Novel registration technique to register neutral zone

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ABSTRACT

Introduction: The three dimensional volume of complete dentures optimally occupies an edentulous space that is substantial, in the light of the progressive changes that accompany edentulism and functional dynamics. The paper discusses current knowledge of neutral zone registration and presents a novel technique for this registration.

Material and methods: Fabricate maxillary and mandibular occlusal rims over conventional record bases using high fusing impression compound. Register the maxillary and mandibular neutral zone separately by swallowing method and after try in of complete denture; remove the wax apical to the tooth surfaces and recording will be completed with putty and light body impression material.

Results: Complete dentures are a biomechanical device that must be designed in harmony with normal neuromuscular function to get stability and proper function. Improper teeth positioning and polished surface contour will result in compromised stability of denture.

Conclusions: This article describes a preview of facio-lingual positioning of denture teeth along with a novel approach of recording the neutral zone with an elastomeric impression material.

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INTRODUCTION

Practical objectives of complete denture therapy include placement of a functional and esthetic dentition substitute, with replacement of associated dental supporting structures. Regardless of the fabrication technique used, functionally inappropriate facio-lingual denture teeth positioning or physiologically unacceptable denture base volume/contour have been implicated in poor prosthesis stability and retention,^{1–3} compromised phonetics,^{4,5} inadequate facial

tissue support,⁵ inefficient tongue posture and function,⁶ and hyperactive gagging.⁷

Beresin and Schiesser suggested the use of the neutral zone concept^{8,9} to guide posterior denture teeth arrangement and denture base contouring. The neutral zone describes 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. Historically, different terminology has been loosely associated with this concept, including dead zone, stable zone, zone of

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minimal conflict, zone of equilibrium, zone of least interference, biometric denture space, denture space, and potential denture space.^{8,9}

With the advent of new recording materials and development of novel clinical techniques, the neutral zone technique may be incorporated with less effort and time consumption, to various edentulous conditions. This paper presents a novel technique to register neutral zone.

MATERIAL AND METHODS

A novel clinical protocol/procedure for the registration of neutral zone for complete denture cases is described below.

1. Fabricate maxillary and mandibular occlusal rims over conventional record bases using high fusing (Pinnacle, DPI, Mumbai, India) impression compound. Cover the rim surfaces that will come in contact with tongue and cheek muscle activities with low fusing (Green Tracing sticks, MAARC, Mumbai, MH, India) impression compound as the latter is easily molded and registered.
2. Register the maxillary and mandibular neutral zones separately, by swallowing technique, to avoid occlusal contact interferences during the functional recording procedure (Fig. 1).
3. Make the neutral zone indices with plaster of paris to facilitate artificial teeth arrangement (Fig. 2).
4. After trial, carefully remove modeling wax apical to denture teeth facially, lingually and palatally, leaving sufficient wax to hold the teeth in position.
5. Record denture polished surface contour by placing addition silicone impression material (Aquasil Ultra LV, DentsplyCaulk, Milford, USA) on the removed wax surfaces. Do this surface contouring in two steps:

Fig. 1 Maxillary and mandibular neutral zone records.

Fig. 2 Maxillary and mandibular teeth arrangement within neutral zone indices.

first with putty consistency silicone and then with light body silicone for precise recording (Fig. 3). Any exposed part of the putty indicates over contouring and should be trimmed before adding light body silicone again.

6. For maxillary and mandibular trial denture facial contouring, the patient was asked to pucker lips, smile broadly, open mouth wide, and move the mandible forward and side to side. For the palatal and lingual aspects, the patient was instructed to sip and swallow, perform sibilant and fricative phonetics, extend the tongue, move it from side to side and lick the lips.
7. Follow this by conventional procedures of investment, processing, finishing and polishing (Fig. 4).

Fig. 3 External surface contouring of maxillary and mandibular denture with addition silicone material.

DISCUSSION

A number of techniques relying on oral function to develop the shape of the neutral zone have been described. The swallowing impression compound technique as detailed by Beresin and Schiesser (1976), who located the neutral zone using swallowing as the principle modeling force. The softened impression compound material was adapted to the specially designed record bases and formed into the shape of an occlusion rim. The record bases were carefully placed in the subject's mouth without distorting the rim. The subject was instructed to swallow and then purse the lips as in sucking several times to define the neutral zone.

Fig. 4 Processed maxillary and mandibular complete dentures.

Next, impression generated matrices were fabricated to facilitate denture tooth arrangement within the registered neutral zone. Upon completion, wax trial dentures were made and zinc oxide – eugenol impression paste was placed between the cervical aspects of the denture teeth and peripheral denture borders on the facial, lingual and palatal surfaces of the trial dentures. This recorded functional tissue interactions on the denture surfaces. Once complete, excess impression material was removed and the trial dentures were invested and processed using conventional methods.^{8,9}

In the phonation/tissue conditioner technique (Makzoume, 1976), the record bases were seated on the edentulous ridge and tissue-conditioning material mixed in a 1:1 ratio was injected on either right or left lateral segment of the record base. The subject was asked to pronounce the phoneme “SIS” 5 times, followed by the phoneme “SO” once. Both sounds had to be pronounced clearly, loudly, and vigorously to induce sufficient muscle contraction. This phonetic sequence was repeated until the material had polymerized. The record bases were removed from the mouth and excess tissue-conditioning material extending anterior to the premolar area removed with scissors. The record bases were reinserted intra orally and the same procedure was repeated to mold the lateral segment of other side. Finally, material was injected in the anterior region and the subject was made to pronounce successively, the phonemes “DE, TE, ME, PE, SE” vigorously, until polymerization of material was complete.^{5,6}

Different thoughts are mentioned in literature for the facio-lingual positioning of artificial teeth. Weinberg¹ stated that buccal cusps and fosse of the posterior teeth should be directly over the crest of the ridge. This position was said to

result in more stability and less lateral force since the occlusal pressure on the tooth fell close to the fulcrum and created little or no torque. Hertwell and Rahn¹⁰ indicated that the posterior teeth should be positioned buccolingually on the residual alveolar ridge. Pound⁴ stated that invariably arranging the teeth over the crest of the residual ridge condemned patients to accentuated facial deformity, phonetic problems, difficult food manipulation and instability of the mandibular denture. Murray¹¹ and Watt¹² were of the opinion that artificial teeth should be positioned where the natural teeth grew. Wright et al⁶ indicated that the mandibular denture received more tongue pressure in the event of an increase in tongue size.

The neutrocentric concept requires that posterior mandibular denture teeth should be arranged to occupy as central a location as possible, relative to the denture foundation, without disturbing adequate tongue function.¹³ El-Gheriani¹⁴ recommended that posterior maxillary denture teeth should be arranged to satisfy specific mathematical formulas based on natural intercanine width. Lammie¹⁵ argued that in aging 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 may be achieved and maintained.

Artificial teeth arranged within the neutral zone achieve two important objectives: (1) prosthetic teeth do not interfere with normal muscle function; and (2) normal oral and perioral muscle activity imparts force against the complete dentures that serves to stabilize and retain the prostheses rather than cause denture displacement.⁹ Many studies have compared dentures made utilizing neutral zone technique to dentures made conventionally.^{16,17} It was shown that neutral zone dentures were functionally more stable than conventional dentures.^{16,17} The neutral zone method typically locates posterior denture teeth slightly facially, when compared to teeth arranged over the crest of the residual ridge from complete denture made by conventional waxing methods. Hand waxed denture base contours typically incorporate concavities along facial prosthetic surfaces. More frequently, however, contours resulting from physiologically molded external impressions yield generalized convexities along the facial surfaces of both maxillary and mandibular dentures, especially in the molar region.

Many techniques have been suggested utilizing impression compound,¹⁸ soft wax,¹⁹ dimethyl siloxane filled with calcium silicate,¹⁶ silicone,¹⁷ tissue conditioners and resilient lining materials^{20,21} to shape the neutral zone in conjunction with movements such as sucking,⁵ grinning, whistling,¹⁹ and pursing lips.²² All described techniques used soft wax,¹⁸ ZOE¹⁹ or tissue-conditioning materials

to record external denture base contours functionally. Our technique utilized elastomeric impression material to record the external denture base contours for recording details more precisely to enhance stability of denture bases. Further, it emphasized and illustrated 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.

CONCLUSION

The article presents the clinical significance of neutral zone for artificial teeth positioning and contouring of complete denture polished surfaces. Also, a novel technique for neutral zone registration is presented that can be incorporated precisely with less effort and time consumption.

CONFLICTS OF INTEREST

All authors have none to declare.

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