ORIGINAL RESEARCH PAPER
Volume-6 | Issue-11 | November-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

AN ANALYSIS OF NEUTRAL ZONE POSITION IN MANDIBULAR RESORBED RIDGES: A CLINICO-RADIOGRAPHIC STUDY.

Dental Science

Rimsha Ahmed* Post Graduate Student, Department of Prosthodontics and Crown & Bridge Kothiwal dental college and research center, Moradabad, India *Corresponding Author

Ravi Madan Reader Department of Prosthodontics and Crown & Bridge Kothiwal dental college and research center, Moradabad, India

Rachna Maheshwari Reader, Department of Prosthodontics and Crown & Bridge Kothiwal dental college and research center, Moradabad, India

Swatantra Agarwal Professor and Head of Department of Prosthodontics and Crown & Bridge Kothiwal dental college and research center, Moradabad, India

Rudra Kaul Sr Lecturer Department of Conservative dentistry and Endodontics IGGDC Jammu, Jammu & Kashmir, India

Vibhuti Kaul Registrar Department of oral medicine and Radiology IGGDC Jammu, Jammu & Kashmir, India

ABSTRACT

Various changes in the denture foundation take place as deminution of residual alveolar ridge occours. As the resorption increases, it becomes important to record the affect of muscles of tongue and cheek on the complete denture so that the denture becomes stable. Although a lot of studies with respect to neutral zone have been done in the recent past, but most of them have tried to relate period of edentulism to neutral zone. The current study corelated the **severity of resorption to the neutral zone** so that the arrangement of teeth in correct position can enhance the stability of the mandibular denture. This study was conducted on 30 completely edentulous patients and were divided into three groups resorption. The results of the current study indicated that as the degree of resorption increases, there is a non significant buccal shift of neutral zone posteriorly and in anterior region the shift is lingually from the centre of the crest of ridge.

KEYWORDS

Neutral zone, Polyether, Resorption, Edentulism, Stability, Mandibular teeth arrangement

1. Introduction

Techniques of complete denture fabrication, although not standardized, have met with high levels of success on part of the patient[1]. Complete dentures function inside the oral cavity under direct muscular influences offered by tongue, cheeks and lips. In order to maintain the dentures in harmony with the surrounding musculature, different concepts related to positioning of the artificial teeth and shaping of the polished surfaces have been proposed. [2-5]But continuous resorption of the residual alveolar ridge and the forces from the perioral musculature imposes challenges in determining the tooth position. So teeth should be placed in a region where the forces of the tongue pressing outwards are neutralized by forces of the cheeks and lips pressing inwards to aid in stability of denture.[2]

The extraction of teeth causes bone loss which leads to smaller maxillae and larger mandibular residual ridges. In addition, due to absence of teeth for a long time, the tongue has a tendency to enlarge in the edentulous mouth. These factors influence the bucco-lingual position of the neutral zone. [6]

The aim and objectives of the study were: 1)To determine the location of neutral zone in relation to crest of mandibular alveolar ridge. 2)To compare the location of neutral zone in patients with different degree of ridge resorption. 3)The objective of this study is to determine the bucco-lingual position of neutral zone with respect to the centre of alveolar ridge crest at anterior, premolar and molar regions on both right and left sides.

2. Materials and method

2.1.1 Patients

This study was conducted on 30 completely edentulous patients reporting to the department of Prosthodontics and Crown & Bridge, Kothiwal Dental College and Research Centre. Inclusion criteria for the subjects were as follows: Completely edentulous maxillary and mandibular arches, adequate inter arch space and patients with good neuromuscular function. Patients suffering from clinical temporomandibular joint disorders, intraosseous pathosis or defects, restricted and deviated mouth opening and neurofunctional disturbances and neuromuscular diseases were excluded from the study.

These patients were divided into three groups according to Wical and Swoop's classification based upon the severity of alveolar ridge resorption (Wical and Swoop 1974).

- GROUP 1: Up to one third of the original vertical height lost
- GROUP 2: From one third to two thirds of the vertical height lost
- GROUP 3: Two thirds or more of the mandibular height lost

2.2 Methodology:

After obtaining permission from institutional ethics and review board (Ref. No.: KDCRC/IERB/11/2014/38), the study was commenced. Over a time period of 6 months, clinically edentulous patients were randomly selected from the Out Patient Department and requested to contribute to the study as participants. Of all the subjects, some agreed to participate whereas others refused due to different reasons. A written consent was obtained from the selected patients. For the purpose of division into groups, digital O.P.G was carried out for each patient and based on the degree of resorption, three groups were made. Of all the groups, Group 2 had maximum number of patients whereas group 3 had the least. Patient selection was terminated when all the groups had 10 a minimum of subjects each.

The preliminary impressions of the maxillary and the mandibular residual alveolar ridges were made with impression compound and casts were poured with type II gypsum. After obtaining the diagnostic casts, custom trays were fabricated with autopolymerizing resin following sprinkle technique. Maxillary and mandibular border molding was carried out with green impression compound followed by final impressions with zinc oxide eugenol impression paste which were then poured in type III gypsum. A 29 guage wire was adapted to the centre of the crest of mandibular alveolar ridge. Record bases then were fabricated using autopolymerising acrylic resin by sprinkle technique and allowed to polymerize in water bath at 37^0 C and 20 psi for 15 minutes in curing pressure pot followed by the preparation of occlusal rims. Facebow transfer was carried out and vertical and centric relation records obtained. The base of the mandibular cast was made parallel to the occlusal plane of the mandibular rim and occlusal rims were then mounted on a semi adjustable articulator.

After mounting was done, wax was removed from mandibular denture

base and three blobs of modelling wax were made on mandibular recording base. Polyether impression material was used to record the neutral zone. Impression material was placed between the blobs on mandibular record base and carefully seated in patient's mouth. Patient was instructed to do swallowing, sucking and various other functional movements of cheeks and tongue along with pronouncing the words like 'eee' and 'ooo'. During the function of cheeks, lip and tongue the forces were exerted on the material molding it into the neutral zone. A 23 guage stainless steel wire was adapted and stabilized over the centre of mandibular occlusal rim and occlusal radiograph were obtained. Central rays were directed towards the centre of the cast. Radiographic parameters were 90kvp, 8mA, 20 impulses for 1 sec.

Films were viewed for relationship between images of two wires in bucco-lingual direction with the thinner wire representing crest of alveolar ridge and thicker wire denoting the centre of neutral zone. The values were recorded at five different locations i.e right premolar, left premolar, anterior, right molar and left molar region. Buccal/labial location of neutral zone with respect to ridge was assigned positive value and lingual location a negative value. When both the wires coincide zero score was given. In this way, location of neutral zone in patients with different degrees of ridge resorption was comparatively analysed.

3. Results

The Comparison of Mean Positional differences in neutral zone in relation to the centre of the crest of mandibular alveolar ridge in different Groups was made Analysis of Variance (ANOVA). There was a gradual increase in the buccal shift when the severity of resorption increased from Grade I to Grade III in left premolar region. The overall mean shift of neutral zone from the centre of the crest of the ridge for this region was 0.52±1.25mm. Whereas the total mean shift of neutral zone from the centre of the crest of the ridge for right premolar region was found to be comparable to that of the left premolar region with very slight variations. The total mean shift of neutral zone from the centre of the crest of the ridge for this region was 0.62±1.19mm. Again, a gradual increasing trend was observed in the three groups with increase in severity of resorption towards the buccal region. In right and left molar regions, the mean values of neutral zone shift from the centre of the crest of the ridge indicated a buccal shift with the increase in severity of the resorption. The total mean for this region was 0.75±1.56mm and 0.70±1.37mm for right and left molar regions respectively The buccal shift in both the areas was gradual but more as compared to the premolar region on both the sides. For left and right premolar and molar regions, statistically no significant buccal shift was observed.

In the anterior region, there was again a gradual shift of neutral zone from the centre of the crest of ridge but in a lingual direction with an overall mean shift of 0.18±2.62mm. The shift of neutral zone was found to be more lingual in Group III subjects. So, anteriorly as the degree of resorption increases, there is more lingual shift of the neutral zone.

The results of the current study indicated that as the degree of resorption increases, there is a non significant buccal shift of neutral zone posteriorly and in anterior region the shift is lingually from the centre of the crest of ridge.

4.Discussion

Bone resorption is a chronic, progressive, irreversible and disabling disease of multifactorial origin. Resorption of residual ridges is a common occurrence after the extraction of teeth and several anatomic changes invariably take place within the alveolar processes of the jaws following dental extractions. The edentulous ridges are characterized by high resorption rate following teeth extraction in the early period, followed by a remarkably slowing rate within the first year.[7] This may result in insufficient bone to accept future prosthesis. Wical and Swoope investigated the possibility of using the inferior border of the mental foramen as a reference point to estimate the original retrospective bone height of the edentulous mandible. They concluded that the relationship of the mental foramen and lower border of the mandible remains relatively constant inspite of increasing age or resorption of the residual ridge above the mental foramen. By measuring the distance from the inferior border to the lower edge of the mandible and using the approximate ratio of 3:1, original height of mandible can be estimated. Also, mental foramina are a permanent point of reference, no matter how much resorbed the ridge is.[8] It is situated in premolar areas, so act as point of transition from anterior to posterior areas.

An increase in resorption eventually leads to smaller maxillae and larger mandibular residual ridges due to shape of the basal bone. Thus the residual alveolar ridge crest changes its location in a buccolingual direction after resorption.[6] In addition, the tongue has a tendency to enlarge in the edentulous mouth. These factors influence the buccolingual position of the neutral zone (NZ). When teeth erupt in the oral cavity, they are guided into the neutral zone by the forces generated by muscles of cheek and tongue. In natural dentition arch integrity and tooth position are maintained when all the forces generated by musculature are neutralized. When all the teeth are lost, centre of the ridge is considered to be the most accepted position for placement of artificial teeth.[9] But the artificial teeth should be placed in the same relative position to the musculature as the natural teeth. [10]The term relative position rather than exact position is used because age, tonus, resorption and other factors may modify or alter the denture space and neutral zone so that the artificial teeth should not necessarily in the exact same position as natural teeth as the resorption increases. So, one should not be dogmatic and insist that the teeth should always be placed over the crest of the ridge or lingual or buccal to the ridge. The teeth should be placed as dictated by musculature. Positioning artificial teeth in neutral zone achieves two objectives. Firstly, teeth will not interfere with normal muscle function and secondly the forces exerted by denture periphery are reduced.

Beresin and Seichesser have suggested that teeth should be arranged in the neutral zone, where during function the forces of the tongue pressing outward are neutralized by the forces of cheeks and lips pressing inwards.[2] Fish in 1933 emphasied on the role of lower muscles in stabilizing the full lower dentures. According to him, the principal factor in stabilizing the full lower denture is the modelling of that part of its surface which comes in contact with the muscles of the cheek, tongue and lips. These muscles can be made to hold the denture in place while mastication. The denture must be made to fit the tongue and cheek, both in a state of rest and during mastication. So, it is important to understand the role of muscles so that the flanges can be fashioned in such a manner that they would not interfere with the muscular movement.

While recording the neutral zone, assesment of vertical dimension is important because [12] a) The width of the neutral zone is minimum at the level of the occlusal plane and increases gradually as it goes up and down.b) The width of the neutral zone is also minimum at the posterior (molar) region and increases gradually towards the anterior. c) The width of the neutral zone increased as the vertical dimension of occlusion increases and decreases as the vertical dimension of occlusion decreases.

Some authors have suggested the use of maxillary rim while recording the neutral zone whereas others are not in the favour of the same. Although a lot of authors have advocated the recording of Neutral Zone without maxillary rim, importance of recording neutral zone with maxillary occlusal rim cannot be overlooked. Use of Maxillary rim while recording jaw relation helps to: a) Maintain the correct vertical dimension.[13] b) Neutral zone is a three dimensional cubical space so using maxillary rim while recording it becomes important. Therefore, for this study maxillary rim was used while recording the neutral zone.
A shift of neutral zone in molar and premolar regions on both the sides with the increase in degree of resorption may be attributed to the reason that the tongue is a muscular organ which is free ended on one side. It has a tendency to enlarge in the edentulous mouth. Transformation from a dentulous to edentulous state causes about one tenth increase in size which results in more pressure to the mandibular denture lingually.

In anterior region as the resorption reaches to a severe level, the level of ridge crest falls below the former origin of the superior fibres of mentalis muscle. Lammie [14] has shown that in order to maintain its area of origin, the muscle attachment folds over the resorbing alveolar ridge and comes to lie on its superior surface which results in the reduction of neutral zone anteriorly. Also, in old denture wearers the mentalis muscle becomes hyperactive. So, this hyperactivity may result in lingual positioning of the neutral zone. The influence of lip on mandibular denture becomes more critical as resorption of the ridge increases or as the patient becomes older as patient applies more force labially to stabilize the denture. All these factors result is a lingual

positioning of the Neutral Zone which may indicate the need to place the mandibular anterior teeth more lingually.

Although the results of this study showed that neutral zone lies buccally posteriorly and lingually anteriorly as the severity of resorption increases, but a lot more studies are required with a larger sample size to further reach to more substantial results.

5. Conclusion

The following conclusions were drawn from the present study:

1. The position of neutral zone region shifts slightly bucally in molar and premolar regions on both right and left sides.
2. In anterior region shift of neutral zone is more towards lingual region.
3. More the resorption, more buccal shift of neutral zone in molar/premolar regions and more lingual shift was seen in anterior regions.
4. The findings of this study may be useful in arranging artificial teeth for mandibular complete dentures. Slight buccal positioning of teeth in posterior regions and lingual positioning in anteriors till the esthetics permit can be done.

6. References

1. Waliszewski M. Restoring dentate appearance: A literature review for modern complete denture esthetics. J Prosthet Dent.2005; 93: 386-94.
2. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. J Prosthet Dent 1976;36:356-67.
3. Payne AGL. Factors influencing the position of artificial upper anterior teeth. J Prosthet Dent 1971;26:26-32.
4. Pound E. Lost fine arts in the fallacy of the ridges. J Prosthet Dent 1951;1:98-111.
5. Heartwell CM, Rahn AO. Syllabus of complete dentures. 4th ed. Philadelphia: Lea & Febiger.
6. Atwood DA. Reduction of residual ridges: A major oral disease entity. J Prosthet Dent 1971;26:266-79.
7. Atwood DA. Some clinical factors related to rate of resorption of residual ridges. J Prosthet Dent 12; 1962: 441 – 450.
8. Gabriel A.C. Journal of Anatomy. Some anatomical features of the mandible. 92(4): 582-86.
9. Winkler S. Essentials of complete denture Prosthodontics. 2nd ed. St. Louis: Mosby; 1988.22-38.102-103.
10. Fish EW. Using the muscles to stabilize the full lower denture. J Am Dent Assoc 1933;20:2163-9.
11. Fish EW. Principles of full denture prosthesis. 5th ed. London. 1952: Staples press limited; 32-101.
12. Razek M, Abdalla F. Two-dimensional study of the neutral zone at different occlusal vertical heights. J Prosthet Dent 1981;46:400-84.
13. Agarwal S, Gangadhar P, Ahmad N, Bhardwaj A. A simplified approach for recording neutral zone. J Indian Prosthodont Soc 2010;10(2): 102-104.
14. Lammie GA. Aging changes in the complete lower denture. J Prosthet Dent 1956;6:450-64.
15. Brill N, Tryde G, Cantor R. The dynamic nature of the lower denture space. J Prosthet Dent 1965;15:401-16.
16. Cagna DR, Massad JJ, Schiesser FJ. The neutral zone revisited: From historical concepts to modern application. J Prosthet Dent 2009;101:405-12.
17. Fahmi FM. The position of the neutral zone in relation to the alveolar ridge. J Prosthet Dent 1992;67:805-9.
18. Roraff AR. Arranging artificial teeth according to anatomic landmarks. J Prosthet Dent 1977;38:120-30.
19. Raybin NH. The polished surface of complete dentures. J Prosthet Dent 1963;13:236-41. Rinaldi P, Sharry J. Tongue force and fatigue in adults. J Prosthet Dent. 1963;13(5):857-865.
20. Schiesser FJ. The neutral zone and polished surfaces in complete dentures. J Prosthet Dent 1964;14:854-65.
21. Weinberg LA. Tooth position in relation to the denture base foundation. J Prosthet Dent 1957;8:398-405.
22. Wical KE, Swoope CC. Studies of residual ridge resorption Part I. Use of panoramic radiographs for evaluation and classification of mandibular resorption. J Prosthet Dent. 1974;32:7-12.
23. Wright CR. Evaluation of the forces necessary to develop stability in mandibular denture. J Prosthet Dent 1966;16:414-30.
24. Tuckfield WJ. The problem of the mandibular denture. J Prosthet dent 1953;3(1):8-28.