

Zone of Minimal Conflict: The Mystery Unveiled - An Overview

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Abstract

The coordination of complete dentures with neuromuscular function is the foundation of successful stable dentures. The lower denture commonly presents the most difficulties because the mandible atrophies at a greater rate than the maxilla and has less residual ridge for retention and support. Regardless of implant availability, physiologically optimal denture contours and physiologically appropriate denture teeth arrangement should be achieved to maximize prosthesis stability, comfort, and function for patients. The neutral zone technique is most effective for patients who have had numerous unstable, unretentive lower complete dentures owing to atrophied ridge, altered or diminished neuromuscular control or more powerful oral musculature. This article illustrates the concepts and canons behind the neutral zone and the techniques for recording it.

Key words : Neutral zone, Neuromuscular function, Stability, Biometric denture space.

Introduction

Great strides have been made in many technical procedures in complete denture prosthodontics. However, some phases still must be explored.¹ The "neutral-zone approach" to complete denture construction is neither new nor original but, rather, constitutes the bringing together of the concepts and ideas of many men into a viable and practical procedure.² Wilford Fish³ have contributed the most to the neutral zone concept. Although the concept is valuable, unfortunately, it is not often practised and is frequently bypassed in denture construction.⁴

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 (Fig.1).⁵ In general, boundary conditions that define the neutral zone are developed through muscular contraction and relaxation during the various functions of mastication, phonation, deglutition, and facial expression. These neuromuscular forces vary in magnitude and direction in different areas of the oral cavity, in different individuals, and at different periods of life.⁶ Historically, this zone is referred to by various names, including dead zone,⁷ stable zone,⁸ zone of minimal conflict,⁹ zone of equilibrium,¹⁰ zone of least interference,¹¹ biometric denture space,¹² denture space¹³ and potential denture space.¹⁴ It is impossible to construct a denture where the perfect, absolute equilibrium exists and no displacement occurs. The aim of the neutral zone technique is to construct a denture which is in harmony with its surroundings and provides optimum stability,

retention and comfort.

The lower denture commonly presents the most difficulties with pain and looseness being the most common complaint.¹⁵ This is because the mandible atrophies at a greater rate than the maxilla and has less residual ridge for retention and support.¹⁶ The neutral zone technique is most effective for patients who have had numerous unstable, unretentive lower complete dentures. These patients usually have a highly atrophic mandible and there has been difficulty in positioning the teeth to produce a stable denture. Dental implants may provide stabilization of mandibular complete dentures in such cases, however there may be situations when it is not possible to provide implants on the grounds of medical, surgical or costs factors. The neutral zone technique is an alternative approach for these complex cases.⁴ The neutral zone approach has also been used for patients who have had a partial glossectomy, mandibular resections or motor nerve damage to the tongue which have led to either atypical movement or an unfavourable denture bearing area.¹⁷ In some patients the size of the neutral zone may be drastically reduced. A poorly planned transition to edentulous state by uncontrolled tooth extraction may lead to lateral spreading of the tongue, called as proptosis lingualis.¹⁸ There may be excessive anterior resorption leading to increased prominence of mentalis muscle. In some patients, the shape of the neutral zone is more bizarre, for example following a surgical resection, stroke, scleroderma, Parkinson's disease or arising from other natural causes such as prominent mental groove.¹⁹

Importance of Neutral Zone

During childhood, the teeth erupt under the influence of muscular environment created by forces exerted by tongue, cheeks and lips, in addition to the genetic factor. These forces have a definite influence upon the position of the erupted teeth, the resultant arch form, and the occlusion. Generally,

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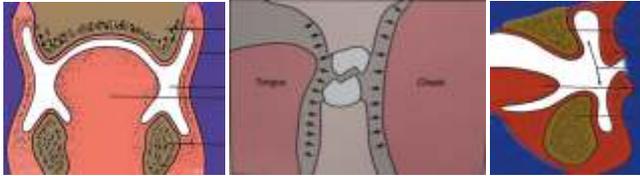


Fig. 1: Diagrammatic representation of neutral zone

muscular activity and habits which develop during childhood continue through life and after the loss of teeth, it is important that the artificial teeth be placed in the arch form compatible with these muscular forces.² There is no occlusal scheme that can stabilize teeth if they are in an unbalanced relationship with neuromuscular forces against them. Whereas leverage during function is of primary concern for the conventional "teeth over ridge" concept, muscular forces during function are considered more crucial for the neutral zone concept. Advocates of the neutral zone do not ignore the resulting, less favourable leverage, but assume that it is counterbalanced by the controlling actions of cheeks, lips, and tongue, especially for resorbed alveolar ridges.²⁰

Neutral Zone Philosophy

It is based upon the concept that for each individual patient, there exists within the denture space a specific area where the function of the musculature will not unseat the denture and where forces generated by the tongue are neutralized by the forces generated by the lips and cheeks. The influence of tooth position and flange contour on denture stability is equal to or greater than that of any other factor.²¹ The artificial teeth should not be placed on the crest of the ridge or buccally or lingually to it rather they should be placed as dictated by the musculature, and this will vary for different patients.

The objectives² achieved by this approach are,

- a) The teeth will not interfere with the normal muscle function, and
- b) The forces generated by these muscles against the denture, especially for the resorbed lower ridge, are more favorable for stability and retention.
The dentures will have other advantages:³
- a) Posterior teeth will be correctly positioned allowing sufficient tongue space
- b) Reduced food trapping adjacent to the molar teeth
- c) Good aesthetics due to facial support.⁴

Functional Anatomy

The musculature of the denture space is divided into two groups.⁸ (Table 1)

- (1) Those muscles which primarily dislocate the denture during activity, and
- (2) Those muscles that fix the denture by muscular pressure on its secondary supporting surfaces.

Table 1: Dislocating & fixing muscles of the denture space

Dislocating Muscles	Fixing Muscles
Vestibular	Vestibular
Masseter	Buccinator
Mentalis	Orbicularis oris
Incisive	Labii Inferioris
Lingual	Lingual
Medial Pterygoid	Genioglossus
Palatoglossus	Lingual longitudinal
Styloglossus	Lingual vertical
Mylohyoid	Lingual transverse

These muscles have been divided according to their location on the vestibular or lingual side of the denture and to their dislocating or fixing actions. (Fig.2)



Fig. 2: Muscles involved in the neutral zone

- a: Levator labii superioris alaeque nasi
- b: Levator labii superioris
- c: Orbicularis oculi
- d: Zygomaticus minor
- e: Zygomaticus major
- f: Risorius
- g: Platysma
- h: Depressor anguli oris
- i: Depressor labii inferioris
- j: Mentalis
- k: Orbicularis oris
- l: Incisivus inferior

Denture Surfaces

The surface of a denture can be divided into different regions, each with its own function.⁶

- (1) Pressure receiving surface (the occlusal table)
- (2) Pressure transmitting surface (the primary supporting surface or basal seat) and
- (3) Secondary supporting surface which is comprised of the polished surfaces of the denture and the lingual and buccal surfaces of the teeth.

The junction of the primary supporting surface and the secondary supporting surface is called the denture border.

- a) **Active muscular fixation:** Brodie¹⁹ has advocated that antagonistic activity of muscles can be used to advantage in stabilizing dentures; e.g., if the right side of the tongue and the right buccinator muscle are pressed against the denture at the same time, the opposite directed forces will hold the denture in place. A similar action of antagonistic muscle groups between the functioning genioglossus and orbicularis oris muscles will fix a lower denture by opposing forces on its anterior section. When the right and left buccinator muscles contract at the same time, an active muscular fixation can be established even with an

inactive tongue.

b) **Passive muscle fixation:** The polished surfaces of the denture must exhibit a series of inclined planes in relation to the muscles of the tongue and cheeks.^{22, 23} The palatal surface of the upper denture looks inward and downward while the lingual surface of the lower denture looks inward and upward. The flanges of lower dentures should extend under the fold of the buccinator muscle and under the tongue to act as 'handles' to hold the denture in place. The lower denture must be narrow in the bicuspid region (the region of modiolus function to avoid being lifted up) by the corners of the mouth, and the posterior teeth must not encroach on the tongue posteriorly. The lower denture will be unstable if:

- (1) It is too wide in the bicuspid region,
 - (2) The incisor teeth are set so far labially that the lip causes the denture to rise, and
 - (3) The molars encroach on the tongue, and the buccal and lingual flanges in the molar region are parallel so that the tongue and buccinator muscle will not hold them down.⁸
- Narrow artificial teeth permit the polished surfaces to be automatically formed with favourable inclined planes that can be wedged below the tongue, lower lip, and cheeks. In this way, these structures are brought to rest on the polished surfaces, and their weight will force the denture to remain on its foundation.⁸

Position of Neutral Zone

Fahmi FM²⁰ conducted a study and found that longer the duration of edentulousness, more buccally/labially was the neutral zone located. Also the neutral zone in most posterior location is located more buccally than lingually. Razeq MKA and Abdalla F²⁴ conducted a study on neutral zone and found that the width of the neutral zone is minimum at the level of the occlusal plane and increases gradually as it goes up and down. The width of the neutral zone is also minimum at the posterior (molar) region and increases gradually toward the anterior. There is no significant difference in the width of the neutral zone in patients with prominent or flat alveolar ridges. The width of the neutral zone increases as the vertical dimension of occlusion increases and decreases as the vertical dimension of occlusion decreases.

Technique

The basic concept behind the technique for recording neutral zone considers the actions of the tongue, lips, cheeks, and floor of the mouth during a specific oral function, to push the soft material into a position where buccolingual forces are neutralized. Many materials have been suggested for shaping the neutral zone: modeling plastic impression compound,¹ soft wax,²⁵ a polymer of dimethyl siloxane filled with calcium

silicate,²⁶ silicone,²⁷ and tissue conditioners and resilient lining materials.^{28,29} Many techniques have been suggested using the previously described materials in conjunction with movements including sucking,²⁰ grinning and whistling,²⁵ and pursing the lips.³⁰ The swallowing/modeling plastic impression compound technique³⁰ located the neutral zone, using swallowing as the principle modeling function. The phonation/tissue conditioner technique uses phonation to develop a mandibular impression.^{26,30,31} Many studies have analyzed the neutral zone^{30,32,33} and neutral zone dentures as compared with dentures made using conventional techniques in the edentulous patient.^{20,26,34,35} It has been shown that neutral zone dentures are functionally more stable than conventional dentures.^{20,25,27,34} A number of techniques relying on function to develop the shape of the neutral zone and polished surface of mandibular dentures have been described.^{36,37}

- (a) The neutral-zone technique²: the usual sequence of complete denture construction is somewhat reversed. Individual trays are constructed first and adjusted in the mouth for stability during opening, swallowing, and speaking. Next, modeling compound is used to fabricate occlusion rims. These rims, which are moulded by muscle function, locate the patient's neutral zone (Fig. 3). After a tentative vertical dimension and centric relation have been established. The mandibular neutral zone is indexed with plaster placed on the buccal and

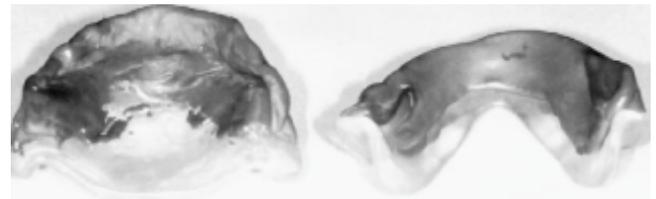


Fig. 3: Molded material according to the muscle function intra-orally, demarking the position of the teeth

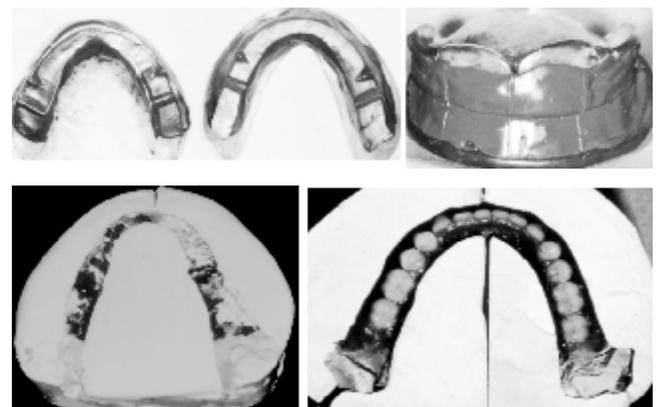


Fig. 4: Jaw relation records with reference lines, plaster index fabrication and tooth arrangement

lingual surfaces. Teeth are set up exactly following the index (Fig. 4). The final impressions are made with a closed-mouth procedure.

- (b) Anthropoidal Pouch technique:¹⁹ Also called as "muscle formed mandibular denture technique"³⁸ or "denture form impression technique".²⁷ After making primary and secondary impressions, transparent heat cured acrylic baseplate is made and assessed for retention, stability and support. Wax block is added to base plate and occlusal registration is recorded. Mandibular wax block is removed and replaced with vertical wire loops. Alternatively acrylic pillars can also be used. Tissue conditioner is applied to wire loops (Fig. 5) and patient is instructed to carry out simple oral movements (for 30 minutes) such as moving of lips, cheeks and tongue; swallowing, chewing, puffing of cheeks, sucking in of lips, whilst keeping the rims in occlusal contact. The neutral zone is indexed with silicon putty and accordingly the teeth are arranged (Fig. 6).



Fig. 5: Mandibular baseplate with vertical wireloops attached and application of tissue conditioning agent to the wire loops



Fig. 6: Putty indices made for Teeth arrangement

- c) Cagna DR, Massad JJ and Schiesser³⁸ advocated the use of sticks of grey and green modeling plastic impression compound on the edges of red modeling plastic impression compound for recording neutral zone. After the prosthetic teeth arrangement according to the index, the external impressions are made with polyvinyl siloxane. For facial aspect of maxillary trial denture, patient is instructed to pucker lips forward, smile broadly, open mouth, move mandible from side to side. For palatal aspect, patient is instructed to sip water and swallow and perform sibilant and fricative phonetics. For mandibular facial aspect, patient is instructed to pucker lips forward, smile broadly, move

mandible into protrusive posture and then move mandible from side to side. For mandibular lingual aspect, patient is instructed to sip water and swallow several times, extend tongue and move from side to side and lick upper and lower lips. The excess impression material from trial denture is removed and denture is processed.

Summary :

Techniques described here are intended to emphasize and illustrate the clinical value of recording the physiologic dynamics of oral and perioral muscle function and of using this information to develop complete denture contours and denture tooth positions. Using the neutral zone to arrange posterior teeth takes advantage of the stabilizing potential of existing muscle conditions. This physiologically based complete denture design concept has been shown to be especially effective for mandibular removable prostheses. It is particularly remarkable to observe neutral zone recorded for patients affected by neuromuscular decline or gross dysfunction; for example, patients of advancing age and/or long term edentulism with decreasing facial muscle tonicity, anatomic deformity or insufficiency, such as in post-cancer oral surgical resections or those suffering facial neuromuscular deficit secondary to cerebral vascular accidents or Parkinson's disease. Conventional methods used for these patients result in denture contours that may not facilitate prostheses stability against expected oral and perioral muscle function. Conversely, the fabrication of denture contours to harmonize with aberrant neutral zone dimensions, characteristic of these compromised patients, results in increased denture stability and improved oral function. A thorough understanding of the anatomy and physiology of structures that impact sound complete denture fabrication and function is important for successful treatment of edentulous patients. Use of the neutral zone method to identify and register the anatomy and physiology that impact prostheses stability may result in improved prosthodontic therapy for patients.

References :

1. Schiesser FJ. The neutral zone and polished surfaces in complete dentures. *J Prosthet Dent* 1964; 14:854-65.
2. Beresin VE and Schiesser FJ. The neutral zone in complete dentures *J Prosthet Dent* 2006; 95:93-101.
3. Fish EW. Using the muscles to stabilize the full lower denture. *J Am Dent Assoc* 1933; 20:2163-9.
4. Beresin VE, Schiesser FJ, editors. *Neutral zone in complete and partial dentures*. 2nd ed. St.Louis: Mosby, 1979:15:73-108, 158-83.
5. *The Glossary of Prosthodontic Terms*. *J Prosthet Dent* 2005; 94:10-92.
6. Brill N, Tryde G, Cantor R. The dynamic nature of the lower denture space. *J Prosthet Dent* 1965;15:401-18.
7. Matthews E. The polished surfaces. *Br Dent J* 1961; 111:407-11.
8. Grant AA, Johnson W. *An introduction to removable denture prosthetics*. Edinburgh: Churchill Livingstone, 1983:24-8.

9. Wright SM. The polished surface contour: a new approach. *Int J Prosthodont* 1991; 4:159-63.
10. Watt DM, MacGregor AR. *Designing complete dentures*. 2nd ed. Bristol: IOP Publishing Ltd, 1986:1-31.
11. Schlosser RO. *Complete denture prostheses*. Philadelphia: WB Saunders, 1939:183-90.
12. Roberts AL. The effects of outline and form upon denture stability and retention. *Dent Clin North Am* 1960; 4:293-303.
13. Basker RM, Harrison A, Ralph JP. A survey of patients referred to restorative dentistry clinics. *Br Dent J* 1988; 164: 105-108.
14. Atwood DA. Post extraction changes in the adult mandible as illustrated by micrographs of midsagittal sections and serial cephalometric roentgenograms. *J Prosthet Dent* 1963; 13: 810-824.
15. Ohkubo C, Hanatani S, Hosoi T, Mizuno Y. Neutral zone approach for denture fabrication for a partial glossectomy patient: a clinical report. *J Prosthet Dent* 2000; 84: 390-393.
16. Schuermann H. *Proptosis buccalis*. 1959:879-882
17. Lynch CD and Allen PF. Overcoming the unstable mandibular complete denture: the neutral zone impression technique. *Dent Update* 2006; 33:21-26.
18. Fahmy FM, Kharat DU. A study of the importance of the neutral zone in complete dentures. *J Prosthet Dent* 1990; 64:459-462
19. Brodie, AG. *Facial Patterns, Angle Orthod* 1946:1-13.
20. Fahmi FM. The position of the neutral zone in relation to the alveolar ridge. *J Prosthet Dent* 1992; 67:805-9.
21. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. *J Prosthet Dent* 1976; 36:356-67.
22. Schiesser FJ. The neutral zone and polished surfaces in complete dentures. *J Prosthet Dent* 1964; 14: 854-65.
23. Srivatsava V, Gupta NK, Tandan A, Kaira LS, Chopra D. The Neutral zone concept and technique. *J Orofac Res* 2012;2(1):42-47.
24. Razek MKA, Abdalla F. Two-dimensional study of the neutral zone at different occlusal vertical heights. *J Prosthet Dent* 1981; 46:484-489.
25. Barrenas L, Odman P. Myodynamic and conventional construction of complete dentures: a comparative study of comfort and function. *J Oral Rehabil* 1989; 16:457-65.
26. Ohkubo C, Hanatani S, Hosoi T, Mizuno Y. Neutral zone approach for denture fabrication for a partial glossectomy patient: a clinical report. *J Prosthet Dent* 2000; 84:390-3.
27. 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.
28. Neill DJ, Glaysheer JK. Identifying the denture space. *J Oral Rehabil* 1982; 9:259-77.
29. Beresin VE, Schiesser FJ. *The neutral zone in complete and partial dentures*. 2nd ed. St Louis: Mosby; 1978:73-86.
30. Karlsson S, Hedegard B. A study of the reproducibility of the functional denture space with a dynamic impression technique. *J Prosthet Dent* 1979; 41:21-5.
31. Miller WP, Monteith B, Heath MR. The effect of variation of the lingual shape of mandibular complete dentures on lingual resistance to lifting forces. *Gerodontol* 1998; 15:113-9.
32. Raybin NH. The polished surface of complete dentures. *J Prosthet Dent* 1963; 13:23-9.
33. Stromberg WR, Hickey JC. Comparison of physiologically and manually formed denture bases. *J Prosthet Dent* 1965; 15:213-30.
34. Walsh JF, Walsh T. Muscle formed complete mandibular dentures. *J Prosthet Dent* 1976; 35:254-58.
35. McCord JF, Grant AA. Impression making. *Br Dent J* 2000; 188:484-492.
36. Lott F, Levin B. Flange technique: an anatomic and physiologic approach to increased retention, function, comfort and appearance of dentures. *J Prosthet Dent* 1966; 16:394-413.
37. Miller WP, Monteith B, Heath MR. The effect of variation of the lingual shape of mandibular complete dentures on lingual resistance to lifting forces. *Gerodontol* 1998; 15:113-9.
38. Cagna DR, Massad JJ and Schiesser. The neutral zone revisited: from historical concepts to modern application. *J Prosthet Dent* 2009; 101:405-12.

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