

**รายงานผู้ป่วย: การทำฟันเทียมในเขตเป็นกลางในผู้ป่วยที่มีขากรรไกรล่างบกพร่องและอ้าปากได้จำกัด**  
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### บทคัดย่อ

ผู้ป่วยได้รับการรักษาโรคมะเร็งบริเวณศีรษะและลำคอ เป็นผลให้เกิดความผิดปกติบริเวณช่องปากและใบหน้า ได้แก่ ภาวะขากรรไกรยัด และเกิดแผลเป็นซึ่งเป็นผลตามมาจากกระบวนการผ่าตัด และส่งผลกระทบต่อคุณภาพชีวิตของผู้ป่วย วิธีการบูรณะการสบฟันในผู้ป่วยที่มีการอ้าปากได้จำกัด ได้แก่ การผ่าตัดการใช้อุปกรณ์ช่วยอ้าปาก และการออกแบบฟันเทียมด้วยวิธีการพิเศษ เป็นต้น เขตเป็นกลางเป็นวิธีที่ทำได้ง่ายที่ช่วยให้ได้เสถียรภาพและการยึดอยู่ ซึ่งเป็นปัจจัยสำคัญในการใส่ฟันเทียม เขตเป็นกลางเป็นแนวคิดในการทำฟันเทียมทั้งปากที่จำเพาะต่อผู้ป่วยแต่ละคนในพื้นที่ที่กล้ามเนื้อรอบช่องปากไม่ผลักฟันเทียมหลุดออกจากสันเหงือก โดยช่วยให้ฟันเทียมมีเสถียรภาพและการยึดอยู่ที่ดี การทำฟันเทียมทั้งปากภายใต้แนวคิดเขตเป็นกลางช่วยให้ผู้ป่วยรู้สึกมั่นใจและช่วยเพิ่มคุณภาพชีวิตของผู้ป่วยได้

**คำสำคัญ:** ฟันเทียมทั้งปาก, อ้าปากได้จำกัด, สภาพปากเล็ก, เขตเป็นกลาง

**Neutral zone approach for denture fabrication in mandibular defect and restricted mouth opening patient: A case report**

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**Abstract**

The patients treated for head and neck rhabdomyosarcoma occurred dentofacial abnormalities include trismus and scar band sequelae from surgical procedure that affected the patient's quality of life. There are various techniques for prosthetic rehabilitation of restricted mouth opening such as surgeries, use of dynamic opening devices, magnetic devices and modification of denture design. A simplified technique to obtain stability and retention which are important factors for fabrication complete dentures is neutral zone. The neutral zone is the concept for each individual patient in making complete dentures, there exists within the denture space where the function of the musculature will not unseat the dentures and the dentures in neutral zone are favorable for stability and retention. The reconstruction of dentures under neutral zone concept make patient feels confident and enhancing the quality of life.

**Keywords:** Complete dentures , Limit mouth opening , Microstomia , Neutral zone

## Introduction

Microstomia is defined as an abnormally small oral aperture, involving a severe reduction of oral opening enough to compromise the patient's aesthetics, nutrition and quality of life.<sup>1</sup> This can result from congenital defects, trauma (mechanical, chemical or thermal) and can be secondary to some type of trauma or after cancer surgery for head and neck tumors. In the latter microstomia may be associated with radiotherapy as an additional factor that can damage the masticatory muscles limiting their mobility.<sup>2</sup> In some cases when the masticatory muscles or the temporomandibular joint became to damage, a protective reflex contracture may occur reducing oral aperture. Clinically, microstomia may affect social relationships, mastication and proper oral hygiene. Difficulty in oral hygiene results in a higher incidence of oral diseases such as caries, periodontal diseases or other type of oral infections that are difficult to treat due to the limited access.<sup>1</sup>

The prosthetic rehabilitation of microstomia patients presents difficulties at all stages. The difficulty starts with the preliminary impression making. This is due to the tongue rigidity and the decreased mouth opening. In addition, small and resorption of alveolar ridges affect the retention, stability, and adaptability of dentures. The unstable mandibular complete denture is a challenging scenario. Hinged and sectional complete dentures may use for restricted mouth opening patient, but the technique is complicated and need additional time and materials.<sup>3</sup>

The neutral zone concept plays a significant role in overcoming these challenges. The neutral zone is defined as the potential space between the lips and cheeks on one side, and the tongue on the other, that area or position where the forces between the tongue and cheeks or lips are

equal.<sup>4</sup> It is the area where the outward forces from the tongue are neutralized by the forces of the lips and cheeks acting inward during functional movements.<sup>5</sup> The neutral zone technique is an alternative approach for the construction of lower complete dentures. The technique aims to construct a denture that is shaped by muscle function and in harmony with the surrounding oral structures.<sup>6</sup>

The advantages of neutral zone technique are improved stability and retention, allowing sufficient tongue space due to correctly positioned of posterior teeth, reduced food trapping adjacent to the molar teeth and good esthetics due to facial support. Besides patients with a severely atrophic ridge, the neutral zone technique for complete denture reconstruction can also be suggested for with anatomic deformity or insufficiency due to post-cancer oral surgical resections.<sup>7</sup>

## Case report

The patient's data was permitted from patient and retrieved from medical record with the permission from the hospital director. The informed consent was obtained from the patient by mean of a written and signed informed consent form.

A 18-year-old woman presented to the dental department of Sakon Nakhon hospital with a complaint of limit mouth opening and generalized gingival swelling and feel pain for many years. She had history of treated Rhabdomyosarcoma with a combination of surgery, chemotherapy, and radiotherapy since 9 years old. The complication after treatment is limited mouth opening and cannot keep good oral hygiene, revealed generalize dental caries exposed pulp and gingival swelling. Then patient was referred for hyperbaric oxygen therapy and remove all remaining teeth and infected tissues. (Figure 1)



**Figure 1 Panoramic radiograph.**

The physical examination revealed asymmetrical face and lip, right side shifted mandible, tight facial skin at right mandibular area. The maximum mouth opening is 25 millimeters. Intraoral examination revealed maxillary and mandibular hypoplasia with edentulous ridge. There is tight scar band and no buccal shelf at right mandible. The saliva is serous and adequate quantity. (Figure 2)



**Figure 2 Extraoral photographs of patient after extracted all remaining teeth, revealing mouth opening at 25 millimeters.**

Following the American College of Prosthodontics index, which is a classification system for complete edentulism based on diagnostic findings.<sup>8</sup> From the radiographic finding, the least vertical height of mandibular bone was approximately 10–15 millimeters. A clinical examination showed insufficient inter-arch space, maxillofacial defects which is a sequelae from oncological treatment. Patient could be classified as class IV complete edentulism which surgical reconstruction is almost always indicated or special prosthodontic techniques must be used to achieve an adequate treatment outcome.

Treatment plan for prosthetic rehabilitation is providing complete dentures prosthesis using neutral zone concept for the replacement of associated structures within the oral cavity and aesthetic substitutes. And recall periodically after 1 day, 1 week, 4 weeks and every 6 months for continuous evaluation and required correction of dentures.

### Clinical procedures

1. After the oral tissue healed and no infection was found, then providing complete denture prosthesis. (Figure 3) Due to microstomia and the smallest size of stock tray cannot put inside the mouth, make preliminary impression by non-rigid tray, using putty silicone (Aquasil Easy Mix Putty; Dentsply, Konstanz, Germany). Fabricate preliminary models and custom impression trays (Formatray acrylic, Lang Dental Manufactory Co.; USA). (Figure 4)



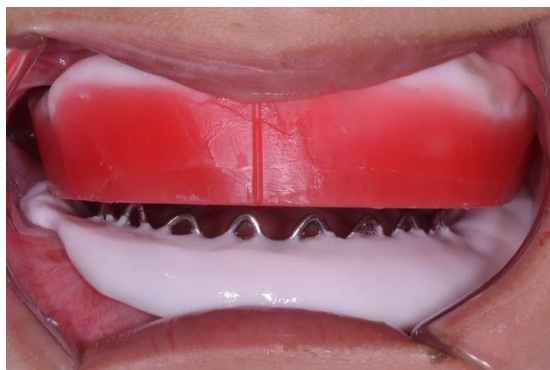
**Figure 3 Intraoral photographs after extracted all remaining teeth.**



**Figure 4 Preliminary impression by putty silicone.**

2. Try in custom impression trays and border molding using impression compound (Impression Compound; Kerr Corp, CA, USA) and take impression with polyether impression material (Impregum Penta; 3M ESPE, Seefeld, Germany). Fabrication of master models. For maxillary master model, fabrication of record base with wax rim. For mandibular master model, fabrication of record base with metal spurs.

3. Confirm fit and extension of record bases. Contour maxillary wax rim for lip support, future incisal edge position, occlusal plane and midline. To record the neutral zone, the patient was sitting in an upright position, the mandibular record base was placed in the patient's mouth, add warm impression compound on metal spurs to be framework, then add tissue conditioner (Coe-Comfort, GC, USA) on framework. (Figure 5) Instruct the patient to perform functional movements such as licking lips, sucking, smiling, swallowing, pronouncing some words. Repeat the actions until the material set, then removed the excess material. Neutral zone matrices were made of silicone putty material (Aquasil Easy Mix Putty; Dentsply, Konstanz, Germany). Wax was poured into the space confined by the putty matrices to make a wax rim, which represented the neutral zone on the newly formed baseplate on the mandibular master model. (Figure 6)



**Figure 5** The mandibular record base was placed in the patient's mouth.



**Figure 6** The neutral zone record on mandibular record base.

4. The patient was made to sit in an upright position and two prominent points on nose and chin were marked. The maxillary occlusal rim was inserted, and parallelism was verified using the Fox occlusal plane. The mandibular occlusal rim was also placed in the patient's mouth. The vertical dimension at rest (VDR) was checked between two points on nose and chin. The determined VDR was 50 millimeters. The mandibular occlusal rim was also placed in the patient's mouth, adjust the mandibular occlusal rim to parallel to the maxillary occlusal rim with the vertical dimension at occlusion (VDO) was less than VDR about 2 millimeters. The patient was instructed to bite on bite registration wax. (Alu wax, Alu wax dental product Co.; USA) for jaw relation record. Transfer the jaw relation to articulator (Hanau® Wide-Vue II). The artificial teeth (Yamahachi, Japan) were arranged to lingualized occlusion and positioned within the matrices. The artificial teeth were reduced due to the limitation of mesio-distal space.

5. Vertical dimension, centric relation, esthetics, and phonetics were rechecked during trial denture try-in. Then, return all items to laboratory for prosthesis fabrication.

6. Insert dentures and adjusted individually to the contacted anatomic findings by using disclosing

paste. The denture is covered with paste, placed in the mouth, and checked until there are no bare areas of denture-base material showing through the disclosing paste. For occlusion, using articulating paper for highlight occlusal interferences, then the artificial teeth are ground into occlusion for function. (Figure 7)

7. Post insertion follow-up includes 24-hour, one-week, one-month and six-month appointments. Patient can adapt to the dentures at one-month recall appointment. Then, make an appointment every 6 months.



**Figure 7 Patient wear complete denture**

## Discussion

Hyperbaric oxygen has been utilized as an adjunctive treatment modality in the management of osteoradionecrosis since the 1960s. The basis for applying hyperbaric oxygen to osteoradionecrosis is an extension of Marx's theory that osteoradionecrosis is the result of tissue hypoxia, hypocellularity and hypovascularity. The purpose of hyperbaric oxygen is to increase the blood-tissue oxygen gradient, which enhances the diffusion of oxygen into hypoxic tissues.<sup>9</sup> Patients who require dental extractions more than four months after radiation therapy should be treated with hyperbaric oxygen. The patient underwent following Marx protocol of 20 dives at 2.4 atmospheres for 90 minutes per dive

before extraction and 10 dives after extraction.<sup>10</sup>

Restricted mouth opening makes the insertion and the removal of the impression tray extremely difficult. Putty material can be manipulated with minimal effort and time. Because of its flexible nature, the silicone tray can be easily inserted and removed. The resultant preliminary casts can then be used for diagnostic purposes and for making an individual trays for final impressions.<sup>11</sup>

The neutral zone is area in the potential denture space where the forces of the tongue pressing outward are neutralized by forces of the cheeks and lips pressing inward. Positioning artificial teeth in the neutral zone achieves two objectives. First, the teeth will not interfere with the normal muscle function, and second, the forces exerted by the musculature against the dentures are more favorable for stability and retention.<sup>5</sup>

The neutral zone impression requires a material that can be molded by muscle activity.<sup>6</sup> Various materials such as modeling impression compound, soft wax, silicone, polyvinylsiloxane, tissue conditioner and polyether have been recommended for recording neutral zone. The reason for using tissue conditioner for recording the neutral zone is that it has sufficient viscosity, easy to manipulate and addible properties.

Several studies have compared dentures fabricated by using neutral zone and conventional techniques, and it has been observed that neutral zone dentures are functionally more stable than conventional dentures, increase patient comfort and function, and experience minimum postinsertion problems.<sup>12</sup> Some studies conclude that arrangement of teeth with neutral zone may improve denture success in patients with prolonged edentulous periods.<sup>13</sup> Neutral zone technique can be used for patients with resorbed mandibular ridges and also poor neuromuscular coordination.<sup>14</sup>



## Conclusion

The neutral zone is a technique for the construction of lower complete denture. The aim is to construct a denture in muscle balance, as muscular control will be the main stabilizing and retentive factor during function. Denture stability can be obtained not only for severely resorbed edentulous patients but also for patient with oral deformities.

## References

1. Silvestre-Rangil J, Martínez-Herrera M, Silvestre FJ. Dental management of patients with microstomia. A review of the literature and update. *Journal of Oral Research*. 2015; 4: 340-50.
2. Lyons AJ, Crichton S, Pezier T. Trismus following radiotherapy to the head and neck is likely to have distinct genotype dependent cause. *Oral oncology*. 2013; 49(9): 932-6.
3. Shams SH, Shams SS, Ghasemi E. A sectional complete denture for microstomic patients. *Dental research journal*. 2020; 17(2): 162-6.
4. The glossary of prosthodontic terms. *J Prosthet Dent*. 2005; 94(1): 10-92.
5. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. *J Prosthet Dent*. 1976; 36(4): 356-67.
6. Gahan MJ, Walmsley AD. The neutral zone impression revisited. *Br Dent J*. 2005; 198(5): 269-72.
7. Yeh Y-L, Pan Y-H, Chen Y-Y. Neutral zone approach to denture fabrication for a severe mandibular ridge resorption patient: Systematic review and modern technique. *Journal of Dental Sciences*. 2013; 8(4): 432-8.
8. McGarry TJ, Nimmo A, Skiba JF, Ahlstrom RH, Smith CR, Koumjian JH. Classification system for complete edentulism. *The American College of Prosthodontics. Journal of prosthodontics: official journal of the American College of Prosthodontists*. 1999; 8(1): 27-39.
9. Jacobson AS, Buchbinder D, Hu K, Urken ML. Paradigm shifts in the management of osteoradionecrosis of the mandible. *Oral oncology*. 2010; 46(11): 795-801.
10. Marx RE, Johnson RP. Studies in the radiobiology of osteoradionecrosis and their clinical significance. *Oral surgery, oral medicine, and oral pathology*. 1987; 64(4): 379-90.
11. Whitsitt JA, Battle LW. Technique for making flexible impression trays for the microstomic patient. *J Prosthet Dent*. 1984; 52(4): 608-9.
12. Barrenäs L, Odman P. Myodynamic and conventional construction of complete dentures: a comparative study of comfort and function. *Journal of oral rehabilitation*. 1989; 16(5): 457-65.
13. Zafar H, Saleem MN. Neutral zone dentures versus conventional dentures in diverse edentulous periods. *Biomedica*. 2009; 25.
14. Saravanakumar P, Thirumalai Thangarajan S, Mani U, Kumar V A. Improved Neutral Zone Technique in a Completely Edentulous Patient with an Atrophic Mandibular Ridge and Neuromuscular Incoordination: A Clinical Tip. *Cureus*. 2017; 9(4): e1189-e.