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CASE REPORT

Modified Suction-Effective denture technique for mandibular flat ridge

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Keywords: Closedmouth impression, Mandibular flat ridge, Suction denture, Suction-effective method

ABSTRACT

Aging is a universal, progressive physiological process affecting all living organisms, leading to the loss of bone, bone mineral density, and muscle in humans. The rate and extent of musculoskeletal decline vary due to factors such as diet, systemic diseases, medications, and clinical interventions. Prolonged denture use can lead to atrophy of the residual alveolar ridge, particularly in cases of a flat mandibular ridge, where achieving adequate denture retention and stabilization is challenging. Proper impression techniques play a crucial role in addressing this challenge. This report aims to describe the management of complete dentures in cases of mandibular flat ridges using a modified suction-effective method. A 70-year-old female presented for a complete denture following the extraction of her last upper left tooth. She had previously used removable partial denture around 3 years ago but has not used them since. Clinical findings revealed significant bone loss in the mandible, sufficient spongy tissue on the sublingual area, and panoramic examination classified the mandibular cortical index and bone density as C2. A centric tray was used to record the vertical dimension to fabricate the bite rim used for closed-mouth impression. Lingualized occlusion scheme was then used during denture fabrication to achieve a more stable denture. The suction-effective denture is an enhanced method for achieving retention and stability in patients with flat mandibular ridge. Creating a good peripheral seal on all borders is crucial to achieve the suction effect, which can be facilitated through proper planning and impression technique. (IJP 2025;6(1):1-5)

Introduction

Tooth loss has always been an issue all over the world, especially on elderly patients. Somehow it is an inevitable phenomenon due to aging, and it can cause several problems such as decrease in the masticatory function, speech, profile and affect social aspect in the individual, which eventually leads to reduction of their quality of life.[1] Anatomic changes on the alveolar ridge will always occur following dental extractions. Once teeth are extracted, the whole distribution is changed. Alveolar bone can only tolerate masticatory load to a certain extent. By time, the long term-effect of denture wearers is the atrophy of the residual alveolar ridge or what so called reduction of residual ridge (RRR).[2] The most common problem in treating edentulous patients, especially in elderly patients, is the highly resorbed mandibular ridge.[3] The rate of resorption is related to anatomic, metabolic, functional and prosthetic factors, which involve the osteoblast and osteoclast, where mandible is twice more prone to resorb compare to maxilla. The lower residual ridge is classified by the amount of remaining alveolar bone:[4]

Class I: Alveolar ridge have an adequate height for denture support and able to resist lateral movement of the denture; Class II : Alveolar ridge has undergone some resorption, but still have enough bone to resist lateral shift of the denture; Class III: Alveolar ridge is almost or completely resorbed, where there is little or no resistance to lateral movement of the denture.

This report aims to describe the management of complete denture in case of mandibular flat ridge using a modified suction-effective method.

Case Report

A 70 years old female patient came to the Prosthodontic Clinic at Universitas Indonesia Dental Hospital to make complete denture. The patient has undergo her last tooth extraction on the upper left and had a history of using partial removable denture around 3 years ago but not been used since. She also has a history of diabetes and osteoarthritis, but are under control with routine medication taken. She wants to make a complete denture on both arch to improve her masticatory and aesthetic function. There were no abnormalities found on the extraoral examination. On the intraoral examination was found a fully edentulous ridge on both arch, with a quite significant bone loss and low ridge on the mandible with sufficient spongy tissue on the sublingual area. As it shown in figure 1, for the upper arch residual ridge was ovoid in every region with a sufficient height on the vestibulum. For the mandibular, the residual ridge was flat on the posterior lower left and right, with an tapering ridge and irregular surface on the anterior area.

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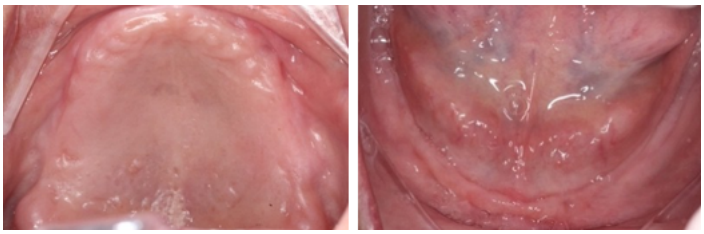

Figure 1. Intraoral condition

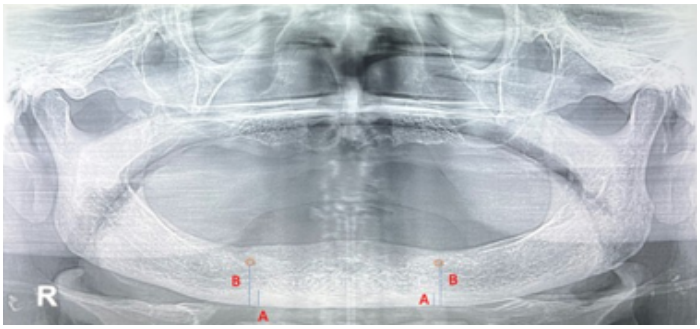

Figure 2. Panoramic radiograph

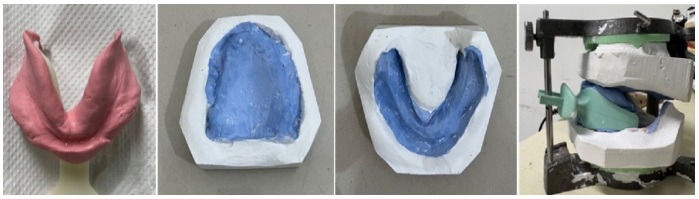

Figure 3. Mandibular ridge preliminary mpression with FCB tray ; study model and mounted on articulator with centric tray

Figure 4. Border moulding and result of result of close mouth impression

Figure 5. Vertical dimension measurement and facebow transfer

From the panoramic examination shown in figure 2, the distance from alveolar ridge to the maxillary sinus is 2mm and the distance from foramen mental to the lower alveolar ridge is 5mm. Mandibular cortical width on the left side was 6mm with PMI score 0.35 while the right side 7mm and PMI score 0.41. In summary, the density of the bone was classified as C2.

The first visit was to get the anatomical impression of the upper and lower arch and the preliminary vertical dimension occlusion (VDO). The preliminary impression of the mandibular ridge was taken with a frame cut back tray (Accutray, Ivoclar USA) and two consistency of alginate, the first one was the low viscous with high water ratio and injected into the mandibular ridge with the help of 10cc syringe, and the normal consistency was applied to the FCB tray. The result of the impression can be seen on Figure 3. Meanwhile for the maxillary ridge was taken with edentulous stock tray and normal alginate consistency. Frame cut back tray was chosen due to the mandibular atrophic ridge condition and can capture the anatomical condition for such case. The preliminary VDO was taken with the help of centric tray (Ivoclar, USA) and putty impression material and then mounted on the non-adjustable articulator (Handy II, Shofu, Japan) prior to fabrication of the custom individual tray figure 3.

On the second visit, the VDO was measured once again to reassure the occlusion vertical dimension. Border moulding was done arch by arch with green stick compound and close mouth technique, with passive and active movement done by the patients and with the help of the operator. Final impression was taken directly for both arch with the close mouth technique and light body polyvinylsiloxane impression material figure 4.

Beading and boxing was done to make sure all the borders can be seen clearly in order to fabricate the second bite rim. The second bite rim was made from the working model and the patient came again for the third visit to measure the correct vertical dimension and to do a facebow transfer figure 5. Midline, canine, and smile line was also marked on the bite rim prior to the tooth arrangement procedure.

Working cast was mounted on the semi-adjustable articulator (Bioart Articulator A7 Plus). Teeth arrangement was done with an occlusal scheme of lingualized occlusion and arranged directly for the anterior and posterior teeth due to patient's condition and limitation. The fourth visit agenda was to try in the teeth arrangement figure 6, record the neutral zone, and taking protrusive and lateral record to adjust the condylar and Bennett angle on the articulator.

For the final step, we do the gum cuffing, making post dam, packing, finishing, and polishing the denture is ready for insertion.

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Figure 6. **Try in teeth arrangement**

Figure 7. **Denture insertion**

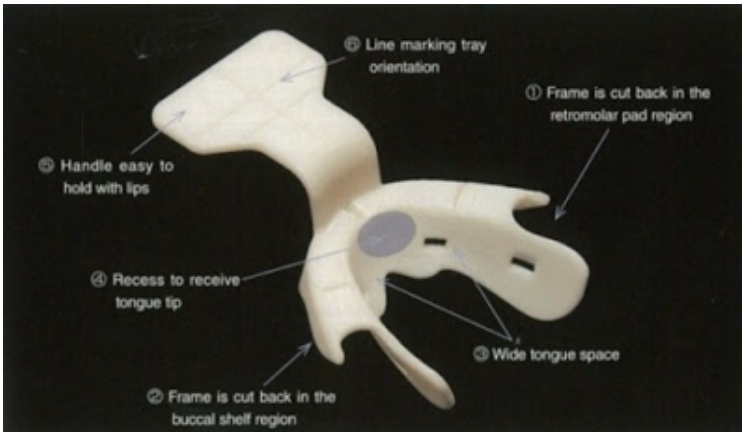

Figure 8. **Frame cut back tray**

Figure 9. **Preliminary VDO with centric tray**

Discussion

Residual ridge resorption is a complex biophysical process following dental extraction. Rapid resorption usually occurs in the first year after tooth extraction and progressively slower by time. Compromised ridges may be broadly classified as atrophic ridges, flabby ridges, knife edge ridges, and abused ridges. Atrophic ridges usually leads to an unstable and non retentive dentures because of its inability to bear the masticatory load.[5] Patient who has flat ridge and wear dentures often felt pain and discomfort due to vertical and horizontal movement.[6] A proper preliminary impression is needed to help fabricate the custom individual tray prior to the mucofunctional impression. It is important to obtain the maximum support area and peripheral seal, especially for such case where the patient have flat or atrophic ridges.[7] Frame cut back tray is a prefabricated tray with a special design used for flat ridge fully edentulous patient. The design itself enables the operator to capture the depth of the retromylohyoid due to its flange extension on the lingual area and the open area on the distal part of the tray helps to capture the retromolar pad under rest position and not deformed figure 8.[8]

There are basically two methods to record the VDO with the centric tray. The first one is by using the free way space method and the second method is to train the patient to blow air from the mouth. Since this is not the final VDO we want, it is determined 2-3mm above the patient's actual VDO to help fabricate the custom individual tray figure 9.[9] The centric tray was originally made by Ivoclar to link with the Stratos semi-adjustable articulator, but in this case we improvised by using the non-adjustable articulator Handy II to make the custom individual tray with wax rim according to the preliminary VDO. The bite rim individual tray was then prepared for the functional impression.

In suction-effective method, it is important to identify anatomical landmark from the diagnostic cast. There are 8 points the operator needs to understand:[9] Identify and mark the retromolar pads; Avoid the sinew string; Draw a line at the most inferior point of the buccal shelf; The line enters the retromylohyoid fossa passing 2-3mm beyond the mylohyoid muscle line; Avoid buccal frenulum; Avoid mentalis muscle attachment; Avoid the median inferior labial frenum; Draw a line on the convexity and avoid lingual frenum.

Sinew string is a mucosal string forms at the buccal root of the retromolar pad, posterior to the second molar, resembling a frenum or wrinkle figure 10.[10] It is somehow visible in only 10-20% of the edentulous patients. Somehow it is believed that the role of this string is to pull the buccal mucosa strongly inward during the swallowing process and it contributes the formation of BTC (buccal-tongue contact) point.[9]

After understanding the key points and anatomical landmark, fabrication of the custom tray should be easier:[9]

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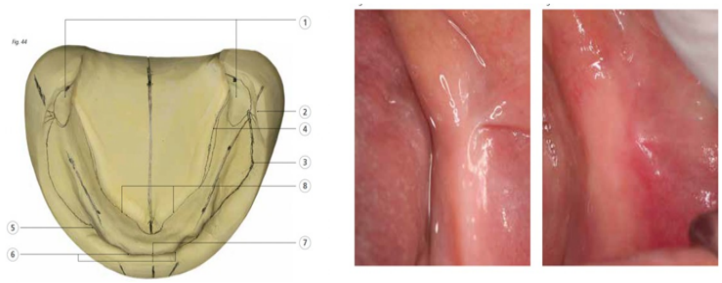

Figure 10. Anatomical landmark and outline ; intra oral image of sinew string

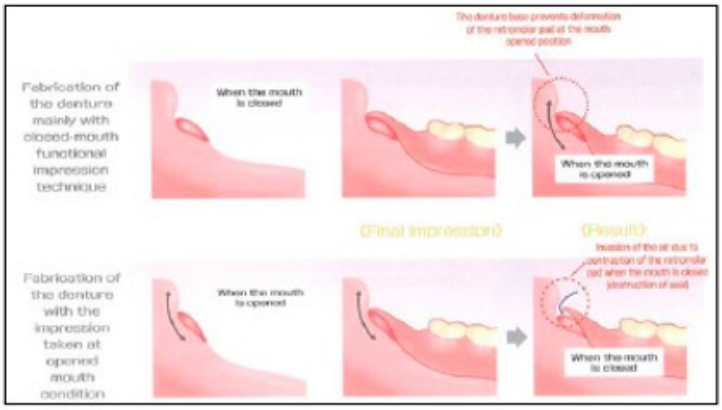

Figure 11. Illustration of the retromolar pad condition when mouth is open and closed

Figure 12. Normal occlusion, A. Lingualized occlusion, B. Lingualized occlusion in lateral movement

Cover the entire retromolar pad with a thin layer of resin; Sinew string must be avoided; Polished surface should be given a concave shape, especially on the second molar to the retromolar pad region; Wax rim should be positioned in the middle of alveolar ridge or in the neutral zone (buccolingually); Lingual polished surface should be shaped in such way to provide adequate space for the tongue; Mandibular anterior polished surface between lateral incisor should be given a concave shape.

The thickness of the tray itself should be sufficient enough especially in the sublingual fold region that can ensure a strong suction effect combined with the spongy tissue of the patient, and the labial region to ensure sufficient lip support.[9]

Basically, different materials can be used to record the border of the denture, such as with low fusing impression compound, waxes, elastomeric materials, acrylic resin, and tissue conditioner.[11] The most common materials used for border moulding are either the heavy body (elastomer material) using the one step or single step technique and the sectional technique with the green stick compound. For the maxillary arch, resistance to upward and forward force of the handle indicates a good posterior peripheral seal (PPS), while the resistance towards the downward, buccal, and lateral force of the handle indicates a good labial border extension and seal. For the mandibular tray, resistance towards the downward and forward indicates a good seal of the posterior area, and resistance of the upward force of the handle indicates a good labial border extension and seal.[12]

Close mouth impression technique is a method that rely only on the patient's movement. Patients need to fully understand and follow the instructions. This technique has advantage the advantage to minimalize the chance of over and under extension of the flange because the impression is done in an occluding position (optimal border moulding) and can record the the ridge in functional pressure. Meanwhile the disadvantage of this technique is it can cause pressure to the underlying structure, that it is contraindicated on flabby tissue.[13] The illustration shown on Figure 11 about the deformities of retromolar pad that can happen in open mouth impression. This method can create a negative pressure that seals the denture border all around.[14,15]

With the help of silicone adhesive and light body impression material, it can be done arch by arch or both arch together while the patient is instructed to say "woo", "eee", and instruct to move the tongue to the left and right. Patient is also instructed to swallow and make all movements while in the close mouth position.[9]

Retention and stability of the denture does not rely solely from the impression technique. The concept of occlusion for complete denture has to give an aesthetic yet a good masticatory efficiency, and the most important thing is the stability of the denture itself while in function.[16] An optimal occlusal scheme is essential to achieve a stable, retentive, and supporting denture. The fully bilateral balanced articulation (FBBA) has been considered as the ideal occlusal scheme for conventional complete denture.[17] As the residual ridge resorb to the point where ridge is classified as flat or atrophic, consideration in occlusal scheme plays an important role. In conventional denture setup, both buccal and lingual cusp of the upper and lower denture contact on the working side in lateral movement. This achieve the goal of bilateral balance occlusion and distributes the bite force as wide as possible to the jaw. On the contrary, lingualized occlusion is an occlusal scheme developed to enhance denture stability in patients with flat ridge. It somehow eliminate the stress of lateral force by eliminating the contact on the buccal cusp.[18,19] This occlusal scheme is developed to maintain the

masticatory mechanical function with the use of anatomic teeth on the upper jaw and semi or non anatomic teeth on the lower teeth.[20]

Lingualized occlusion is indicated in cases where high priority on aesthetic but a non anatomical tooth is needed, severe residual ridge resorption, class II jaw relationship, flabby supporting tissue, and when a complete denture opposes a removable partial denture. Few advantages of lingualized occlusion are figure 12:[19,20] Good cutting efficiency with a combination of anatomic and semi or non anatomic tooth; Limited amount of lateral forces due to small area of contact between maxillary palatal cusp and zero degree of mandibular teeth during lateral movement; Can be used for a variety of residual ridge conditions.

After combining all the technique from preliminary impression to the final tooth arrangement, the delivery of the complete denture results in satisfactory of the patient. The denture have a good retention and stability regarding the severely resorbed mandibular ridge. Few days after the insertion the patient was still adapting to the denture and several adjustment was done on the retromylohyoid flange due to its overextension intentionally made to compensate the complete seal, and patient can fully adapt after seven days of insertion.

Conclusion

Mandibular flat ridge has always been a challenge due to it's improper anatomical condition to maintain a stable and retentive denture. Mandibular suction effective method is a technique developed especially for such cases, differ the conventional method from the preliminary impression until the functional impression. Closed-mouth impression helps in capturing the intraoral condition under rest and functional movement. Modification of this technique such as the use of border moulding material and semi adjustable articulator can be used as long as we understand the basic concept of the technique, from the anatomical landmark to the practical technique that needs to be done. Lingualized occlusal scheme is basically just another concept that can increase the stability of the denture due to it's ability to minimalized the lateral force by using a combination of anatomical and semi or non anatomical teeth. For whatever the occlusal scheme chosen, the main goal is to achieve a retentive and stable denture which can restore both aesthetic and function for patients.

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