## Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies **NLM ID:** 101716117

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 91.86

(e) ISSN Online: 2321-9599;

(p) ISSN Print: 2348-6805

Case Report

# Role of reducing denture weight and incorporating neutral zone in maintaining balanced occlusion

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#### ABSTRACT:

Conventional complete denture prosthesis undergoes tooth wear on occlusal surfaces with due loss of balancing and working contacts established at the time of denture insertion. Other factors, like water sorption and polymerization shrinkage that are dependent on the bulk of acrylic resin contribute to loss of occlusal contacts over a period of time. Incorporation of the neutral zone and the hollowing of denture has never been attributed to maintenance of balanced occlusion. We present a new clinical technique along with a modified denture insertion and follow up protocol to overcome these difficulties. An elderly male patient was selected for the clinical technique. First the neutral zone was recorded in which artificial teeth were arranged. This was followed by hollowing out the permanent denture base using one of the many techniques described in the literature. The denture was stored in water for a period of seven days before delivering to the patient. On the day of denture delivery, a clinical remount was undertaken to refine the balanced occlusal contacts were still functional in the patient's mouth. The patient was highly comfortable and satisfied with the outcome of the treatment. **Keywords:** dead space, occlusion, hollow denture, stability, complete denture

Received: 16 February, 2022

Accepted: 19 March, 2022

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This article may be cited as: Razdan S, Jamaal TS, Bhatnagar RK, Shetty SAS, Bhat A, Karir S. Role of reducing denture weight and incorporating neutral zone in maintaining balanced occlusion. J Adv Med Dent Scie Res 2022;10(4):73-76.

## **INTRODUCTION**

Natural teeth, be it deciduous or permanent occupy a particular position within the oral cavity, a position that is compatible with surrounding musculature. The natural tooth despite having long roots embedded deep into the bone can be either tipped or moved bodily if the crown of the tooth does not fall in line where the surrounding musculature has to accomplish its functional activity. One of the most complex functional units of the body is the masticatory system, the mechanical activity of which itself is so extraordinarily designed keeping in mind the muscles are bilateral which are attached to a single bone (mandible). <sup>1,2</sup> Functional activities in the form of swallowing, speech, laughing or mastication therefore needs a synergistic action of surrounding musculature. The space where there is a balance of this synergistic muscular activity has been referred to as dead space, minimal conflict zone, neutral zone.<sup>3</sup> Its importance has been rather focussed mainly on the position of artificial teeth within the complete denture

prosthesis and most of the emphasis has been laid on its advantage of improving denture retention and denture stability. This zone of minimal conflict is altered in abnormal conditions like facial paralysis, hemiplegia etc.. <sup>4</sup> Its relation and significance to occlusion has never been thought of. A complete denture prosthesis should have adequate bulk to improve strength, because it is basically made of a plastic that can be customized into any shape. The life of a complete denture prosthesis has been termed as a maximum of 5 years (4 years ideal) after which it should be remade to accommodate changes in underlying foundation. <sup>5</sup> Minimal uses of denture and providing a balanced occlusion are meant to preserve the residual alveolar ridge for the future. <sup>6,7</sup> Because the teeth and denture is made of plastic, all plastic materials tend to wear with friction. Despite being biocompatible, the denture plastic can alter in shape upon taking hot or cold food/beverage. 8 Therefore, maintaining balanced contacts in a denture is difficult unless the occlusal surface is prepared that of metal.<sup>9</sup>

More than wear, the dimensional changes that occur in denture base resins due to water sorption are perhaps one of the biggest threats to maintain balanced occlusion. Because water sorption occurs maximum in the first few weeks, that is why it has been recommended for frequent follow up appointments initially. <sup>10</sup> More the amount of resin within the denture, more is the amount of water sorption, which in turn are detrimental to maintain balanced occlusion contacts. If at least these above mentioned two factors are controlled are achieved within the fabrication of the denture, long term maintenance of balanced occlusal contacts can be readily achieved. In short, the balanced occlusal contact in a denture will remain for a long time in the relationship that is desired by the technician.

This article represents a combination of two critical factors that is arranging teeth within neutral zone followed by locating their occlusal surface within the zone and reducing the bulk of the complete denture prosthesis to decrease the weight of the denture which in turn will result in less warpage and/or distortion of complete denture prosthesis.

## **CASE REPORT**

An elderly completely edentulous male patient reported to the department of Prosthodontics with a chief complaint of difficulty in eating food due to the complete absence of teeth. The patients' medical history was unrelated to the treatment, while his social and personal history also did not impact the choice of treatment or its accompanying procedures. Extra oral examination presented normal features while intra oral examination disclosed a healthy oral mucosa with appropriate completely edentulous residual alveolar ridges (Fig 1a). Occlusal vertical dimensions were appropriate with no reduction of lower third of the face. The patient was presented with various treatment options that included an implant supported fixed complete denture or an overdenture for both arches, single arch or either of the arch, a conventional complete denture with/without balanced occlusion. Due to economic viability the patient consented to the fabrication of complete denture with balanced occlusion. For effective and long term maintenance of balanced occlusion, we decided to incorporate the neutral zone and hollow out both dentures. Routine clinical and laboratory procedures were performed till jaw relations, at that stage the mandibular denture base (Fortex; Lucite Intl, Durham) was modified to incorporate three retentive custom modified stainless steel wire (Pigeon Dental stainless steel, India) so as to hold green stick impression compound (Pinnacle, DPI) (Fig 1b). The denture base was tried in the patient's mouth (Fig 1c) followed by recording of neutral zone using one of the techniques that utilizes impression compound as the recording material (Fig 1d). After recording the jaw relations, the teeth were arranged in balanced occlusion using anatomic teeth

(33 degrees) (Efucera AC, Yamahachi Dental CO, Japan) (Fig 2a, b). Once the trial denture was approved by the patient and his close associate, the maxillary and mandibular dentures were sent for processing of a hollow denture.

In the laboratory, the hollowing of the denture was performed using a non-setting putty (Fig 2 c) which was later removed after processing cycle was completed (Fig 2 d). All openings through which the putty was removed were sealed using self-cure denture base repair resin (Major C&B-V Dentine, Major, Moncalieri, Italy) and the denture was evaluated for leakage (Fig 2e). Both dentures were placed in normal water at room temperature for a period of 7 days before they were considered fit to be delivered. On the day of insertion, a new centric relation record was made using interocclusal records (Take 1, Kerr, Romulus, MI, USA) and both dentures were mounted on an articulator. Occlusal contacts were adjusted to provide an already

Figure 1: (a) Intra oral view of the patients mandibular residual alveolar ridge showing a unilateral undercut on the lingual side (b) Maxillary occlusal rims and mandibular denture base modified to hold impression compound (c) Modified denture base trial (d) Molded compound mandibular rim



Figure 2: (a) and (b) Trial dentures showing balanced contacts on working and non-working side (c) Denture processing for hollowing out the denture (d) Material removed from within the denture (e) Denture placed in water to absorb maximum water before denture delivery (f) Maxillary and mandibular dentures when worn by the patient



incorporated balanced occlusion within the denture. Both dentures were inserted and the simultaneous and

even contacts evaluated in centric and eccentric positions (Fig 2 f). The patient was provided with verbal and written instructions and placed on a follow up (1 day, 3 months, 1 year). At all follow up visits till a period of 18 months, there were no changes in the occlusal contact positions, thus affirming the presence of balanced contacts that have been maintained over the years.

## DISCUSSION

A case of an elderly patient has been reported in this article. The main feature of this article is relating the neutral zone and hollow denture to establishing and maintaining balanced occlusion in the denture. The technique of recording the neutral zone and hollowing out dentures is same as described in the previous literature. <sup>11,12</sup> The importance of locating occlusal surfaces within the dead space is straight forward and simple. The teeth for balanced occlusion are not placed parallel to the occlusal plane, rather each cusp is placed at different level than the other and each tooth is placed at another level than adjacent tooth to incorporate curves within the occlusion (curve of Spee, curve of monsoon).<sup>13</sup> If the curves are not incorporated, the chances of achieving balancing contacts during protrusion and excursion are minimized. While incorporating the curve by changing the inclination of the coronal portion of the artificial tooth, one must keep in mind that the tooth after being inclined should not encroach out of the neutral zone. <sup>14</sup> This is especially important for maxillary anterior teeth. The anterior teeth are placed within the profile contour of the occlusal rims that have been previously established for the patient. Even a slight increase in inclination towards the labial side to accommodate balancing contact from the mandibular teeth can result in denture becoming useless. The same may not apply for posterior maxillary or mandibular teeth, yet the freedom of placing the teeth away from the neutral zone stands minimal. To eliminate such a situation, the maxillary anterior teeth should be placed in the final position after which any interfering contacts on the palatal and incisal surface should be selectively ground to accommodate a balance from mandibular anteriors. The tissue surface of the complete denture prosthesis is in direct contact with the surrounding musculature, therefore it should accommodate the inner slopes of the falling tissues like a drape that does not tend to dislodge or move the denture. <sup>15</sup> In cases where the muscles are paralyzed like bell's palsy, the muscles may not or may continuously apply forces on the tissue surface thus hampering denture stability. <sup>16</sup> In some other clinical conditions like ankyloglossia, the tongue may be limited by applying or balancing muscular forces coming from opposite musculature. <sup>17</sup> One of the limitations of developing balanced occlusion on a semi adjustable or non-adjustable articulator in which the guidance's (condylar and anterior) are not accurate can be overcome by recording functional movements within the occlusal rims. This technique has been discussed in details a functional chew in method. <sup>18</sup>

Denture base acrylic resin has the inherent disadvantage of polymerization shrinkage during processing and water sorption when stored in water or while functioning in the oral environment. While many changes may not be evident in patients suffering from xerostomia, <sup>19</sup> such patients are rarely encountered in daily clinical practice. The amount of shrinkage and water sorption are dependent upon the bulk of acrylic that is used. <sup>20</sup> Either of the two can lead to loss of balancing contacts as well as hyper occlusal contacts resulting in denture instability and residual ridge resorption. The basis of removing maximum acrylic resin by hollowing out the denture has both advantages and disadvantages. While it reduces the amount of shrinkage and water sorption, the denture becomes weak, especially in its impact strength, <sup>21</sup> Therefore it is imperative to caution patient about denture strength.

In this case we also modified denture delivery appointment. The respective dentures were stored in water for a period of 7 days, in order to effectuate cause deliberate maximum water sorption. This allows changes due to sorption to occur before carrying out the clinical remount which is necessary to refine occlusion at denture delivery appointment. While laboratory remount was done immediately after denture processing, the clinical remount is meant to refine occlusal contacts after water storage. The follow up protocol also needs modification in such case.

## CONCLUSION

An innovative clinical technique incorporating neutral zone concept and hollowing out the denture has been described. The efficacy of such types of clinical approach needs to be established through further research. Maintaining balanced contacts in denture occlusion is a challenge and needs attention.

#### ACKNOWLEDGEMENTS

We would like to appreciate the efforts of various postgraduate students of the department of Prosthodontics whose name may not be among the authors but have contributed during treatment of the patient.

#### **CONFLICT OF INTEREST**

None as declared

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