

# The Neutral Zone: Concept and Technique

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## ABSTRACT

When all of the remaining natural teeth are removed; there exists within the oral cavity a void that may be called the potential denture space. The denture space is bounded by the tongue, medially or internally, and by the muscles and tissues of the lips and cheeks laterally or externally. Within the denture space, there is an area that has been termed the neutral zone.

The 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. Since these forces are developed through muscles contraction during the various functions of chewing, swallowing and speaking, they vary in magnitude and direction in different individuals and in different periods of life. The way these forces are directed against the dentures will either help to stabilize them or will tend to dislodge them.

In summary, the neutral zone philosophy is based on 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 at the same time, where the forces generated by the tongue are neutralized by the forces generated by the lips and cheeks. Furthermore, denture stability is as much or more influenced by tooth position and flange contour as by any other factors.

**Keywords:** Denture space, Stability, Neutral zone.

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## INTRODUCTION

The goal of dentistry is for patients to keep all of their teeth throughout their lives in health and comfort. If the teeth are lost despite all efforts to save them, a reestablishment should be made in such a manner as to function efficiently and comfortably in harmony with the muscles of the stomatognathic system and the temporomandibular joints.

The lower denture commonly presents the most difficulties with pain and looseness being the most common complaint.<sup>1</sup> This is because the mandible atrophies at a greater rate than the maxilla and has less residual ridge for retention and support.<sup>2</sup> The neutral zone technique is most effective for patients who have had numerous unstable, unretentive lower complete dentures. These patients usually have a highly atrophic mandible and there has been difficulty in positioning the teeth to produce a stable denture.<sup>3</sup>

## REVIEW OF LITERATURE

Various theories have been put forward to enhance stability of mandibular denture. Majority of literature support that

posterior denture teeth should be arranged to occupy the position of their natural tooth predecessors<sup>4-8</sup> or posterior denture teeth should be arranged directly over the crest of the edentulous ridge.<sup>9-13</sup>

Weinberg<sup>14</sup> suggested that buccal cusps and central fossae of mandibular posterior denture teeth should be arranged directly over the crest of the edentulous residual ridge.

Pound<sup>15,16</sup> recommended that the lingual surfaces of mandibular posterior denture teeth should occupy an area bounded by two lines originating from the mesial surface of the mandibular canine and extending posteriorly to the lingual and buccal aspects of the retromolar pad.

Lammie<sup>17</sup> suggested that mandibular posterior denture teeth should be arranged over the buccal shelf to provide increased tongue space and to facilitate the development of vertical facial polished surfaces, against which an effective facial seal can be achieved and maintained.

Wright et al<sup>18</sup> believed that posterior mandibular denture teeth should be arranged directly over the center of the denture stress-bearing area. This location may not correlate with the crest of the edentulous ridge, particularly in the presence of severe ridge atrophy.

Campbell<sup>19</sup> stated that mandibular posterior denture teeth should be arranged slightly lingual to the crest of the edentulous ridge, while the maxillary posterior denture teeth should be arranged slightly buccal to the edentulous ridge.

Neutral zone is defined as the potential space between the lips and cheeks on one side and the tongue on the other; that area or position where the forces between the tongue and cheeks or lips are equal.<sup>20</sup> It is also known as dead zone<sup>21</sup>, stable zone<sup>22</sup>, zone of minimal conflict<sup>22</sup>, zone of equilibrium<sup>23</sup>, zone of least interference<sup>24</sup>, biometric denture space<sup>25</sup>, denture space<sup>26</sup> and potential denture space (Fig. 1).<sup>27</sup>

The 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. Since these forces are developed through muscles contraction during the various functions of chewing, swallowing and speaking, they vary in magnitude and direction in different individuals and in different periods of life.<sup>28</sup> The way these forces are directed against the dentures will either help to stabilize them or will tend to dislodge them.

The more ridge loss, the less area of the denture base and the less influence impression surface area will have on the stability and retention of the denture. As the surface

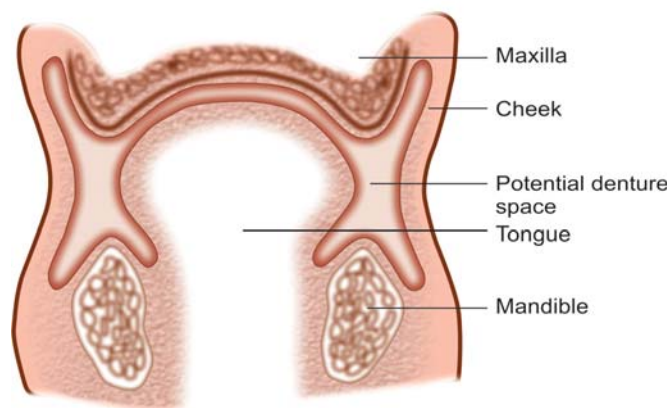


Fig. 1: Potential denture space

area of the impression surface decreases and the external surface area increases, the development and contour of the external surface become more critical.

The polished surfaces of the denture must exhibit a series of inclined planes in relation to the muscles of the tongue and cheeks. The palatal surface of the upper denture looks inward and downward, while the lingual surface of the lower denture looks inward and upward.<sup>29</sup>

The forces on the external surface are constantly changing in magnitude and direction during swallowing, speaking and mastication. It is only when the mouth is completely at rest that the forces are constant.

If a person's teeth were in contact all the time, the external surface would be relatively unimportant in denture stability. Conversely, if a person never brought his teeth into contact, the occlusal surface would be relatively unimportant and the stability would be dependent on the forces on the external surface as transmitted to the impression surface.

The only time teeth are in contact is during mastication and swallowing. This means that the patient will only make tooth contact during normal function. But the lips, cheeks and tongue are constantly in function. This stresses the significance of the horizontal forces exerted by the lips, cheeks and tongue.

It seems reasonable that when the dentures are made, the artificial teeth should be placed in the same relative position to the musculature as the natural teeth. The term 'relative position' rather than 'exact position' is used because age, tonus, ridge resorption and other factors may modify or alter the denture space and neutral zone so that the artificial teeth should not necessarily be in the exact same position as the natural teeth.

Fahmi<sup>30</sup> investigated neutral zone in relation to the crest of the residual ridge in the anterior, premolar and molar regions. He found that the position of the neutral zone in relation to the alveolar ridge was found to be highly affected

by the period of edentulousness. The longer period of edentulousness, the more buccally or labially located was the neutral zone.

## CLINICAL AND LABORATORY PROCEDURES

After a thorough examination of the patient, stock trays are selected for the patient. Primary impressions of the maxillary and mandibular ridges are made with modelling compound. While making the impressions, the patient is asked to do the functional movements, including sucking and swallowing movements. There should be minimal displacement of tissues, while making impressions. After acceptable impressions are made, they are poured in plaster.

### Construction of the Acrylic Base

The acrylic base to be made in the neutral zone approach in complete dentures has to serve two purposes. On this acrylic base, occlusion rims will be constructed that will be formed and molded by the patient to locate the individual's neutral zone and to establish a tentative vertical dimension and centric relation. Its second purpose is to serve as a tray for the final impression which is obtained by a closed mouth procedure. It is, therefore, extremely important that the primary impression be carefully and meticulously developed so that the resultant tray is accurate and stable.

### Manipulation of Compound

To develop the body of the denture and register the neutral zone by the use of modeling compound, there are three important factors to be considered. First, the compound must be very securely attached to the tray. Second, the compound must be thoroughly and uniformly softened for the muscles to mold the material. Third, it must be hard enough so that it will not flow and will maintain its shape as an occlusion rim until inserted into the mouth for forming the neutral zone. The consistency of the compound should be similar to that used when making a primary impression. Instead of impression compound, low fusing green sticky wax or the mixture of two<sup>31,32</sup> can be used to record the neutral zone depending on operator's choice to modify the properties.

A water bath, preheated to the adequate temperature, is used to soften the material. It is then kneaded and rolled into 'U' shaped and adapted on the temporary denture base. A Hanau torch can be used to heat and sear the compound so that it will completely adhere to the tray. The compound is tempered in the water bath. This keeps the compound soft so that it can be molded. Repeated flaming, tempering and shaping keep the compound soft, while it is shaped into the form of an occlusion rim.

## Locating the Neutral Zone

To locate the neutral zone for the lower arch, the patient's lips are lubricated with petroleum jelly. The tray with the softened modeling compound is rotated and carefully seated. Care must be used so that the lips do not press against the compound until it is completely seated. The patient is instructed to swallow and then purse the lips as in sucking. Most patients will swallow without any problem. However, some patients will have difficulty in swallowing correctly. With these patients, it is necessary to practice before they can deliver a proper swallow on command. The practice or instructional procedure is as follows:

1. Remove the compound rim from the mouth and instruct the patient to swallow. If the patient swallows correctly several times, explain that this is exactly what should be done when the material is put into the mouth. If the patient does not swallow correctly, instruct the patient to keep the lips together and swallow as if swallowing a bolus of food.
2. If difficulty still persists, place a few drops of water on the tongue by means of a syringe to help the patient swallow.
3. Once the patient has swallowed correctly several times, resoften the compound and proceed in locating the neutral zone.

It is important to instruct the patient to keep the lips together and swallow. We should not tell the patient to close and swallow. By doing so, the patient may overclose and press the compound into the maxillary ridge, distorting the compound. If there are repeated impressions of the maxillary ridge onto the compound, the patient is either overclosing during swallowing or too much compound has been used. Proper swallowing actions will mold the compound rim into the neutral zone. Sufficient time is allowed for the compound to harden and it is then removed from the mouth and inspected.

If initially an excessive amount of compound is used, it will be forced upward above the normal height of the occlusal plane and because of excessive bulk of compound, the tongue, lips and cheeks will be unable to mold the compound into a neutral zone of proper width. Therefore, any excess compound above the usual height of the occlusal plane is removed with a sharp knife and the compound is resoftened, placed back in the mouth and the patient is instructed to suck and swallow. If additional compound has been pushed up, it should be reduced and the procedure repeated until the functions of swallowing and sucking no longer force the compound to an excessive height.

In all cases, the compound will exhibit similar shapes and contours, but there will be definite differences for each

patient. The lingual surface of the compound rim will be shaped to the contour necessary to avoid interference with functional tongue movements. The anterior segment of the compound rim may have a labial, straight or lingual inclination depending on the tonus of the muscles in the lower lip and also the action of the tongue during swallowing. The buccal surface will generally be inclined to the lingual with a narrowing in the bicuspid area where the modiolus functions. The lingual surface will be inclined to the buccal.

## Testing the Stability of Occlusion Rims

The occlusion rims are placed back into the patient's mouth and checked for stability by having the patient open wide, wet the lips with the tongue, count from 1 to 100, and say exaggerated 'oh' 'ahs' and 'ees'. If these movements raise the rim, the lack of stability must be caused by an improper molding of the compound, as the tray or base was proved to be stable. So, the lack of stability is because of the compound on the base rather than the base itself. In such cases, the compound is resoftened and the procedure is repeated until a stable rim is achieved.

The next procedure is to test the outer edge of the rim with the tip of the index finger in the bicuspid and incisor regions. If pressure on the outer edges causes the opposite side of the rim to lift up, then the rim must be narrowed from the labial or buccal to where the vertical pressure will not cause the rim to tilt. This will occur where there has been extensive ridge resorption and where the residual ridge is narrow buccolingually and labiolingually. If this is not corrected and the teeth placed at this position, then the vertical forces as in mastication will tilt the denture.

After the labial contour and curvature of the occlusion rim have been established and if the width of the anterior section is thicker than the incisal edges of the anterior teeth, the occlusion rim should be narrowed by trimming from the lingual.

The final test is to have the patient speak, swallow, wet the lips and open wide without the rim moving or being dislodged. We have therefore created a tray or base that is not dislodged by muscle function and have placed on it a body that is also not displaced by muscle function.

## Final Impressions

To achieve optimum success in complete denture prosthesis, the dentures should be both retentive and stable. The retention of a denture is mainly dependent on the accuracy of the impression and fit of the denture base to the tissues.



Impression techniques can be either closed mouth or open mouth. Both these can be incorporated into the neutral zone approach, but a closed mouth technique is preferred. The advantages with the use of a closed mouth technique are as follows:

- A more accurate functional molding of the borders can be obtained, especially in the lower arch.
- By having the patient to close gently and swallow, there is more even distribution of pressure and impression material with less likelihood of excessive pressure in one area or another.

### Fabrication of Tongue, Lip and Cheek Matrices

Prior to construction of the matrices, the casts must be indexed so that the matrices will fit back into their proper positions. Several circular holes are made on the labial and buccal surfaces of the cast and a cross is made in the tongue area of the lower model.

With the lower occlusion rim in place, the lower model is lubricated and stone is placed on the lingual portion of the model, forming an artificial tongue and, on the labial and buccal of the lower model, completely encasing the occlusion rim. These matrices are trimmed to the exact height of the lower occlusal plane, which was established in the mouth. This preserves the height of the lower occlusal plane. The same is done for the upper model and occlusion rim.

After the stone is set, the labial and buccal matrices are split in the middle to facilitate removal. When two occlusion rims are now removed, the matrices can be placed back into position. Instead of stone, rubber base putty can also be used to form the matrices<sup>26</sup> (Fig. 2).

The space between the matrices on the lower rim represents the neutral zone and indicates where the teeth should be positioned. The matrices on the upper indicate the outer limits of the neutral zone and serve as a guide for positioning the upper anterior teeth (Fig. 3).

After selection of the proper size, occlusal morphology and material of the posterior teeth to be used, we go in for the positioning or arrangement of teeth. The following are a step by step sequence for arrangement of anterior and posterior teeth:

1. The lower anterior teeth are set to the height of the labial matrix and to the labial limit of the neutral zone.
2. The upper anterior teeth are set against the labial limits of the upper matrix.
3. The lower posterior teeth are set against the tongue matrix and against the template occlusally.
4. The upper posterior teeth are set to the buccal limits of the neutral zone.

5. The upper posterior teeth will have to be rearranged to assure maximum contact with the lower posterior teeth.
6. The upper and lower posterior teeth are checked for the buccal and lingual relationship to each other.
7. In order to avoid an edge to edge relationship which might lead to check biting, the lower posterior teeth may be moved buccally within the neutral zone, resulting in a crossbite relationship.

### The Trial Denture

After the verification and correction of the stability, retention, vertical dimension, phonetics, centric relation and esthetics are done. There is an important step to be completed during the trial denture tryin is the making of external impressions on the labial, buccal and lingual surfaces of the dentures. These will determine the thickness, contours and shape of the polished surfaces of the denture. With conventional complete dentures, the technician or dentist

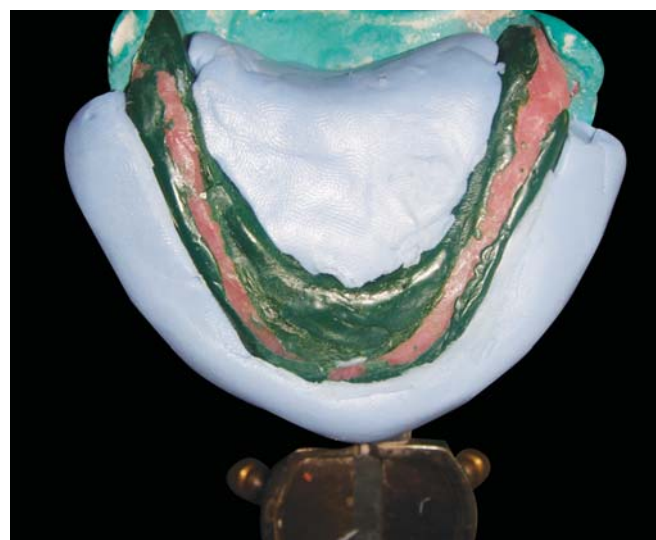


Fig. 2: Construction of matrices

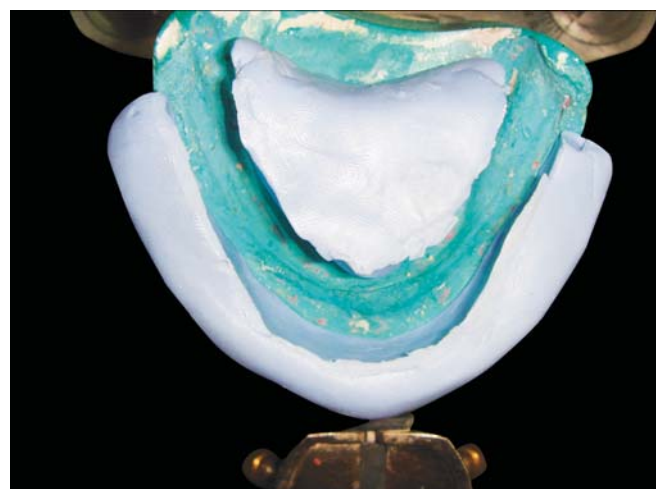


Fig. 3: Potential denture space

empirically waxes the external surface. By means of external impressions, a physiologic molding is made so that the external surfaces are functionally compatible with muscle action.

The trial denture acts as a tray to be used for the accurate secondary impression for forming the contours of the external surface of the denture. The trial dentures are waxed up so that there is just enough wax to hold the tooth in position. The materials for the external impressions are either zinc oxide eugenol, one of the conditioning materials or light body addition silicone impression material.

Both the upper and lower trial denture external impressions are done in two steps, either the labiobuccal and then the lingual or palatal, or vice versa.

The impression material is placed on the lingual surfaces of the lower denture, between the necks of the teeth and the denture periphery. The upper trial denture is placed in position, and the lower is then rotated into the mouth, taking care not to wipe off any material on the lips. With the lower trial denture in position, the patient is asked to close, purse the lips as in sucking and swallow. This is repeated several times. After the material has set, the trial dentures are removed from the mouth, and the gross excess is cut away. The impression material is then placed on the buccal and labial surfaces of the lower trial denture, and sucking and swallowing motions are repeated (Fig. 4). The same procedure is then followed for the upper external impressions.

The impression on the lingual of the lower trial denture will frequently result in a very large and extensive ledge in the anterior region. This should be duplicated exactly in the processed denture. Experience has shown that practically all patients do tolerate these contours which rarely have to be reduced. As a matter of fact, these ledges seem to help to retain the lower denture. The tongue sits on these ledges and helps to keep the lower denture in position.



Fig. 4: External impression of polished surface

Another important reason for using this procedure is that it tends to minimise the accumulation of food on the external surface of the denture. With the use of external impressions proper contours, which eliminate or minimize food accumulation, are developed. The external impression tends to fill out the denture space, thus making it easier for the cheek to push the food back onto the occlusal surfaces of the teeth. Finally, by duplicating these impressions in the final denture, the operator has reproduced functionally contoured external surfaces of the denture that will aid immeasurably in the retention and stability of the dentures.

### Processing of the Dentures

The laboratory procedures for investing, packing and processing of the dentures using the neutral zone technique are generally the same as for conventional dentures. However, because of the materials used for the external impressions, it is necessary to be especially careful in some of the procedures.

When zinc oxide eugenol paste has been used for taking the impression of the polished surface, the flasks should not be allowed to remain in the boil-out tank for more than 5-minute. Reason being the zinc oxide eugenol paste gets liquefied, if left for a longer time. This results in bleached appearance of the processed denture.

After the dentures are being processed, they are mounted on the articulator. Occlusal discrepancies are checked for with the template and carbon paper. They are corrected, the dentures are finished, polished and insertion is done.

### CONCLUSION

The neutral zone philosophy is based on 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, at the same time, where the forces generated by the tongue are neutralized by the forces generated by the lips and cheeks.

In other words, we should not be dogmatic and insist that the teeth should always be placed over the crest of the ridge, or lingual to the ridge or buccal to the ridge. Placement of the teeth should be dictated by the musculature and will vary for different patients.

The neutral zone has not been given enough importance, in the literature but as a determinant of occlusion, it cannot be ignored. Complete and partial denture failures are often related to noncompliance with neutral zone factors.

Regardless of the method of treatment, any part of the dentition out of harmony with the neutral zone will result in instability, interference with function or some degree of discomfort to the patient. Thus, the neutral zone must be

considered as an important factor while rehabilitating the edentulous patients. The operator should try to neutralize forces acting on complete dentures, which will make the prostheses more functionally physiologically and psychologically acceptable to the patient.

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