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Case Report

Comparative Study Of The Position Of Posterior Teeth In Patients With Atrophic Mandibular Ridges In Relation To Anatomical Landmarks And Neutral Zone Recording: A Clinical Study

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ABSTRACT

AIM: To assess difference in the position of posterior mandibular teeth as dictated by existing anatomical landmarks on the cast and that attained physiologically by neutral zone recording.

OBJECTIVES –To assess:

(1) Deviation (buccal/lingual) of the potential space for the placement of posterior teeth in atrophic mandibular ridges.

(2) The period of edentulousness and the condition of surrounding tissues affecting relative position of the teeth.

Materials and Methods: The study included 8 edentulous patients, previous denture wearer, with atrophied mandibular residual ridges and a variable period of edentulous equal or more than 5 years. Neutral zone recording was performed for each patient and the bucco-lingual relationship of the crest of the mandibular alveolar ridge and position of the neutral zone was examined.

Results: The results suggested that the location of the neutral zone varies from individual to individual depending on their musculature and that there is a significant relation to the duration of edentulousness. As edentulousness increases, there is more lingual positioning of the neutral zone at the molar region of both sides of the arch. At the premolar region, there is no change in position of the neutral zone; it remains constant as resorption of the alveolar ridge is directly under the buttress. In the anterior region, there is more labial positioning of the neutral zone as edentulousness increases.

Conclusions: This technique proves itself to be an easy and inexpensive way to determine the relationship between the crest of alveolar ridge and neutral zone. Incorporating this technique into practice will be a great aid that can be exploited by the clinicians for functional and psychological comfort of the patients.

Introduction

Practically objectives of complete denture therapy for patients with severely reduced residual alveolar ridges includes the placement of functional and aesthetics dentition substitutes and replacement or associated dental supporting structures. In so doing the prostheses often occupy a substantial volume within the edentulous oral cavity[1,2].So proper relation of artificial teeth to the basal seat and surrounding tissue is of great importance[3,4]. The stability of complete denture is influenced by the surrounding neuromuscular system in the oral cavity. Oral functions, such as speech, mastication , swallowing , smiling and laughing , involves the synergistic actions of the tongue , lips cheeks, and the floor of the mouth, that are very complex and highly individual[3,4,5,6].

Neuromuscular control is the key for the stability of denture. Size and position of denture teeth & the

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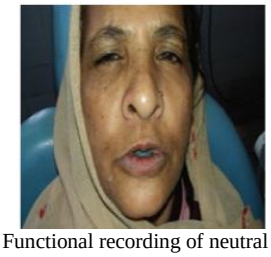

Fig. 1 Functional recording of neutral zone by sip and swallow method

Fig. 2 Adaption of the 26 gauge wire over the cast of the mandibular alveolar ridge and adaption of putty indices both buccally/labially and lingually

Fig.3

Fig. 4.
Try in of denture and after trial adaptation of 26 gauge wire over the central fossae of mandibular posterior teeth

contours of the polished surfaces play a crucial role in denture stability as they are subjected to destabilizing force from the tongue, lips and cheeks if they interfere with the function of oral structures[3,4,5,6] .Retention and stability of complete denture become unfavourable when ridge resorption gets more severe especially in the mandible.

Various authors have suggested optimal facial-lingual arrangement of posterior teeth. As stated previously, the concept that posterior denture teeth should be arranged to occupy the position of their natural teeth predecessors has been put forward[7,10,11,12,13,16]. Other has suggested that posterior denture teeth should be arranged directly over the crest of the edentulous ridge[8,9,19].Weinberg suggested that buccal cusps and central fossae of mandibular posterior denture teeth should be arranged directly over the crest of the edentulous residual ridge[3,6]. Pound recommended that the lingual surfaces of mandibular posterior denture teeth should occupy an area bounded by 2 lines originating from the mesial surface of mandibular canine & extending posteriorly to the lingual and buccal aspects of the retro molar pad. This area is called Pound's triangle[7,10,11,12,13,16]. The Neutrocentric concept requires that posterior mandibular denture teeth be arranged to occupy as central, a location as possible, relative to denture foundation, without disturbing the tongue function[14]. Lammie argued that in ageing patients, mandibular posterior denture teeth should be arranged over the buccal shelf to provide increased tongue space and to facilitate the development of vertical facial denture polished surfaces, against which an effective facial seal can be achieved and maintained[15].

Historically different terminology has been associated with the concept –including (1)dead zone (2) stable zone (3)zone of minimum conflict (4) zone of equilibrium (5) zone of least interference (6)Biometric denture space (7) potential denture space. Neutral zone is defined as –"the potential space between the lips and cheeks on one side and tongue on other; that area or

Fig 5

Fig. 6

Occlusal film viewed in a viewing box for the relationship betweeen the images of two wires in a bucco-lingual direction

position where the forces between the tongue and cheeks or lips are equal[16], where the forces of tongue pressing outward are neutralized by forces of the checks and lips pressing inward[6],,. It was first described by Wilfred Fish, who reported the influence of the polished surface on retention and stability of complete denture in 1931. He stated that the polishing surface contour should conform to the shape of the tongue, lips and cheeks. These tissues in function or rest, would exert an elastic pressure on the dentures, and retain them in place rather than dislodge them.

The advantages of neutral zone technique are (1) improved stability and retention (2) posterior teeth will be correctly positioned allowing sufficient tongue space (3) reduced food trapping adjacent to molar teeth (4) good aesthetics due to facial support[17].

Beside patients with a severely resorbed atrophic ridge, the neutral zone technique for complete denture or removable partial denture (RPD) reconstruction can also be suggested foe patients of advancing age and long term edentulism with decreasing facial muscle tonicity, anatomic deformity or insufficiency due to

Fig. 7

post cancer oral surgical resections, or those suffering stroke or Parkinson disease, leading to either atypical movement or an unfavourable denture bearing area[4,17,18].

Material And Method

Included in this study were 8 completely edentulous healthy patients, with severely atrophied mandibular ridges, treated in the Patna Dental College & hospital, Patna, Bihar, India.History revealed variable periods of edentulism (>5 years) and complete denture wearing since then. Written consent from patients and ethical clearance from the institution were taken for this study.

The preliminary impression of maxillary and mandibular ridges were recorded with modelling impression compound (DPI pinnacle impression compound, The Bombay Burmah trading Corporation, Mumbai), using metallic stock trays. They were poured with dental plaster to obtain primary casts. The custom trays were prepared using autopolymerising acrylic resin (DPI-RR cold cure, acrylic repair material) by using sprinkle-on method. The custom trays were checked for comfort, stability, retention & overextension. Final impressions were made using zinc oxide eugenol paste (DPI Impression Paste, The Bombay Burmah trading Corporation, Mumbai) after border molding. Impressions were poured with type 3 dental stone (Kalstone, Kalabhai Karson Pvt. Ltd., Mumbai, India) to obtain master casts. Temporary

denture base were fabricated on the master casts using autopolymerising acrylic resin.

Neutral zone approach- a combination of medium fusing modelling impression compound and low fusing green stick were used in 1:1 ratio, to record the neutral zone.

Record denture bases were checked for retention, stability, comfort and overextension. After sufficient patients training, the softened impression compounds were kneaded and rolls were formed according to crest and were attached to the denture bases. These attached roll were reheated in water bath (65^0C) and carried in patient's mouth. The patients were asked to perform various movements like swallowing (tongue protrusion) and speaking exaggerated "EEE,, and "OOO,, sounds repeatedly, to bring all oral muscles in function.

Excess materials were trimmed off, and anatomical structures were used as guidelines to mark the reference plane. Anteriorly, vermilion border of the lower lip, corner of the mouth and posteriorly retro molar pad were taken as reference points to orient occlusal plane. Locating grooves were cut on the master casts in non-anatomical areas, and putty indices (Photosil, DPI, polyvinyl-siloxane impression material) were made by adapting putty both buccally/labially & lingually over the recorded templates.

Anatomical landmarks were marked on the master casts and a line were drawn using lead pencil from the centre of retro molar pad to canine prominence on both the sides of ridges.

A 26 gauge stainless steel wire (Sendent S.S. soft wire) was adapted over the marked line. The provisional denture bases were fabricated without disturbing fit of the putty indices. Mandibular occlusal rims were made by pouring molten modelling wax (DPI modelling wax) in the space confined by putty indices on the new denture bases.

Jaw relationships were recorded and the casts were mounted on the articulator. The mandibular teeth were arranged within the confines of putty indices, the buccal-lingual dimensions were adjusted. If required, to accommodate the teeth within the available neutral zone space. Try in of maxillary and mandibular dentures were done to check aesthetics, phonetics and occlusion. After try in, a 26 gauge wire (Sendent S.S. soft wire) were adapted over the occlusal surfaces of the posterior mandibular teeth following their central fossae.

Occlusal view radiographs (INSIGHT Occlusal Film, Care stream Health India Pvt. Ltd.) were obtained by using parallel cone technique, of each record base and its casts. The objects to source distance were 8 inches and the central rays were directed at the centre of the casts. Exposure parameters used were 70 kV voltages, 8mA current and 2.5s impulse. All films were developed in the X-ray processor. The films were viewed in a viewing box to determine the relationship between the images of two wires in a buccal-lingual direction, which shows shifting of posterior teeth arrangement in neutral zone as compared to conventional following anatomical landmarks. Where the two images coincided, a zero score were assigned. Buccal /labial locations of the neutral zone with respect to ridges were assigned a positive value and the lingual were assigned a negative value. Measurements were made with a millimetre ruler to an accuracy of 0.5mm.

TOOTH	LEFT SIDE(mm)	RIGHT SIDE(mm)
PREMOLAR	- 0.06	- 0.24
MOLAR	- 0.53	- 1.06

Results

The study involved estimate the position of the neutral zone and its relation to the crest of the mandibular alveolar ridge in completely edentulous patients at four locations – left molar, left premolar, right premolar and right molar.

Table shows the position of the neutral zone in relation to the alveolar crest ridge at the left molar region, left premolar region, right premolar region and right molar region, the mean values of the neutral zone in relation to the crest of the mandibular alveolar ridge are -0.53mm, -0.06 mm, -0.24 mm, -1.06 mm respectively.

Discussion

Artificial complete denture prosthesis is the conventional treatment option for all edentulous patients. Establishing support, harmonious occlusion with good retention, stability, esthetics and phonetics are the prime objectives and goals for all Prosthodontists. In order to construct dentures that function properly not only in chewing but also in speaking and swallowing, Prosthodontists must develop the fit and contour of the external surface just as accurately and meticulously as the fit and contour of the impression surface and occlusal surface.

Natural teeth are the most movable parts of the masticatory system. If outward horizontal forces from the tongue are greater than inward forces exerted by the buccinator muscle bands and the lips, the teeth will move horizontally until the opposing forces are equal. This is the neutral zone. As teeth erupt into the mouth, they are guided into a specific zone of neutrality that determines the horizontal position of each tooth in the arch.

Generally, muscular activity and habits that develop during childhood continue through life. After the teeth have been lost, muscle function and activity remain highly individual and greatly influence any complete denture that is placed in the mouth.

In this study, position of neutral zone at the right and left molar regions showed a trend of normal physiological process where mandibular posterior ridges resorb lingually and neutral zone was positioned lingually, which is highly significant. However, in this study only one patient have shown buccal positioning of the neutral zone.

At right and left premolar regions, a trend of normal physiological process where mandibular posterior ridges resorbed directly under the buttress and position of NZ was directly over the crest of the ridge was seen, which is highly significant. However, a small percentage of subjects have shown buccal and lingual positioning of the neutral zone.

This small percentage of buccal positioning of the neutral zone may be reasoned for increase in muscular forces from the tongue muscle and decreased muscular forces from cheek muscles, which is a resultant neutral zone in the molar region.

The observations suggested that the location of the neutral zone varies from individual to individual, depending on their musculature, and there is significant relation to the duration of edentulousness. As edentulousness increases, there is more lingual positioning of the neutral zone at the molar region of both sides of the arch. At the premolar region, relatively there is no change in position of the neutral zone; it remains constant as resorption of the alveolar ridge is directly under the buttress.

Conclusion

The neutral-zone philosophy 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. We should not be dogmatic and insist that teeth be placed over the crest of the ridge, buccal or lingual to the ridge. Teeth should be placed as dictated by the musculature, and this will vary for different patients. 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 favourable for stability and retention.

If the sizes of the mandibular teeth are too large or if the posterior teeth are set even 1 mm lingually, the tongue is deprived of approximately 1000mm^3 of its functional space[20].

In this study it was observed that negligible shift of the posterior teeth in the premolar region and significant slight lingual shift of the molars in the posterior region with patients wearing complete denture.

The buccolingual relationship of the neutral zone to the crest of the residual alveolar mandibular ridges was studied in 8 edentulous patients with severely resorbed mandibular residual ridges. The correlation was studied in vitro from radiographic images obtained on occlusal films.

Further studies must be done to evaluate the period of edentulousness in a non-denture wears patients and its effect on position of neutral zone as it help in various articles, that edentulousness may results in alteration in size and tonicity of musculature i.e. tongue and cheeks.

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