

# Comprehensive Prosthodontic Treatment of an Elderly Patient with Compromised Ridges: A Clinical Case Report.

Tratamiento prostodóntico integral de un paciente anciano con proceso alveolar comprometido: Informe de un caso clínico.

Nada Fathalla Abdelbagi.<sup>1</sup>  
Ibrahim Ahmed Ismail.<sup>1</sup>  
Fadia Awadalkreem.<sup>1</sup>  
Mohammed Nasser Alhajj.<sup>1,2</sup>

#### Affiliations:

<sup>1</sup>Department of Oral Rehabilitation, Faculty of Dentistry, University of Khartoum, Khartoum, Sudan.

<sup>2</sup>Department of Prosthodontics, Faculty of Dentistry, Tamar University, Dhamar, Yemen.

**Corresponding author:** Mohammed Nasser Alhajj. Department of Oral Rehabilitation, Faculty of Dentistry, University of Khartoum Khartoum, Sudan. **E-mail:** [m.n.alhajj@hotmail.com](mailto:m.n.alhajj@hotmail.com)

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**Abstract:** **Introduction:** The objective of a complete denture prosthesis is restoring aesthetics, comfort, and function by the replacement of missing dental and alveolar structures employing a stable prosthesis. **Case Report:** Many conditions can complicate the treatment plan and fabrication of a complete denture prosthesis. Complete denture fabrication in clinically compromised conditions is a challenging task for the dentist. In this clinical report, we present comprehensive management of a patient with denture-induced hyperplasia, flabby ridge, and severely resorbed edentulous ridge. The three-part strategy for management of the above-mentioned challenges can provide high-quality complete dentures, based on recognized prosthodontic principles. This first part will discuss the management of denture induced hyperplasia by elimination of the inflammation and excision of the lesion. Part two will cover management of the flabby ridge using a modified window technique for the impression of maxillary flabby tissues for an improved and controlled application of the impression material that is usually obtainable in dental practice. Part three highlights the rehabilitation procedure of the resorbed mandibular ridge using a functional impression technique with minimum soft tissue displacement and neutral zone arrangement of teeth to improve stability of the denture. **Conclusion:** rehabilitation of a patient with denture induced hyperplasia, flabby ridge, and severely resorbed edentulous ridges was successful.

**Keywords:** *mouth rehabilitation; denture induced hyperplasia; alveolar process; denture, complete; oral surgical procedures, preprosthetic; laser.*

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**Resumen:** **Introducción:** El objetivo de una prótesis completa es restaurar la estética, la comodidad y la función mediante el reemplazo de las estructuras dentales y alveolares faltantes empleando una prótesis estable. **Case Report:** Muchas condiciones pueden complicar el plan de tratamiento y la fabricación de una prótesis completa. La fabricación completa de la dentadura en condiciones comprometidas clínicamente es una tarea desafiante para el dentista.

En este reporte de un caso clínico, presentamos el manejo integral de un paciente con hiperplasia inducida por dentadura postiza, cresta flácida y cresta edéntula severamente reabsorbida. La estrategia de tres partes para el manejo de los desafíos mencionados anteriormente puede proporcionar prótesis completas de alta calidad, basadas en reconocidos principios protésicos. La primera parte discutirá el manejo de la hiperplasia inducida por dentadura postiza mediante la eliminación de la inflamación y la extirpación de la lesión. La segunda parte cubrirá el manejo de la cresta alveolar flácida utilizando una técnica de ventana modificada para la impresión de tejidos flácidos maxilares para una aplicación mejorada y

controlada del material de impresión que generalmente se obtiene en la práctica dental. La tercera parte destaca el procedimiento de rehabilitación del reborde mandibular reabsorbido utilizando una técnica de impresión funcional con un desplazamiento mínimo de los tejidos blandos y una disposición de la zona neutra de los dientes para mejorar la estabilidad de la dentadura. **Conclusion:** La rehabilitación de un paciente con hiperplasia inducida por dentaduras postizas, cresta flácida y reabsorbida fue exitosa.

**Palabras Clave:** *rehabilitación bucal; hiperplasia inducida por dentadura; proceso alveolar; dentadura completa; procedimientos quirúrgicos pre protésicos orales; rayos láser.*

## INTRODUCTION.

The aged community is rapidly growing, and their dental complications are likewise increasing.<sup>1</sup> Many factors can complicate the treatment plan and/or fabrication of a complete denture prosthesis. These problems may arise following the insertion of complete dentures and, if not well handled, they may lead to serious oral conditions that could result in the patient being unable to tolerate dentures. A poorly fitted prosthesis can lead to complications such as pain, discomfort with mastication, and speech, in addition to tissue abuse.<sup>2</sup>

One of the most common tissue reactions to a persistently poorly fitted denture is the occurrence of tissue hyperplasia along the denture borders.<sup>1</sup> Denture induced hyperplasia (DIH) is tumor-like hyperplasia of fibrous connective tissue affecting the soft tissues of the vestibular sulcus produced by poorly adapted dentures.<sup>3</sup> Complete denture fabrication in such clinically compromised conditions is a challenging task for the dentist.<sup>1</sup> DIH can be treated conservatively or by surgical excision.<sup>4</sup>

Another challenging condition is flabby ridges. Flabby ridge can be defined as a mobile soft tissue that is settled on the superficial aspect of the alveolar ridge.<sup>5-6</sup>

Flabby ridges mostly arise when an edentulous ridge opposes natural teeth and is considered a feature of the combination syndrome when arises in the anterior part of the maxilla.<sup>5</sup> In the presence of a displaceable ridge, the fabrication of a stable denture becomes a real challenge. Flabby ridges get easily displaced under occlusal forces owing to poor retention, resulting in compromised denture retention as a result of the loss of peripheral seal.<sup>5</sup> Management of flabby ridge, includes:

- 1) implant therapy;
- 2) surgical removal and augmentation;
- 3) special impression techniques, and/or;
- 4) balanced distribution of occlusal loads.<sup>6</sup>

Furthermore, prosthetic reconstruction of atrophic jaws has always been in great demand for those working in this field.<sup>7</sup> Residual ridge resorption is a complex biophysical process and a common occurrence following extraction of teeth. Ridge atrophy is most dramatic during the first year after tooth loss followed by a slower but more progressive rate of resorption subsequently.<sup>8</sup> Patients with severely resorbed atrophied edentulous ridges often have problems using complete removable dentures, due to the absence of stability, pain and eating difficulties.<sup>4,7</sup>

Management options of the atrophic mandible, are dental implants, special impression techniques, and/or neutral zone techniques. Interest in appearance and desire for physical attractiveness does not decline with age.<sup>9</sup> Complete denture therapy contributes to maintaining aesthetic appearance, fluent speech, and suitable occlusal arrangements for masticatory efficiency.<sup>9</sup> This paper presents comprehensive management of a patient with flabby ridge, and severely resorbed edentulous ridge.

## CASE REPORT

### History taking

A 74-year-old female patient attended the Prosthodontic Clinics at the Faculty of Dentistry, the University of Khartoum with the chief complaint of intense discomfort and an unusual growth along the anterior border of her ill-fitting maxillary complete denture. She also complained of not being able to bite well, instability, and poor aesthetics of her maxillary and mandibular dentures. The past dental history of the patient revealed that she has been handling the same dentures for the last 15 years, without follow-ups or denture adjustments.

The patient was suffering from pain and discomfort during mastication for the last 6 months. She has no medical history of any disease and she denied taking any medications other than painkillers and vitamins from time to time. Social history revealed that her daughter is taking full care of her and she has no history of smoking or alcohol consumption. Examination of her current denture revealed an ill-fitting denture with overextended, thin, sharp flanges and damaged porous denture bases (Figure 1).

### Clinical examination

On extraoral examination, the patient had a reduced lower facial height with deep wrinkles and loss of lip support & cheeks. On intraoral examination, the following conditions were noticed: the location of the lesion is at the maxillary labial vestibule. The second lesion can be seen on the right buccal mucosa opposite to the first and second molar at the level of the occlusal plane; an ulcerative

lesion in the buccal vestibule opposite the right maxillary tuberosity.

The lesion could be described as red fibrous with various thin, long folds, which were tender and ulcerated. Besides the described lesion, there were four rounded grape-like lesions, which were localized, red, fibrous, sessile, and with regular borders located over buccal mucosa. Flabby and displaceable tissue was evident on the maxillary arch covering a considerable area, extending from the right second premolar region to the left first molar area (Figure 2A).

Severely resorbed and atrophied lower arch which had dropped to the basal bone with merely a thin band of keratinized gingiva between the sublingual gland and buccal mucosa (Figure 2B).

For an investigation, a panoramic radiograph showed a major bone loss in both arches with bilaterally enlarged maxillary sinuses adjacent to the thin cortical plate of the atrophic ridge (Figure 3). Study casts were made to contribute to the diagnosis and treatment planning.

### Diagnosis

Following discussion with the patient regarding the available management preferences, the treatment options were either an implant-supported prosthesis or a conventional complete denture. Since the patient was anxious and not willing to undergo any complicated surgical procedures, she decided to have a conventional complete denture fabricated. The full management strategy was described to the patient and a signed consent form was obtained from the patient.

### Treatment stages

Preventive and diagnostic phase

### Management of DIH

Diagnostic casts were made using irreversible hydrocolloid material (Jeltrate Alginate, Dentsply Sirona, USA) for maxillary arch, and low fusing thermoplastic impression material (Hiflex impression compound, Prevest DenPro Hiflex, India) for the mandibular arch. Both were poured with Type II dental stone. The management protocol consisted of both conservative and surgical procedures.

The old denture was adjusted, cleaned, and relined with a tissue conditioner (Viscogel, Dentsply, Germany) weekly for five weeks. The patient was instructed to keep the denture out of her mouth for extended periods during the day. The patient was recalled every week for the relining of the old denture. Two months later, a reduction in the size of the lesions was noticed.

### Pre-prosthodontic phase/surgical phase

The remaining lesions were then operated under local anesthesia (2% lidocaine with 1:100,000 epinephrine) with Diode Laser (SOLASE Dental Diode Laser, Model 808nm, Lazon Medical Laser Co, Ltd, China). Based on manufacturer recommendation the following specifications were set: wave-length: 808nm, initiated tip in contact mode, tip diameter: 400µm, and power output: 1w.

The wound was allowed to heal without sutures. Immediately following the surgery, the old denture was relined using a tissue conditioner and the patient was advised to avoid hot and spicy foods for 3 days. No medications were prescribed except for 0.12% chlorhexidine mouthwash. Healing was assessed 72 hours postoperatively and again after one week (Figure 4). No postoperative pain or signs of edema were reported.

### Prosthodontic phase: Management of flabby ridge

An edentulous stock tray was used to ensure minimal displacement of the tissues. A preliminary impression of the maxillary arch was made using an irreversible hydrocolloid material and was then poured in Type III dental stone. The displaceable areas were marked on the cast. A two-millimeter spaced custom tray was fabricated from Ethylene-vinyl acetate with tissue stops and two finger-rests. The area demarcating the flabby tissue in the anterior maxilla was outlined in the diagnostic cast to make a window on the custom tray before its fabrication.

After fabrication and curing of the tray, a vacuum heat-pressed polyethylene sheet (Patterson® Vacuum Forming Material, Patterson Dental, USA) of 0.5 mm thickness was fitted on the tray.

The window was opened and four vents of similar

dimensions were created opposite to the flabby area (Figure 5A) on the polyethylene sheet in the window area.<sup>5</sup>

The flanges were trimmed to be 2 mm shorter than the depth of the sulcus and the tray was tried in the patient's mouth. Border molding was done using a low-fusing impression compound (Hiflex Tracing Sticks Green, Prevest Denpro, India) and the maxillary impression was made using medium consistency body polyvinyl siloxane (PVS) impression material (Aquasil Ultra+ Medium, Dentsply, USA) (Figure 5B).

The impression was evaluated carefully for defects and the excess material on the periphery was cut. The impression material in the area of the flabby ridge was carefully cut using a scalpel blade. The impression was resealed in the patient's mouth and a light body PVS impression material (Aquasil Ultra+ LV, Dentsply, USA) was injected through a hole until some excess material extruded through the other holes. The impression was boxed and then poured in Type III dental stone.

### Management of severely atrophic mandible

The preliminary impression of the mandibular arch was made using a low-fusing thermoplastic impression material (Hiflex Tracing Sticks Green, Prevest Denpro, India). The impression was poured in Type III dental stone. Denture bases with occlusal rims were fabricated on both the maxillary master cast and the mandibular study cast. A Centric maxilla-mandibular record was obtained to record appropriate horizontal and vertical relations. A closed mouth functional impression technique proposed by Winkler<sup>10</sup> was utilized for making the mandibular final impression.

Tissue conditioning material was applied on the tissue surface of the mandibular denture base and the patient was instructed to close the mouth in the pre-recorded vertical dimension and do various functional movements such as puffing, blowing, whistling, and smiling. Three thin applications of tissue conditioner material were done at an interval of 10 minutes and the patient was instructed to repeat the functional movements each time.

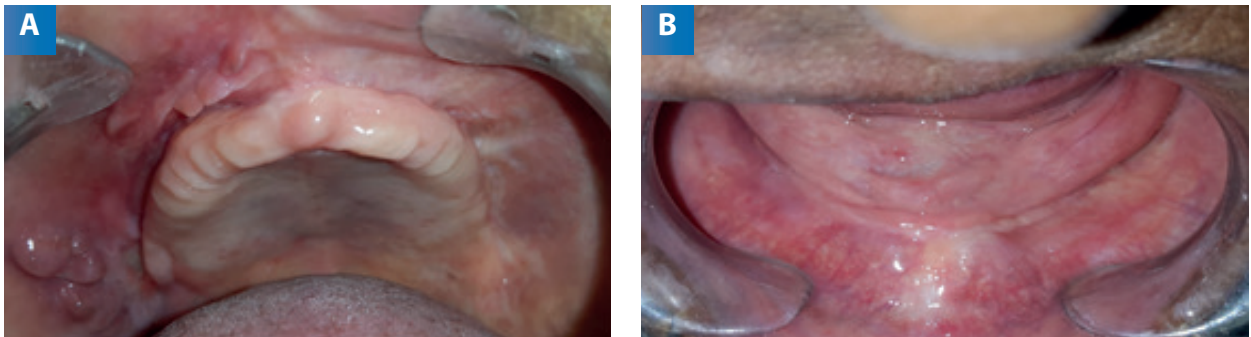
Light body PVS impression material was applied for making the final impression with the closed



**Figure 1.** Old Complete Denture displaying overextended, thin, sharp flanges and damaged bases.

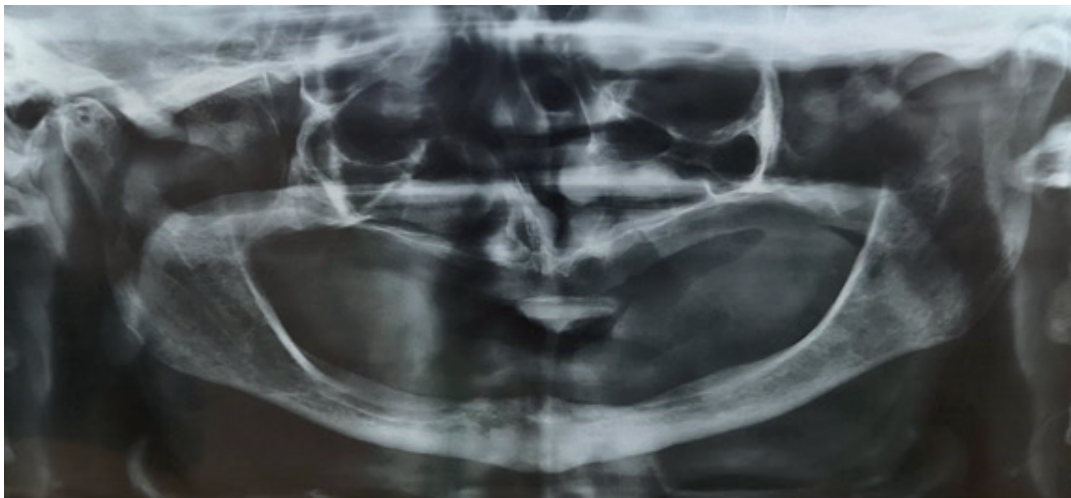


**Figure 2.** Clinical examination of the edentulous maxilla.



**A:** Edentulous maxillary ridge showing denture induced hyperplasia and flabby ridge.  
**B:** Edentulous mandibular ridge view.

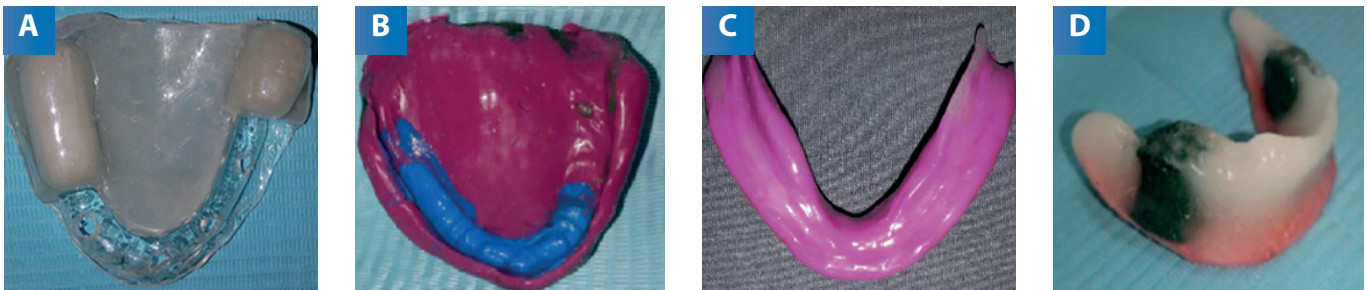
**Figure 3.** Pre-operative panoramic radiograph showing major bone loss in both arches.



**Figure 4.** Post-operative view 1 week after excision with diode laser.



**Figure 5.** Preliminary impression of the mandibular arch.



- A:** Custom try using the window technique.
- B:** Maxillary impression using medium and light consistency body polyvinyl siloxane impression material.
- C:** Mandibular impression with light body PVS impression material applied for final impression with the closed mouth technique.
- D:** Neutral zone technique, using auto polymerizing resin mandibular denture base.

**Figure 6.** Lingualized balanced occlusion.



mouth technique (Figure 5C). The mandibular impression was then poured in Type III dental stone. Jaw relation records were then used to mount the casts on a semi-adjustable articulator and sent to the lab with selected mold and shade of artificial teeth for maxillary denture tooth set-up.

For the neutral zone technique, (Figure 5D) an additional auto polymerizing resin mandibular denture base was fabricated and retentive loops made of a thin orthodontic wire were attached to the denture base along the residual ridge and two vertical pillars made of low fusing compound were placed on the first molar region at the established occlusal vertical dimension (OVD).

A highly viscous mix of tissue conditioning material was placed between the two pillars, and the plate was then rotated into the patient's mouth and the patient was asked to perform a series of actions to stimulate the physiological movements such as smiling, laughing, tightening lips, counting from 60 to 70, reading from a newspaper loudly, pronouncing the vowels, drinking and sipping water, swallowing, slightly protruding the tongue and licking the lips. These actions were performed for 10 minutes until the material was set, removed, and sent to the lab.

On laboratory steps, the base plate was replaced, on the working model, locating grooves were cut, a plaster index was placed around the model and impression, then the tissue conditioning material was removed from the base plate, then indexing the neutral zone impression was made, wax was poured into the remaining space so that it attached to the base plate. and teeth were set up exactly in the place previously occupied by it, and finally, occlusion was checked to ensure that it is balanced in centric occlusion and lateral excursions.<sup>11</sup>

A lingualized balanced occlusion scheme was selected for the posterior tooth arrangement (Figure 6). A trial of the maxillary and mandibular dentures was performed. The occlusion was checked as well as the retention and stability of both maxillary and mandibular dentures. The trial dentures were then returned to the laboratory for processing and finishing. The dentures were fitted into the patient's

mouth and instructions on use and cleaning of the new denture were provided.

### Review and maintenance

The case was followed for three months. Great satisfaction was expressed by the patient concerning the stability and retention of the new denture and a noticeable adaptation of the muscles that showed increasing retention and stability at each follow-up visit.

### DISCUSSION.

Most cases of denture induced hyperplasia (DIH) occur in the anterior region of the upper and lower jaws. This pathology is more frequent in females and aged patients wearing dentures.<sup>12</sup> Around 78% of female denture wearers present with DIH, mostly in the maxilla.<sup>13</sup> DIH may result from an ill-fitting denture, wearing dentures all day long, poor oral hygiene, smoking, age-related changes, and systemic conditions.<sup>14</sup> In this case report, ill-fitting denture, sharp denture borders, poor oral hygiene, no previous denture adjustments, and wearing the denture continuously appeared to be the causative factors. DIH can be treated either conservatively or surgically.

The conservative approach could be tried first; by relieving denture borders, using strict oral hygiene measures, denture instructions, and application of a tissue-conditioning material. This can be sufficient for elimination or decreasing the size of the lesion with adequate time. Yet, in many instances, fibrotic lesions might require surgical excision which can be done conventionally or using laser technology.<sup>3,13</sup>

In this case report, tissue rest, old denture adjustments and, the use of a tissue conditioning material as a soft liner were sufficient for the reduction of a considerable part of the lesion. However, the lesions did not subside completely, which demanded surgical intervention. Laser surgery was selected due to its many advantages over conventional surgery.<sup>15-16</sup>

Diode laser was used, which is becoming an attractive and easy tool in routine clinical practice, which can be used in excision of soft tissue lesions.



It provides several advantages compared to the conventional scalpel or to other types of procedures, such as easier application, better coagulation, no need for suturing, less swelling and pain, low cost, reduction in surgical time, and less or no post-surgical pain as well as for disinfection of the surgical wound. In addition, better repair and recovery and the rare operative and postoperative complications made it an effective and predictable method.<sup>15,17</sup>

Studies have reported that approximately 24% of the edentulous maxilla and 5% of the edentulous mandibles have a flabby ridge. Even a stable denture in the presence of a flabby ridge can get easily displaced under occlusal forces owing to poor support, resulting in compromised denture retention as a consequence of loss of peripheral seal.<sup>5</sup>

The flabby ridge management might be:

- a) surgical removal of fibrous tissue;
- b) implant-retained prosthesis; or
- c) conventional prosthesis without surgical intervention.

However, surgical excision of the flabby tissue can lead to trauma of the underlying tissues increasing the bulk of denture material and eliminating the stress absorbing soft tissues.<sup>18</sup> Flabby ridges are compressed when recorded using a conventional impression technique which will result in an elastic recoil, leading to instability, loss of denture retention, and dislodgement during a function. An accurate impression of the flabby ridge is important to the delivery of a stable and retentive denture.<sup>8</sup> Numerous impression techniques have been described in the literature for recording flabby tissue during impression making.

However, there is no evidence to support one technique over the others. Studies have proposed that a special tray with a window can be used for making the final impression of the flabby ridge in a static position through the window after the final impression. The difficulty of this conventional technique is the even application and control of the low viscosity impression material on flabby tissues due to gravitational forces and supine chair positions.<sup>19</sup>

For example, to minimize the movement of the flabby ridge during function a former impression technique was proposed by Watson. He made a window in the custom tray over the flabby tissues anteriorly and used the impression plaster for the flabby ridge and zinc-oxide-eugenol impression paste for the healthy denture bearing area. Nevertheless, the limitation of this technique is the failure to control and uniform application of impression material.<sup>20</sup>

PVS is available in different viscosities and is suitable as an impression material for both mucostatic and mucocompressive impression techniques of edentulous ridges, which has made it preferred by many clinicians.<sup>21</sup> This case report presented a modified window technique for the impression of the maxillary flabby ridge using PVS impression material.<sup>5</sup>

It provided a way for a more controlled and easy application of the impression material. Moreover, this technique allows for the controlled application of low viscosity materials or the light body PVS through the vents. In addition, minimal exertion of pressure to the flabby ridges due to the presence of vents. Besides, the clear polyethylene sheet in this technique performed as a stent for holding and preventing the low viscosity material from dropping away from the tissue allowing better control and uniform application.<sup>5</sup>

Atrophic mandibular ridges are categorized under the American College of Prosthodontics as a Class IV classification. This demands complex pre-prosthetic surgery to aid in implant placement and augmentation which may lead to complications like paraesthesia. Another feature that can add to the difficulty in clinical steps and denture usage is hyperactivity and hypertrophy of the tongue.

Depicting the most debilitated edentulous condition, surgical reconstruction is almost always indicated in this classification level, but when a surgical revision is not an option, special impression techniques can be used to achieve an adequate treatment outcome.<sup>17</sup>

The patient in this case had difficulties using the old mandibular denture due to mandibular atrophy,



which might have resulted from denture instability. Providing a stable mandibular denture for the highly atrophic mandibular ridge was a real challenge in this situation, as the patient couldn't afford the implant option in addition to the apprehension from associated surgical procedures.

As the residual ridges resorb, tissues become unsupported and displaceable; and it is difficult to obtain good retention and stability of the complete denture. This is caused by the muscular insertions near the ridge crest or border.<sup>8</sup> Therefore, an impression technique in which minimum to no soft tissue displacement and fabrication of a denture in muscle balance with its contour harmonizing with the neutral zone is needed.

Several modified impression techniques for resorbed mandibular ridge have been suggested such as functional,<sup>10</sup> admixed,<sup>22</sup> all green,<sup>23</sup> and cocktail technique.<sup>24</sup> All these techniques record the primary and secondary stress-bearing areas without distortion of the residual ridge.<sup>8</sup>

One study tested all six mandibular impression dentures techniques and presented that on clinical examination, retention of all was found to be acceptable and satisfactory. The study concluded that the functional impression technique showed the highest mean value of retention, and the patient was most satisfied with the denture made from it. Followed by elastomeric, all green, and admixed while cocktail and green stick compound showed the lowest mean value.<sup>8</sup> However, the Admixed technique may have the disadvantage of discomfort produced by the heat used for manipulation and the handling characteristics and its use in undercut areas might limit the use of zinc oxide eugenol impression materials in modified all green compound technique.<sup>17</sup>

Consequently, mandibular denture bases constructed from the closed mouth technique showed more retention than those of the open mouth techniques.<sup>8</sup> In this case, a tissue conditioner was used as a functional impression material, which flows readily through functional stresses and registers the accurate shape of the oral structure.

The impression was easy to make, no handle so less interference, and showed no signs of over or under extension.

Any prosthodontic treatment aims to restore esthetics, function, and form. In this case report, it was decided to employ the neutral zone technique to support the muscle forces to work in harmony and give stability to the denture.<sup>11</sup> Implant overdenture can provide a long-term prognosis and more stable outcome compared with conventional complete dentures. However, in this case, who is financially constrained, this treatment is not an option.

Therefore, a technique to improve retention and stability in a severely atrophic ridge was considered for fabricating a denture in harmony with forces exerted by the tongue, lips, cheeks, and floor of the mouth.<sup>25</sup> The neutral zone technique is an approach for the construction of lower complete dentures whenever there are a highly atrophic ridge and history of denture instability.

The aim was to construct a denture that is shaped by muscle function and is in harmony with the surrounding oral structures.<sup>11</sup> The advantages of the neutral zone technique are

- a) better retention and stability;
- b) posterior teeth will be appropriately placed letting adequate tongue space;
- c) decreased food trapping adjacent to the molar teeth; and
- d) better facial support leading to good esthetics.<sup>25</sup>

One study, found better patient acceptance and fewer post-insertion problems in neutral zone dentures when compared with conventional ones.<sup>26</sup> In another clinical study, it was found dentures fabricated using the neutral zone technique had greater comfort and better speech clearness when compared with conventional ones.<sup>27</sup> Another clinical study also found improved patient adaptability to physiologically formed denture bases when compared with conventional ones.<sup>28</sup>

Esthetics was a priority concern for this patient, but her oral conditions indicated an occlusal scheme with non or semi anatomic artificial teeth.<sup>29</sup> Lingualized balanced occlusion, which is a type

of denture occlusion, where the maxillary lingual cusps articulate with the central fossae of the occlusal surfaces of the opposing mandibular teeth, was elected in this case. The buccal cusps are free of contact and free of interference during lateral excursions.<sup>29</sup>

This type of occlusion is indicated in severe alveolar resorption, in which bilateral balanced occlusion can be obtained around the centric relation and vertical forces are centralized on the mandibular teeth.<sup>30</sup> It enhances patient esthetics, increases chewing efficiency and hence, the patient was very pleased. Examples of other occlusal schemes are neutrocentric occlusion, linear occlusion, non-anatomic occlusion, and balanced occlusion.

Nevertheless, these other schemes were not possible to apply in this case. To illustrate, in neutrocentric occlusion even though it is simple and requires less precise records and it is ideal for a patient who has resorbed ridges with mobile tissue, but the greatest criticism is that it is the least esthetic as there is no incisal overlap and no posterior cusps, and as mentioned above the patient was concerned about her final look.<sup>30</sup>

In balanced occlusion has the advantage of simultaneous contact help to seat the denture in a stable position during mastication, swallowing, and maintain retention and stability of the denture and the health of the oral tissues. However, it was intentionally avoided for it is unsuitability in this case because it is difficult to achieve and may tend to encourage lateral and protrusive grinding habits, which will lead to instability of the denture and more resorption of the residual ridge.<sup>31</sup>

## CONCLUSION.

This case report described a comprehensive rehabilitation of a patient with denture induced hyperplasia, flabby ridge, and severely resorbed edentulous ridge. The denture induced hyperplasia was treated using diode laser while both flabby and atrophic edentulous ridges were managed using special impression techniques.

Even though this case is complicated and requires many steps to reach the final results but this can simply be achieved, thorough history-taking, an investigating eye during clinical examination, and other diagnostic tools lead to a careful selection of an optimal treatment plan based on sound knowledge which is the key to success in complete denture prosthodontics.

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**Authors' contributions:** NFA performed dental treatment and drafted the manuscript. IAI and MNA suggested the treatment method and drafted the manuscript. FA provided comprehensive judgment and assisted in editing the final version of the manuscript. All authors read and approved the final version of the manuscript before submission.

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