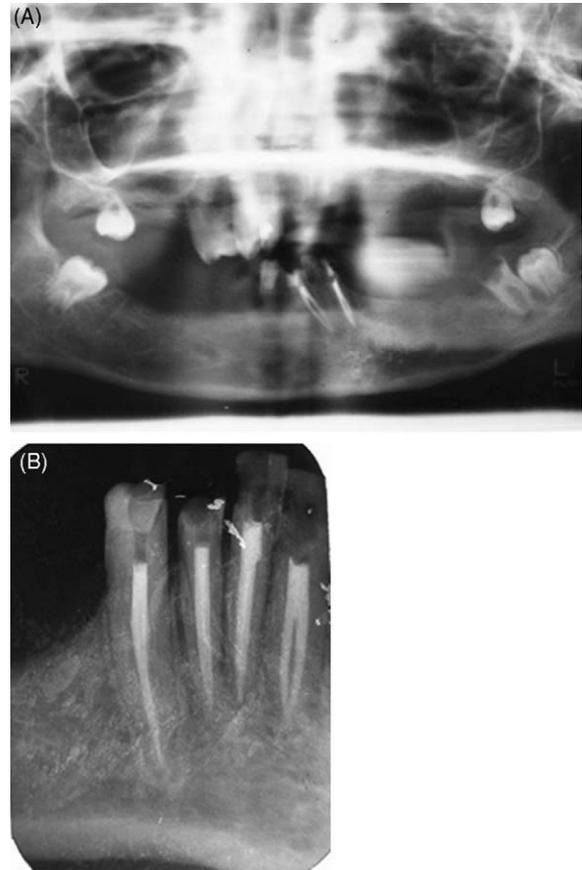


Fig. 3. (A) Pre-treatment panoramic view of existed dentition with the exception of lower left third molar and right second and third molar that had been extracted 1 month before his first visit. (B) A periapical X-ray revealed better view of anterior teeth.

impressions were made with irreversible hydrocolloid (CA 37; Cavex, Haarlem, Holland) and poured with type III dental stone (New Fujirock; GC Corp, Tokyo, Japan). Acrylic record bases (Formatray; Kerr, Romulus, Mich) and occlusion rims were used to establish vertical dimension of occlusion and arch form. The diagnostic casts were mounted on a semi-adjustable articulator (Dentatus ARH; Stockholm, Sweden) using a centric relation record and a facebow transfer. Diagnostic wax-up was performed and the casts were surveyed for removable partial denture design. Casting posts and cores with a silver-palladium alloy (Degussa-Huls; Hanau, Germany) were fabricated for all remaining teeth. They were prepared for the PFM crowns and final impressions were made using poly vinyl siloxan

impression material (Imprint; 3 M/ESPE, Seefeld, Germany). The prepared teeth were temporized with provisional crowns (Protemp II; 3 M ESPE). Artificial teeth for edentulous areas were selected tried in the patient's mouth. The metal substructures were waxed up and contoured with a surveyor (Ney Dental Surveyor; Ney Dental Inc., Bloomfield, CT). A plastic pattern for the castable extracoronal attachment (OT Strategy; Rhein 83, Bologna, Italy) was inserted (Inserting Instrument; Rhein 83) to the maxillary right lateral incisor. The attachment was considered for the maxillary lateral incisor in order to eliminate metal clasp. Including multiple attachments in the design of a RPD resulted in difficulty of path of insertion. The castings were then tried in the mouth for the fitness check. Porcelain was added according to the diagnostic wax-up and the design of the due removable partial dentures and adjusted intraorally (Fig. 4). Final impressions for the fabrication of the RPD frameworks were made with the crowns in place. Cast chrome–cobalt frameworks were fabricated using conventional technique [6]. Both frameworks were fitted in the mouth and adjusted physiologically [6]. For the teeth arrangement, the concept of neutral zone was used. Auto polymerizing acrylic resin trays were fabricated (Formatray; Kerr) with maxillary and mandibular frameworks border molded (Impression Compound; Kerr) to represent functional depth and width of

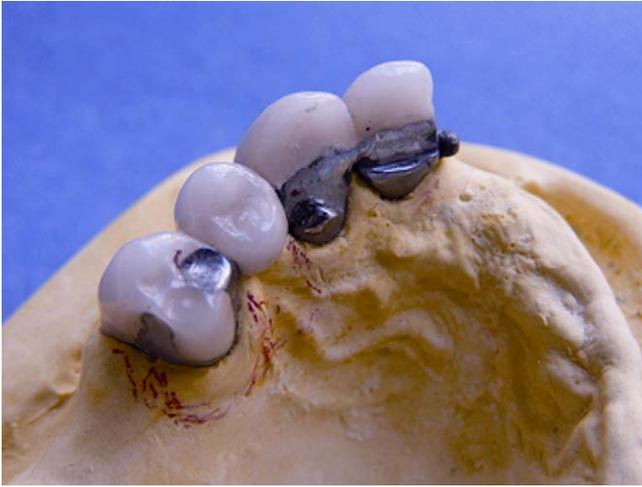


Fig. 4. Completed maxillary crown.



Fig. 6. Intraoral condition view after 1 year.



Fig. 5. (A) Definitive restorations in place, (B) mandibular restoration conformed to the malposed tongue and surrounding tissue.

the sulcus. Maxillary rim was carved to provide support for facial muscles and to establish anterior and posterior occlusal planes. The mandibular rim was adjusted to the corrected occlusal vertical dimension. Thermoplastic compound was relieved from buccal and lingual sides of the tray. A thick-

consistency mix of a tissue conditioner material (Viscogel, Dentsply, Weybridge, UK) was placed along the tray. The patient was asked to perform several functions including smile, sucking, count from 30 (which is pronounced “see” in Farsi) to 40, sip water and swallow, protrude the tongue and lick the lips [7,8]. After the material was initially set, the framework was removed from the mouth and excess material was trimmed away. The “show-through” area of thermoplastic compound was relieved and the procedure was repeated until two subsequent impressions were the same. The centric relation record was also made during repeated swallowing. A silicone putty index (Speedex putty; Coltene, Alstatten, Switzerland) was formed around the impression which was used to guide the lower teeth arrangement and to form the polished surfaces. An artificial teeth layered by composite material (SR Vivodent DCL, SR Orthosit PE; Vivadent/Ivoclar, Schaan, Liechtenstein) was selected because of durability and an advantage to the opposite natural teeth. The teeth arrangement was tried in and were processed, finished and polished following conventional methods [5]. Removable partial dentures were delivered (Fig. 5A and B) and post-delivery instructions were given to the patient. He showed minimum discomfort at 24-h recall. He was recalled every 3 months for 6 months. His annual recall revealed excellent oral hygiene. Gingival recession, however, was evident in mandibular incisors (Fig. 6). No attempt was made to replace the crowns at that time because of patient’s reluctance. Overall, he was satisfied with the treatment.

3. Discussion

Neutral zone was considered as the reference of choice for the placement of artificial teeth in 1976 [1]. This method has lately been once more concerned through the literature [4]. There are several papers on the application of neutral zone for the management of completely edentulous patients [2,8]. Kokubo et al. [4] have successfully used this method along with the application of implants to efficiently rehabilitate partially edentulous patients and Pekkan et al. [3] applied this concept

for the treatment of partially edentulous patient with marginal resection of mandible.

In the present case report, an approach for the registration of the neutral zone for the fabrication of a partial prosthesis is introduced. This method was used to rehabilitate a partially edentulous patient who had undergone surgical removal of a brain stem astrocytoma. Since, the nuclei of the cranial nerves (CN) (with the exception of I and II) are located in brain stem, neurological dysfunction may arise depending on the location, type and grade of the tumors. In the present patient, in addition to hemiparesis (weakness) of the left arm and leg, disturbed eye movement and ataxia, dysfunction of facial muscles (buccinator and orbicularis oris in particular), deviation of the mandibular movement to the affected side and disturbed tongue movements occurred as a result of facial nerve (CN VII), trigeminal nerve (CN V) and hypoglossal nerve (CN XII) involvement. Therefore, residual ridge was not considered an appropriate reference for the teeth arrangement. It was also necessary to form the polished surfaces in harmony to the muscular function to avoid interferences. It is suggested that less horizontal functional forces would be exerted to the natural abutments and removable partial denture that is fabricated according to the neutral zone concept and the denture is provided with better stability and retention [3]. Using tissue conditioner material as a molding material, helped to customize the space for teeth arrangement and to develop the flange surface of the prosthesis.

Post-insertion problems were reduced to minimum by applying the technique presented here in fabrication of the RPD.

Conflict of interest

The authors have no conflict to declare.

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References

- [1] Beresin VE, Schiesser FJ. The neutral zone in complete dentures. *J Prosthet Dent* 1976;36:356–67.
- [2] Karkazis HC. Prosthodontic management of a patient with neurological disorders after resection of an acoustic neurinoma: a clinical report. *J Prosthet Dent* 2002;87:419–22.
- [3] Pekkan G, Hekimoglu C, Sahin N. Rehabilitation of a marginal mandibulectomy patient using a modified neutral zone technique: a case report. *Braz Dent J* 2007;18:83–6.
- [4] Kokubo Y, Fukushima S, Sato J, Seto K. Arrangement of artificial teeth in the neutral zone after surgical reconstruction of the mandible: a clinical report. *J Prosthet Dent* 2002;88:125–7.
- [5] Gahan MJ, Walmsley AD. The neutral zone impression revisited. *Br Dent J* 2005;198:269–72.
- [6] Phoenix RD, Cagna DR, DeFreest CE. Stewart's clinical removable partial prosthodontics, third ed., Chicago: Quintessence Publishing Co.; 2003. p. 397–430.
- [7] Makzoumé JE. Morphologic comparison of two neutral zone impression techniques: a pilot study. *J Prosthet Dent* 2004;92:563–8.
- [8] Wee AG, Cwynar RB, Cheng AC. Utilization of the neutral zone technique for a maxillofacial patient. *J Prosthodont* 2000;9:2–7.