

Comparative Study of Posterior Teeth Position in Patients with Atrophic Mandibular Ridges as Dictated by the Anatomical Landmarks and Neutral Zone Recording: A Clinical Research

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Abstract:

Oral functions like speech, mastication, and swallowing involve complex, individual synergistic actions of the tongue, lips, and cheeks. In edentulous patients, particularly those with severely resorbed mandibular ridges, traditional tooth placement based solely on anatomical landmarks often ignores the influence of these muscular forces, leading to unstable dentures. This clinical research compares the position of posterior mandibular teeth dictated by existing anatomical landmarks versus that determined physiologically through neutral zone recording. The study involved 10 patients with atrophic mandibular ridges and a history of edentulism exceeding 10 years. The neutral zone—the area where inward forces from the cheeks and lips neutralize outward forces from the tongue—was recorded using a 1:1 mixture of modeling plastic and green stick compound. Patients performed functional movements, such as swallowing and speaking, to mold the external contours of the denture body. Posterior tooth positions were then compared using putty indices and occlusal radiographs.

Results indicated a significant deviation between the two methods. In nearly all cases, the neutral zone recording dictated a lingual shift of the posterior teeth relative to the crest of the alveolar ridge, with mean shifts ranging from -0.5 mm to -0.7 mm. By positioning teeth within this physiological space, the musculature acts to stabilize the denture rather than unseat it. The study concludes that the neutral zone technique is a simple, non-invasive, and cost-effective procedure that significantly enhances denture stability, retention, and masticatory efficiency by ensuring the prosthesis is functionally compatible with the patient's unique muscular environment.

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Introduction

Oral functions, such as speech, mastication, swallowing, smiling, and laughing, involve the synergistic actions of the tongue, lips, cheeks, and floor of the mouth which is very complex and highly individual for both dentulous and edentulous subjects. In edentulous cases, cardinal importance of tooth position and flange form and contour remain unrecognized often resulting in unstable and unsatisfactory dentures.

Potential denture space results when all of the natural teeth have been lost. According to Glossary of Prosthodontic Terms (2005), the neutral zone is that 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. Neutral zone is that area in the mouth where, during function, the forces of the tongue pressing outward are neutralized by the forces of the cheeks and lips pressing inward.

Soft tissues that form the internal and external boundaries of the denture space influence the

stability of the dentures. This approach helps to locate area in the edentulous mouth where the teeth should be positioned such that forces exerted by muscles will tend to stabilize the denture rather than unseat it.

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, 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.

Muscle Forces and Denture Stability: Dentures should occupy a position in the mouth where all forces during function are neutralized.

Our objective, therefore, is to recognize and to utilize those forces resulting from muscle function so

that they will have a positive influence on denture stability.

Denture surfaces: Sir Wilfred Fish described a denture as having three surfaces, namely impression surface, occlusal surface and polished or external surface, with each surface playing an important and independent role in the overall fit, stability and comfort of the denture. The third surface – as termed by Fish, “the polished surface” is the rest of the denture that is not part of the other two surfaces. It is mostly denture base material, but it also consists of those surfaces of the teeth that are not contacting or articulating surfaces. The external or polished surface of the denture is in contact with the cheeks, lips, and tongue. One can visualize that, per square unit of area, the polished surface can be as large as or larger than impression and occlusal surfaces combined, depending on anatomic structure.

Influence of Forces on Denture Surfaces: Consequently, retention and stability become more dependent on the correct positioning of the teeth and the contours of the external or polished surfaces of the dentures. Therefore, these surfaces should be so contoured that the horizontally directed forces applied by the muscles should act to seat the denture.

If the teeth were in contact all of the time, the polished surfaces would have relatively little effect on denture stability. Conversely, if the teeth were never brought into contact, the occlusal surfaces would be relatively unimportant. In order to construct dentures which, function properly in chewing, swallowing, speaking, etc., we must develop not only proper tooth position but also the fit and contour of the polished surfaces just as accurately and meticulously as the fit and contour of impression and occlusal surfaces.

Reversed Sequence in Denture Construction: The usual sequence for complete dentures is to make primary impressions, construct individual trays, make final impressions, and then fabricate stabilized bases. Occlusion rims or other devices are used to establish the occlusal vertical dimension and centric relation. With the neutral-zone approach to complete dentures, the procedure is reversed. Individual trays are constructed first. These trays are very carefully adjusted in the mouth to be sure that they are not overextended and remain stable during opening, swallowing, and speaking. Next, modeling compound is used to fabricate occlusion rims. These rims, which are molded by muscle function, locate the patient’s neutral zone. After a tentative vertical dimension and centric relation have been established, the final impressions are made with a closed-mouth procedure. Only when the final impressions are completed are the occlusal vertical dimension and centric relation finally determined.

Base and Body of the Denture: With the neutral-zone concept, the impression surface is called the

“base” and the polished surface is called the “body” of the denture. Here we first create a stable base and then place teeth and flange contours that will not unseat it. Sometimes, it is not the denture base that is the cause for denture instability but, rather, the body of the denture—that is, the tooth position and the flange form which was erected on top of the denture base. For this reason, theoretically and clinically, we differentiate between the base and the body of the denture. By separating these two entities, the dentist can more readily determine and correct the cause of instability of the denture.

With steadily increasing life expectancy we are bound to get more cases of resorbed ridges; alternative approach like neutral zone technique for denture fabrication will help us to enhance stability and retention of the dentures significant.

Aims and Objectives

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 Method

This pilot study at Department of Dentistry Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India from August 2024 to April 2025 to include 10 patients with completely edentulous maxillary and severely resorbed mandibular ridges.

History revealed variable periods of edentulism of more 10 years and complete denture wearing since then.

External Impressions: Usually, the contours of the external surfaces are arbitrarily determined by the dentist or technician. With the neutral-zone procedure, the external contours are molded by muscle function. The moldable material used to locate the neutral zone also determines the shape of the arch and the angles and contours of the body of the denture. These three entities are determined by the size and function of the tongue and action and tonus of the lips and cheeks. Just as a primary impression is the first step in developing the impression surface of the denture, the compound rims which located the neutral zone can be considered the primary impression or the first procedure in developing the polished surface of the denture.

External impressions capture in greater detail the action of the lips, cheeks, and tongue and determine

the thickness, contours, and shape of the polished surface of the denture. By means of these external impressions, a physiologic molding is done so that the external surfaces are functionally compatible with muscle action.

Clinical Procedure: Temporary denture bases were fabricated on the master casts using autopolymerising acrylic resin. Neutral zone approach – A combination of medium fusing modelling plastic impression compound and low fusing green stick was used in 1:1 ratio, to record neutral zone. Temporary denture bases were fabricated on the master casts using

autopolymerising acrylic resin. Record denture bases were fabricated and assessed for stability, extension and comfort. After sufficient patient training, the softened compound was kneaded and a roll was formed according to the crest and was attached to the base. This attached roll was reheated in water bath (65 degree Celsius) and carried into the 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 muscles into function. Excess material was trimmed off and anatomical structures were used as guidelines to mark the reference plane.



Anteriorly, vermillion border of lower lip, corner of mouth and posteriorly, retromolar pad was taken as reference point to orient occlusal plane. LOCATING GROOVES were cut on the master casts in non-anatomical areas; PUTTY INDICES were made by adapting putty both labially and lingually over the recorded template. Anteriorly,

vermillion border of lower lip, corner of mouth and posteriorly, retromolar pad was taken as reference point to orient occlusal plane. LOCATING GROOVES were cut on the master casts in non-anatomical areas; PUTTY INDICES were made by adapting putty both labially and lingually over the recorded template.

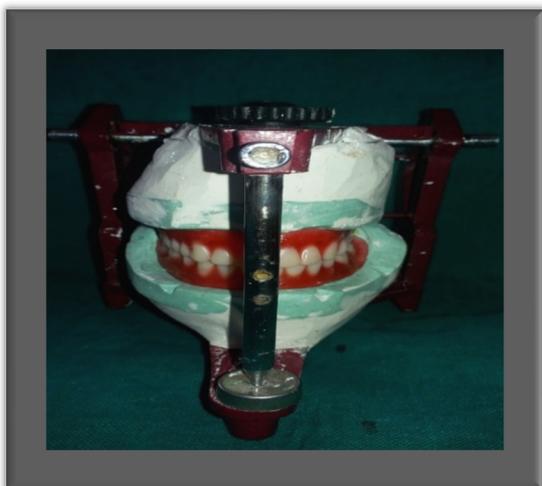


Mandibular occlusal rim was made by pouring molten baseplate wax in the space confined by putty matrices on the new denture base. Jaw relations were recorded and casts were mounted on the articulator. The mandibular teeth were arranged first well within

the confines of the putty indices; the buccolingual dimensions were adjusted, if required, to accommodate the teeth within the available neutral zone space.



Try-in of maxillary and mandibular dentures was done for esthetics, phonetics, and occlusion.

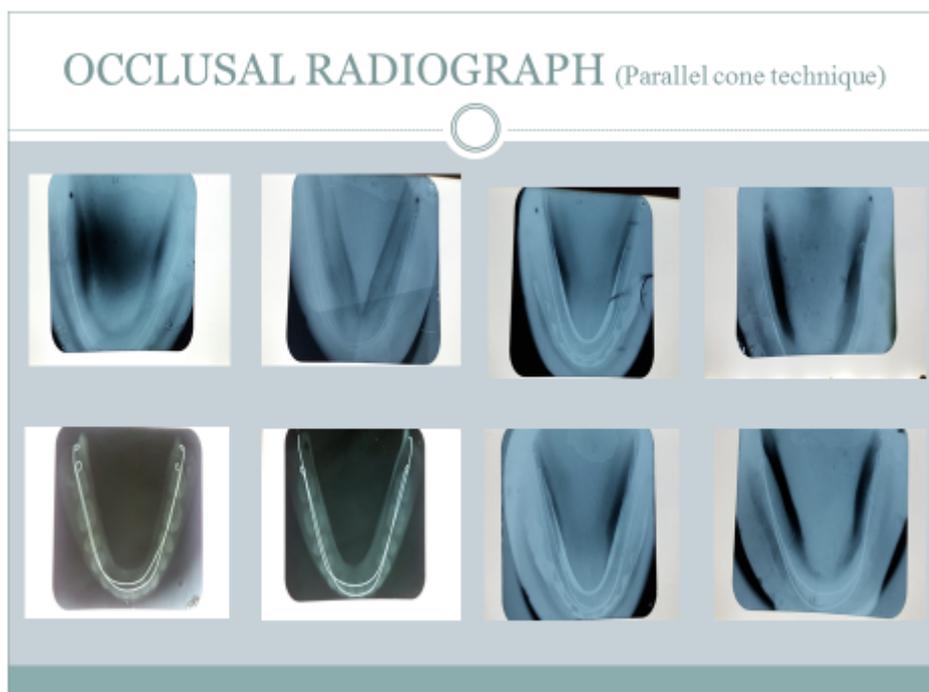
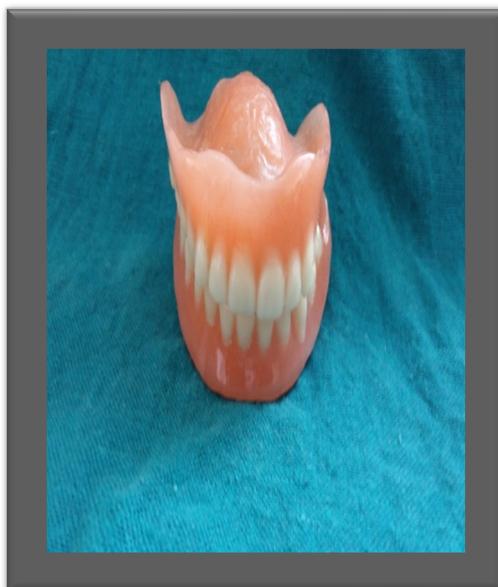


After-try in, a wire was adapted over the occlusal surfaces of posterior mandibular teeth following the central grooves.



An occlusal film was used for radiographic image by using parallel cone technique. The space between the wires was observed, which shows shifting of the posterior teeth arrangement in neutral zone as

compared to conventional following anatomical landmarks. Shift was lingual in all except one where buccal shift was observed.



OCCLUSAL RADIOGRAPH (Parallel cone technique)

Mean Lingual Shift Observed in Posterior Area

SITE	Left Premolar area	Right Premolar area	Right Premolar area	Left Premolar area
MEAN SHIFT (in mm)	-0.7	-0.5	-0.6	-0.6

Negative values obtained show a lingual shift and positive values show a buccal shift of the neutral zone in comparison to the crest of the alveolar ridge.

Discussion

The results of this clinical research is in accordance to several others (Schiesser 1964, Beresin 1973, Fahmy 1990).

However, the research has limitation of sample size and place.

Conclusion

Within the limitations of this study, it is seen that the potential space for placement of the posterior teeth shifted slightly towards buccal when using neutral zone recordings, compared to what was dictated by the anatomical landmarks.

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.

Objectives: achieved by this approach are:

- a) The teeth will not interfere with the normal muscle function,
- b) The forces generated by these muscles against the denture, especially for the resorbed lower ridge will be more favorable for stability & retention.

Hence, we conclude that recording of neutral zone is a simple, effective, noninvasive, and economic procedure which involves only one extra clinical step but improves denture stability tremendously. Advantages include increased retention, stability, esthetics, phonetics, masticatory efficiency due to proper positioning of posterior teeth, and sufficient tongue space.

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