

## Comprehensive approach for highly resorbed mandibular ridge with complete denture

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### ABSTRACT

A 66-years-old female patient was referred to Dental Hospital of Hasanuddin University with a fractured lower denture that impaired patient's masticatory ability. Clinical examination showed full edentulous in both maxilla and mandible with flat mandibular ridge, absence of inflammatory signs, flabby tissues, and bone prominences as well. The treatment plan was fabrication of complete denture with semi-adjustable articulator and modification in impression technique in order to produce retentive dentures. Preliminary impression and fabrication of anatomic cast followed by bolder molding and physiological impression. Two-dots method was used to determine the maxillomandibular relation and measure vertical dimension. Position of the maxilla was transferred using facebow, which attached to the centric tray followed by mounting the cast on a semi-adjustable articulator with guidance from centric tray. Artificial teeth were arranged in lingualized occlusion scheme on wax-pattern and try-in was done. After processing, remounting and selective grinding were performed followed by *finishing and polishing*, and lastly with insertion of both dentures. It is concluded that impression technique is one of the primary factors in management of flat mandibular ridge in order to utilize surrounding tissues to have both active and passive retention in dentures.

**Keywords:** flat mandibular ridge, impression of flat ridge, complete denture, lingualized occlusion

### INTRODUCTION

Bone resorption occurs following tooth extraction, and if atrophy occurs, it'll be followed by excess bone resorption that causes decrease of distance from mental foramen to alveolar ridge crest. Alveolar ridge crest that underwent resorption will eventually form flat or concave ridge. Excessive resorption of alveolar crest leads to flat ridge due to loss of cortical plate layer.<sup>1</sup>

Continuous excessive resorption is problematic due to its effect that compromises full denture function and thus creating disbalanced occlusion. According to Atwood, resorption on mandible is four times bigger than in maxilla. Although resorption rate of alveolar bones varies from individuals. Highest resorption occurs 6 months after extraction of anterior teeth. Three years following extraction, resorption on maxilla is lower than on mandible.<sup>1</sup>

Ridge with severe atrophy will cause increase in interarches distance, denture instability, and unretentive denture with an inability to withstand masticatory pressure. Treatment for individual with atrophic ridge is a challenge faced by dentists around the globe due to the nature of severe ridge resorption that will cause difficulties in the process of making adequate denture. Severe-atrophy ridge often found in the mandibular residual ridge than the maxilla because the supporting tissue in the mandible is less than that in the maxilla; hence resorption in the mandible occurs in a faster rate than that in the maxilla.<sup>1</sup>

Along with age, physiological changes also ari-

se in the oral cavity. Physiological changes in the oral cavity experienced by elderly patients are 1) changes in oral mucosa. Increasing age causes epithelial cells in the oral mucosa to experience thinning, reduced keratinization, reduced capillaries and blood supply, and thickening of collagen fibers in the lamina propria. As a result, clinically the oral mucosa appears paler, thinner and dry, with a slow healing process. This causes the oral mucosa to be more easily irritated by pressure or friction, which is exacerbated by reduced salivary flow;<sup>1</sup> 2) changes in arch size. Most of the aging process is accompanied by osteoporotic changes in the bones. Studies demonstrated that axial inclination of the teeth in the human skull, followed by loss of teeth, is one of the reasons for the initial reduction in the alveolar bone height. Generally, the maxillary teeth are directed downwards and outward, thus the reduction of bone generally also occurs upwards and inwards. Due to this, the outer cortical plate of bone is thinner than the inner one. Resorption of the outer part of the bone cortical plate takes place more and more rapidly, thus, the maxillary arch will be reduced to a smaller size in all dimensions and also the surface of the tooth base will be reduced. In the mandible, the inclination of the anterior teeth is generally upward and forward from the occlusal plane, whereas the posterior teeth are more vertical or slightly tilted lingually. The outer surface of the bone cortical plate is thicker than the lingual surface, except for the molar area, also the lower edge of the mandible is the

thickest cortical layer, so that the bite rim direction of the mandible looks more lingually and downward in the anterior region and buccal in the posterior region. Resorption in the mandibular alveolar bone occurs downward, backward, and then forward. There were changes in the muscles around the oral cavity, the relationship between the interarches distance, and changes in the space of the mandibular and maxillary positions;<sup>1</sup> 3) alveolar rim resorption. Bone will experience resorption where atrophy is always excessive.<sup>1</sup> Excessive resorption of the mandibular alveolar bone causes the mental foramen to approach the crest of the alveolar ridge.<sup>2</sup> Alveolar crest that underwent resorption will form flat or concave ridge with knife edged shaped crest. Excessive resorption at the crest of the alveolar bone results in a flattened ridge due to loss of the cortical layer of bone. Excessive and continuous ridge resorption is problematic because it causes poor complete denture function and imbalance occlusion. The main risk factors for this resorption are the degree of previous bone loss, excessive occlusal forces during mastication and bruxism.<sup>3</sup> Residual alveolar ridge resorption has been put forward in many theories and research results. The resorption in the mandible is four times that of the maxilla.<sup>4</sup> The greatest resorption occurred in the first six months after the extraction of the upper and lower anterior teeth. After three years, the resorption was very small compared to the mandible; 4) changes in salivary flow. Many elderly patients receive medication or develop systemic diseases that also affect salivary function and may lead to dry mouth or xerostomia. Reduced salivary flow will interfere with denture retention, because it reduces the salivary adhesion bond between the denture base and soft tissues and causes mucosal irritation. This situation causes decrease in the ability to use dentures to and leads to lower masticatory ability, denture fitness is reduced, the patient's sensitivity to friction from dentures increases.<sup>1</sup>

In the case of the lower jaw with a flat ridge due to resorption, muscles attachments are located at the top of the ridge thus it will easily cause dentures to move and dislodge. The fabrication of complete dentures in the lower jaw with a flat ridge has its own problems in achieving good and satisfactory results. Difficulties were mainly found in obtaining the retention, stabilization and support of complete denture. In case of continuous resorption of the alveolar ridge, facial muscles namely the lips and cheeks, are ultimately unsupported and tend to fall into the oral cavity. At the same time the tongue enlarges to fill the space previously occupied by teeth and

alveolar bone. Furthermore, a space will be formed in the oral cavity in edentulous ridge, which is called denture space. Resorption of the alveolar ridge will reduce the amount of mucoperiosteal attachment to the bone thus reducing buccal and lingual vestibular space. These changes make it difficult for the clinician to distinguish anatomical and functional boundaries of the oral cavity.<sup>5</sup>

Resorption in the lower jaw will cause flat ridge because muscle attachments are located at the alveolar crest. These conditions greatly affect mandibular complete denture where reduced vestibulum will cause difficulty for the clinicians to distinguish anatomical and functional boundaries of the oral cavity. There are several ways to overcome these problems during mandible full denture fabrication. For example, by performing lingual sulcus deepening and vestibuloplasty to create beneficial ridge shape that will provide good supporting area for dentures. However, patients often suffer disadvantage due to various side effects after undergoing surgical procedures, namely postoperative deformation, anesthesia and neuralgia pains. In addition to vestibuloplasty, denture implants can also be made in patients with flat ridges. However, this method is performed on patients who really meet both local and general indications. In addition, the surgical steps carried out in the process of making these implants can also cause various side effects and failures, such as trauma on mental nerve and jaw fracture. Seeing the various side effects that can occur in the methods described above, in order to obtain satisfactory mandibular complete denture, a special impression technique can be used to understand and look for various retention possibilities from the location of the muscles around the denture. The main effect of mandibular alveolar ridge resorption on complete dentures is retention of denture. Muscle bundles located at the top of the ridge cause great dislodging force. The effect of these forces on retention and stability of dentures, as described above, is closely related to the impression technique used. A good denture will have good retention if it is produced from a good impression. However, the shape and size of the ridges affect retention and stability of complete dentures, with radical changes in the edentulous mandibular arch due to resorption, impression techniques used in the fabrication of complete dentures will not produce the expected results.<sup>5</sup>

Impression technique is one of the most important stages in the fabrication of a mandibular complete denture with flat ridges to get adequate results, and can be performed in two stages; the

initial and then functional impression. Functional impression is intended to record the supporting tissue structure and form a peripheral seal well. This situation provides maximum retention and stability of the denture. Impression on flat ridge is intended to take advantage of all possibilities of tissue fixation both active and passive in dentures. As previously described, alveolar bone with flat ridges is inferior for retention and stability in complete dentures. Muscle attachments are located close to the crest of the ridge and cause a very large dislodging force on denture. For this reason, the limits of muscle movement and the space in which the denture can be extended without removing the denture must be accurately recorded on the impression. Impression like this can be obtained from the dynamic impression method. Dynamic impression technique is an impression technique that can record movable muscle in mucosal area for the extension of the denture border without causing the denture to be dislodged. The advantages of dynamic impression technique are avoiding dislodging effect in the form of an improper denture border, and utilizing as much active and passive tissue fixation. These advantages are a direct result of the impression material being formed by functional movements of the muscles and muscle attachment along the border of the denture base. In dynamic impression technique, the impression is formed by the functional activity of muscles and muscle attachments, thus clinicians do not really need to do as many estimations as in conventional technique. Estimation for posterior extension or lingual flange extension according to Schreimokers suggestion are not required in the dynamic impression technique.<sup>5</sup>

### Dynamic impression

This impression technique maximizes the support aspects of denture base with two approaches, namely functional and anatomical. Impression is acquired using close mouth technique and for the last phase, open mouth technique is performed to acquire anatomical support.

Step by step procedures are 1) fabricate both maxillary and mandibular occlusal rim on diagnostic model and individual tray; 2) both maxillary and mandibular occlusal rims should be occluded to acquire vertical dimension. It is imperative to note that both rims are occluded without any inclination; 3) after acquiring correct occlusion and vertical dimension, border extensions should be performed using tissue-conditioning materials. Lingual border can be formed by asking patients to do specific tongue movements such as touch the cheeks

and touching upper lips with patient's tongue. Physiologic movement should also be recorded in this step by instructing patient to say 'ooo' and 'eee' as they occlude the rims. It should be noted, for the first application the conditioning material it must be applied in a thicker consistency to obtain maximum expansion; 4) repeat step number 3 as many times possible to obtain desired border extension. Each repetition, conditioning material applied should be in a thinner consistency compared to the first on. Remove excessive border extension using warm knife. Overextended impression tray border could be identified by observing which area causes the impression tray to be dislodged during normal mandibular movement; 5) after proper border molding and extension with conditioning material were finished, final impression should be made using polysulphide rubber with open mouth technique and proper border molding scheme. This process minimize pressure during closed mouth impression and produce better surface; 6) beading and boxing is not necessary for this type of technique because it is a tedious and time-consuming process. Cast should be poured immediately to avoid tissue conditioner and polysulphide distortion.

### Sublingual impression technique

This impression is intended to obtain the horizontal extension for the lingual flange up to sublingual area to obtain adequate retention and stabilization from nearby muscles. Stabilization force obtained from muscle is obtained from the tongue muscles, which hold the denture in place by leaning on the lingual flange. In addition to muscle forces, there is also atmospheric power obtained from the border seal due to the expansion of the base.

Step-by step of this impression technique are 1) first impression using irreversible hydrocolloid or compound impression material; 2) fabrication of individual tray, after study model is obtained, it is then outlined covering labial, buccal and sublingual areas. In sublingual areas, relief should be made with 3 mm thick wax. Afterwards, individual tray is fabricated using baseplate wax or self-curing acrylic followed by baseplate trimming. The borders of lingual flanges should be localized in moveable grooves between sublingual floor and sublingual eminence. Similar procedures should also be conducted for buccal and labial area; 3) next, muscle trimming is performed, in the lingual area of the impression tray material is added to record the border of the periphery and then functional movements are carried out so that the genioglossus and frenulum muscles can be free, then patient is ins-

structed to stick their tongue out. The formation of a margin in this area should provide a good border seal for adequate retention when the patient opens the mouth and moves the tongue; 4) lastly, physiological impression is carried out, beforehand holes should be drilled on individual tray in areas that need pressure-relief. Then the zinc oxide eugenol impression material that has been mixed well, is applied to an impression tray and inserted into the patient's mouth. In this position, a swallowing motion is then performed to activate the lingual paraprosthodontic muscular system. Next, the patient is asked to make relief on the lingual frenulum and the genioglossus muscle. Lateral movements should also be performed to record movement of the floor of the mouth. After that the cast is poured to make a working model.

**CASE**

A 66-year-old female patient (Fig. 1) came to the Unhas Dental Hospital with a complaint of a broken lower denture that made it difficult for the patient to chew food (Fig. 2). The patient has been using full denture 21 years ago. The patient wants to have a new denture made so that he can chew food properly again.



Figure 1 Extraoral profile photograph



Figure 2 Intraoral photograph



Figure 3 Border moulding and physiological impression

**MANAGEMENT**

First, it was done anatomical impression and fabrication of anatomical model. Then fabrication of physiological impression tray, border moulding, and physiological impression. Individual tray was fabricated using acrylic; border molding was performed by imitating functional movements using

green stick compound; physiological impression using PVS impression compound (Fig. 3). Then, it was done beading, boxing, and working model fabrication (Fig. 4).

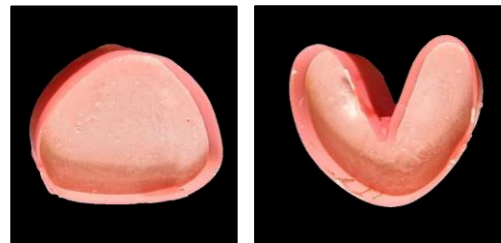


Figure 4 Beading and boxing of physiological impression followed by making working model

After fabrication of base and bite rim, it was followed by performed measurement of upper bite rim height, adjusting labial fullness, parallelism, determination of vertical dimension, determination of centric relation and fixation the rims.

The bite rims were fixated, then removed from the patient's mouth and placed on the working model, which were then mounted into a semi-adjusted articulator via facebow transfer to articulator (Fig. 5). Mounting to articulator, artificial teeth arrangement, and try in (Fig. 6)



Figure 5 Facebow transfer to articulator

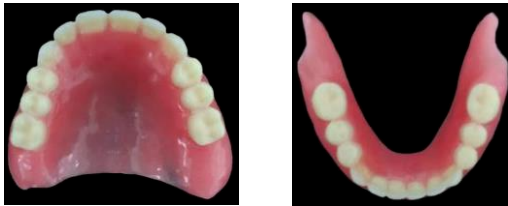


Figure 6 Artificial teeth arrangement and try-in

Arrangement of the artificial teeth using concept of lingualized occlusion due to the fact that mandibular posterior ridge is flat, thus this occlusion scheme was selected to minimize pressure in the area. Anterior teeth were arranged just like normal anterior teeth arrangement; in this case, upper and lower incisor relation was as follow overbite = 0 mm, overjet = 1-2 mm; mandibular teeth arrangement

was set in a way that matches the upper arrangement. Posterior teeth were arranged as non-anatomical teeth on lower posterior area and upper molars palatal cusp contacts central mandibular molar fossa during occlusion.

Denture processing flasking, packing, curing, deflasking, finishing, and polishing and remounting. Laboratory remounting to check if there were any occlusal changes after processing and clinical remounting was performed when checking centric relation (Fig.7).



**Figure 7** Acrylic model

At try-in and insertion stage, denture inspection (Fig.8), that is borders to ensure there wasn't any sharp area, denture adaptation using PIP (Fig. 9), retention and stability were checked, and occlusion and articulation were checked.



**Figure 8** Try-in and occlusion inspection



**Figure 9** Tissue adaptation and insertion

Post insertion instructions were told to the patient, to maintain oral and denture hygiene, wear dentures continuously for the first 24 hours for adaptation, clean dentures under running water, remove dentures at night to give supporting tissue some rest, when removed dentures should be kept in a container whilst keeping the dentures in damp condition.

At first control I (one day after insertion), a thorough inspection of the dentures and oral cavity were performed, that is inspecting if there was any erythematous areas, If tissue irritation occur the flanges or intaglio of dentures that caused it were trimmed; retention, stability, occlusion, articulation, phonetic and esthetic were checked (Fig.10). The patient was instructed to maintain oral and den-

ture hygiene, use denture only to chew soft food, avoid hard and sticky food, remove denture before going to sleep, clean denture under running water, keep denture in a container whilst ensuring that dentures are in damp state and come for a second control visit 3 days after the first control visit.



**Figure 10** First control visit after insertion

At control II (three days after insertion, examination were performed; subjective examination that is patient has no complaint wheter retention, stability, occlusion, phonetic, or esthetic, and there were no any part that cause irritation or discomfort; objective examination that is no complaint, no gingival irritation. The patient was instructed to maintain oral and denture hygiene, use denture only to chew soft food, avoid hard and sticky food; remove denture before going to sleep; clean denture under running water; keep denture in a container whilst ensuring that dentures are in damp state; come for a third control visit 7 days after the first control visit.

At control III, examination were performed like subjective examination: patient has no complaint wheter retention, stability, occlusion, phonetic, or esthetic, and there weren't any part that cause irritation or discomforts; objective examinations: no complaint, no gingival irritation. The patient was instructed to maintain oral and denture hygiene, use denture only to chew soft food, avoid hard and sticky food; remove denture before going to sleep, clean denture under running water, keep denture in a container whilst ensuring that dentures are in damp state, periodic control every 6 months to check if there's any problem

## DISCUSSION

Impression technique is a vital step in the fabrication of a complete denture for a patient with flat mandibular ridge to ensure adequate results. Impressions are usually done in two steps, which are preliminary impression and functional or secondary impression. Functional impressions aim to record the supporting tissue structure and form

a peripheral border that can cover the border seal well. This situation provides maximum retention and stability of the denture. Impression for the flat ridge should aim to take maximum advantage of all possible of tissue fixation both active and passive for fabricating dentures.<sup>6</sup>

It is concluded that difficulties were mainly found in obtaining the retention, stabilization and support of the complete denture. Therefore, the impression is one of the main factors in the success of the denture with a flat ridge by utilizing the surrounding tissue to have active and passive retention.

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