

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

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ABSTRACT

Background: The purpose of this study was to evaluate any difference in the position of posterior teeth in patients with atrophic mandibular ridges as dictated by the anatomical landmarks and neutral zone recording in the same patient.

Materials and methods: A group of 8 patients who were ready to receive complete dentures was selected for this purpose. Their mandibular denture was fabricated using the neutral zone technique. A 28 gauge SS wire was adapted and luted on the alveolar crests of their mandibular master casts. After the wax try-in a SS wire was adapted and luted along the central groove of the posterior teeth. Then an occlusal radiograph was shot of this entire set up to see whether the wire position coincided or shifted. Measurements were taken from the radiographs for each of the 8 cases and analysed.

Results: The measurements showed a mean lingual shift in the posterior mandibular region in relation to the crest of the alveolar ridge.

Conclusion: The potential space for placement of the posterior teeth shifted slightly towards lingual when using neutral zone recordings, compared to what was dictated by the anatomical landmarks.

Keywords: Complete Denture Hygiene, Oral health, Oral hygiene practices.

INTRODUCTION

All 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 are very complex and highly individual. This stands true for both dentulous and edentulous subjects. Especially for edentulous cases, failure to recognize cardinal importance of tooth position and flange form and contour often results in unstable and unsatisfactory dentures due to their disharmony with the oral structures.^{1,2} When all of the natural teeth have been lost, there exists within the oral cavity a void which is the **potential denture space**. 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.³ 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 greatly 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

Received: May. 11, 2019; Accepted: June. 10, 2019

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muscles will tend to stabilize the denture rather than unseat it.⁴

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.⁴

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.⁵

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.⁶

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.^{7,8}

With steadily increasing life expectancy we are bound to get more cases of resorbed ridges^{9, 10}; alternative approach like neutral zone technique for denture fabrication will help us to enhance stability and retention of the dentures significantly. **This technique is not new, but of huge value, yet not used frequently.**

Purpose: 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.

MATERIALS AND METHOD

This short clinical study included 8 patients, with completely edentulous maxillary and severely resorbed mandibular ridges, who were willing to receive complete dentures. The mean period of their edentulousness was of more than 5 years. Written consent from the patients and ethical clearance from the institution were taken for this study.

CLINICAL PROCEDURE

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. A combination of medium fusing modelling plastic impression compound and low fusing green stick was used in 1:1 ratio, to record neutral zone. 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 (Fig.1 a & b). Excess material was trimmed off and anatomical structures were used as guidelines to mark the reference plane.



Fig.1 a & b: Recording of neutral zone

Mandibular occlusal rim was made by pouring molten base plate 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 (Fig. 2 a & b).



Fig. 2 a & b: SS wires adapted on the alveolar crest and occlusal surfaces of posterior mandibular teeth following the central grooves.

An occlusal film was used for shooting radiographic image of the wax try-in set-up placed on the cast with adapted wire on the alveolar crest by using parallel cone technique for each case (Fig 3). The space between the wire placed on the alveolar crest and that placed on centre of occlusal surfaces of teeth was analysed on the radiographs of each of the 8 cases.

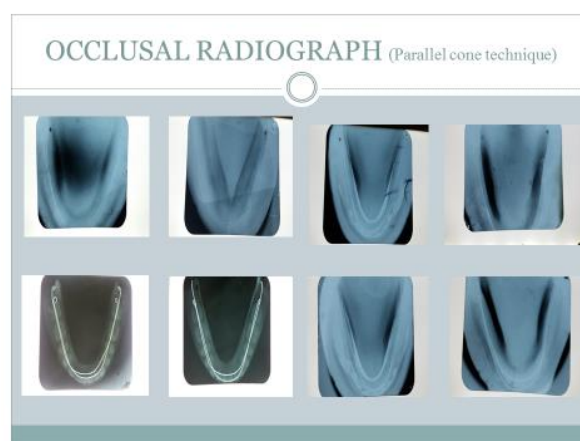


Fig. 3: Occlusal radiographs (Parallel cone technique) used for the measurement of the shifts in lingual zones in relation to alveolar crests.

RESULTS

Any shift in position of the neutral zone as observed through the radiographic images was measured in

millimetres (Table 1). Arithmetic mean was calculated, which showed a negative value for all 8 of the cases. Thus, it could be said that, the centre of the neutral zone did not coincide with the crest of the alveolar ridge; rather it showed a mean lingual shift in the posterior mandibular region (Table 2).

Table 1: Shows position of neutral zone recorded physiologically (in mm) as compared to the crest of the alveolar ridge for patients who had been edentulous for the last 5-10 years.

Number of Cases	Left molar region	Left premolar region	Right premolar region	Right molar region
1	-2	-2	-2	-3
2	-2	-1	-2	-2
3	-2	-1	-2	-3
4	+1	+2	+1	+1
5	-2	-2	-2	-1
6	+1	+2	+2	+2
7	-1	-2	-2	-1
8	+3	+2	+1	+1

Table 2: Mean shift observed in position of neutral zone posterior mandibular region

Site	Left molar region	Left premolar region	Right premolar region	Right molar region
Mean shift (mm)	-0.5	-0.25	-0.5	-0.75

**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.

Description

The findings of this study were in line with most of the literature available on this topic.^{6,7,8,11, 12} However, as no statistical analysis could be done due to a small sample size of this study, its finding should not be generalized.

CONCLUSION

Within the limitations of this study, it was seen that the potential space for placement of the posterior

teeth shifted slightly towards lingual when using neutral zone recordings, compared to what was dictated by the anatomical landmarks. 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.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Zarb GA, Bolender CL, Eckert SE, Fenton AH, Jacob RF, Merickske-Stern R. Prosthodontic treatment for edentulous patients: Complete dentures and implant supported prostheses. 12th ed: St. Louis: Mosby; 2004. p. 252-61; 100-22.
2. Brill N, Tryde G, Cantor R. The dynamic nature of the lower denture space. J Prosthet Dent 1965;15:401-18.
3. The glossary of prosthodontic terms. J Prosthet Dent 2005; 94:10-92.
4. Walsh JF, Walsh T. Muscle-formed complete mandibular dentures. J Prosthet Dent 1976;35:254-8.
5. Weinberg LA. Tooth position in relation to the denture base foundation. J Prosthet Dent 1958; 8:398-405.
6. Schiesser FJ. The neutral zone and polished surfaces in complete dentures. J Prosthet Dent 1964; 14:854-65.
7. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. J Prosthet Dent 1976;36:356-67.
8. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. Principles and technique. St. Louis: The C. V. Mosby Co; 1973. p.1.

9. Atwood DA. Reduction of residual ridges: a major oral disease entity. J Prosthet Dent 1971; 26:266-79.
10. Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: a mixed-longitudinal study covering 25 years. J Prosthet Dent 1972; 27:120-32.
11. Fahmy FM, Kharat DU. A study of the importance of the neutral zone in complete dentures. J Prosthet Dent 1990; 64:459-62.
12. FM Fahmi. Position of the neutral zone in relation to the alveolar ridge. J Prosthet Dent. 1992; 67:805-809.