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Management Of Resorbed Mandibular Ridge

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Prosthodontics in Partial Fulfillment for the Bachelor of Dental Surgery

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بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

فَتَعَٰلَى ٱللَّهُ ٱلْمَلِكُ ٱلْحَقُّ ۗ وَلَا تَعْجَلْ بِٱلْقُرْءَانِ مِن قَبْلِ أَن يُقْضَىٰٓ
إِلَيْكَ وَحْيُهُۥ ۖ وَقُل رَّبِّ زِدْنِى عِلْمًا ﴿١١٤﴾

صَدَقَ ٱللَّهُ ٱلْعَظِيمُ

Supervisor Certification

I certify that this project entitled **"Management of resorbed mandibular ridge"** was prepared by the fifth-year student **Ayaat Hussein Kadim** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Ass. Lec. Mustafa Sh. Mahmood
B.D.S., M.Sc.

Dedication

I dictate this project to myself first, to every obstacle that made me, to every path that helped me reach this wonderful moment, to all my study trip, then I dictate my graduation project to my father, may God have mercy on him, to my family, the first supporter of me and to my supervisor who facilitate the preparation and presenting of this review in best possible way.

Ayaat

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In the Name of Allah, the Most Merciful, the Most Compassionate all praise is to Allah, the Lord of the worlds; and prayers and peace be upon Mohamed His servant and messenger. First and foremost, I must acknowledge my limitless thanks to Allah, the Ever-Magnificent; the Ever-Thankful, for His help and bless. I owe a deep debt of gratitude to our university for giving us an opportunity to complete this work.

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RRR	Residual ridge resorption
VDO	Vertical Dimension of Occlusion

INTRODUCTION

Edentulousness is a multifactorial phenomenon, the prevalence levels of which vary across countries. While the prevalence has decreased worldwide over time, it is more distinctly cumulating into older age group**(Douglass et al., 2002)**. In many countries, more women than men are edentulous. In Scandinavian, the highest prevalence of edentulousness among elderly (60 years or older) subjects has been reported in Finland, where more than one-third of the population are edentulous**(Haikola et al., 2008)**. The older adults have a limited capacity to adapt to the changes in their oral and dental condition, leading to an increased amount of complaints linked with denture wearing. Hence, several studies have shown that tooth loss weakens the quality of life of a person, causing problems owing to facial appearance, problems with speaking, chewing, nutrition, problems in social relations and even emotional problems**(Huumonen et al., 2012)**.

Complete denture therapy is undoubtedly among the age old forms of dental treatment used to rehabilitate an edentulous patient. The key to successful denture therapy lies in precise execution of the treatment plan formulated by evaluation of a complete comprehensive history and through examination. Such a treatment plan must be based on Devan's principles concerned with rehabilitation that is, preservation of what already exists than the mere replacement of what is missing**(Devaki et al., 2012)**. The impression technique plays the key role. The main aim of the impression procedure is to gain maximum area of coverage with minimum pressure by obtaining, a fairly long retromylohyoid flange for a better border seal and retention and to educate and train the patient to maintain tongue position; i.e. forward and resting on top of lower anterior ridge when the mouth is open**(Prasad et al., 2014) .**

AIMS OF REVIEW:

Identify residual ridge resorption, what are the factors that affecting residual ridge resorption and know different types of management of its.

CHAPTER ONE

REVIEW OF LITERATURE

1.1 Residual ridge resorption

Residual ridge resorption (RRR) is a continuous process of alveolar bone loss, which is greater during the first few months after the tooth extraction than later. The rate of resorption is twice more pronounced in the mandible than in the maxilla**(Al-Jabrah & Al-Shumailan, 2013)**

Residual ridge consists of denture-bearing mucosa, submucosa, periosteum, and underlying alveolar bone. Residual bone is that part of alveolar ridge which remains after the teeth have been lost **(Devaki et al., 2012)**

1.2 The structural elements of bone

A basic concept of bone structure and its functional elements must be clear before bone resorption can be understood. The structural elements of bone are:

a. Osteocytes: These are cells responsible for metabolic activity of bone.
b. Calcified cementing substance: The calcified cementing substance consists mainly of polymerized glycoprotein. Mineral salts namely calcium carbonate and phosphates are bound to these protein substances.
c. Osteoblasts: by their function of forming and calcifying the intercellular substance, are the active bone forming cells. The osteoblasts surround the bone in a continuous layer. In the course of bone formation, some osteoblasts get engulfed in the intercellular substance and become osteocytes.
d. Osteoclasts: Osteoclasts are the cellular components of bone that are responsible for bone resorption. Bone resorption always requires the simultaneous elimination of the organic and inorganic components of the intercellular substance **(Sarandha et al., 2007)**

1.3 Classification of edentulous ridge

A classification of edentulous jaw is very important as it simplify description of the residual ridge and thereby assist communication between clinicians; aid selection of the appropriate surgical prosthodontic technique; offer an objective baseline from which to evaluate and compare different treatment methods; and help in deciding on interceptive techniques to preserve the alveolar process**(Benhamida et al., 2019).**

Cawood and Hawell classify the residual ridge to basic six classes:**(Alsaggaf & Fenlon, 2020)**

Class I - dentate.

Class II -immediately post extraction.

Class III- well-rounded ridge form, adequate in height and width.

Class IV - knife-edge ridge form, adequate in height and inadequate in width.

Class V flat ridge form, inadequate in height and width.

Class VI - depressed ridge form, with some basilar loss evident.

According to the American college of prosthodontists: Based on Bone Height (Mandible only) **(Pan et al., 2010)**

Type I : Residual bone height of 21 mm or greater measured at the least vertical height of the mandible.

Type II : Residual bone height of 16 - 20 mm measured at least vertical height of the mandible.

Type III : Residual alveolar bone height of 11 - 15 mm measured at the least vertical height of the mandible.

Type IV : Residual vertical bone height of 10 mm or less measured at the least vertical height of the mandible

1.4 Etiology of residual ridge resorption

Residual ridge resorption is considered a multifactorial disease that occurs as a result of anatomic, metabolic، prosthetic and functional factors **(Gupta et al., 2010)**.

1.4.1 Anatomic Factors

It includes volume of bone and characteristic of bone. Residual ridge resorption varies with the volume and characteristic of bone of the residual ridge. More the amount of bone present, more the quantity of resorption will be seen. Sometimes large ridges are resorbed rapidly, and some knife-edge ridges may remain with little changes for long period of time, thus it is not considered as the predictive factor for residual ridge resorption. Bone loss is greater in broad ridges, because there is more bone present to be per unit time. The rate of vertical bone loss is faster in small ridges than broad ridges. The density of the bone is another major factor to be considered for the residual ridge resorption **(Tiwari et al., 2010; Kumar et al., 2016).**

1.4.2 Metabolic Factors

Metabolic and Systemic Factors has great effect on the rate of bone resorption which include Age, race, present of systematic illnesses such as osteoporosis, nutritional status especially calcium and vitamin D, and the amount of time the patient has been edentulous. Bone resorption rate are much higher in postmenopausal older women, due to inadequate of formation of new bone tissue are associated with estrogen deficiency. Although in those cases the rate of bone resoption can be control by treat the causes by drugs that increase bone mineral density as Bisphosphonates, RANKL inhibitors, SERMs-selective, estrogen receptor

modulators, hormone replacement therapy and calcitonin. moreover the light weight bearing exercise tends to eliminate the negative effects of bone resorption**(Benhamida et al., 2019).**

Edentulous patients should follow a prescribed dietary regimen. This diet should be low in carbohydrates and high in protein intake. The diet should include at least a quart of milk or substitute dairy products, vegetables, fruits and a multiple vitamin supplement **(Sarandha et al., 2007).**

1.4.3 Functional Factors

When considering the force, consider the amount of force, frequency, duration, direction, area over which force is distributed, and the damping effect of the underlying tissue. Woelfel in his study on a patient made maxillary denture of area 4.2 square/inch and 2.3 square/inch on mandible (ratio 1.8:1). If patient bites with a pressure of 50 pounds, so pressure under maxillary denture is 12 pounds/square inch and under mandibular denture is 21 pounds/square inch. So it can be said that there is more of mandibular ridge resorption than in the maxilla **(Burugupalli & Nair, 2018).**

1.4.4 Prosthetic Factors

The wearing of a denture is physiologically incompatible with the function of the ridge tissues because pressure is directed to the bone through vascular tissue by the denture. If the mechanical factors designed into the denture by the impressions, jaw relation records and occlusion are controlled, so that pressure remains within tissue tolerance, the denture base will not contribute to a rapid bone resorption. If the action of the base is favorably controlled in its adaptation to the tissues and its

directed force, it could provide stimuli that retard resorptive processes. Often, a new technique, a new impression material, new denture base or a new form of teeth has been heralded as the answer to the problem of ridge resorption **(Burugupalli & Nair, 2018).**

1.4.4.1 The prosthetic factors contributing to ridge resorption: (Sarandha et al., 2007).

1. Excessive stress resulting from artificial environment.
2. Abuse of the tissue from lack of rest.
3. Long, continued use of ill-fitting dentures.
4. Reduced area of coverage of the foundation resulting in increased load per unit area.
5. Faulty impression procedures, employing compressive forces.
6. Error in relating maxillae to cranial landmarks.
7. Lack of freeway space due to increased vertical dimension of occlusion.
8. Incorrect centric relation record.
9. Faults in selection and placement of posterior teeth.
10. Lack of balance in posterior occlusion.
11. Non-correction of occlusal errors caused due to processing technique and factor of tissue resiliency.
12. Use of non-rigid material with high flexure for denture base.
13. Non-observance of biological principles of stress reduction.
14. Patients with dysfunction state of TMJ resulting in instability of dentures.
15. Age changes in senility.

1.5 Changes in the maxilla and mandible

In research conducted by numerous authors a difference between the rate of mandibular alveolar resorption and resorption of the maxillary alveolar process has been reported. According to Atwood, the degree of mandibular loss of its alveolar portion is three or four times higher than alveolar resorption in the maxilla, which is due to a smaller denture-bearing area in the mandible and thus a greater load per square cm. Differences in resorption can have effects which are limited to the alveolar process in the maxilla, rarely moving to its body, while in the mandible changes also affect the mandibular angle, leading to its atrophy. Alveolar loss in the maxilla runs from the cheek to the palate in the horizontal plane, in the mandible the alveolar ridge becomes atrophic in the glosso-buccal direction in its lateral parts, while in the anterior part this occurs from the oral vestibule **(Zmysłowska et al., 2007).**

1.6 Management of residual ridge resorption

In cases of severe resorption of the mandible, the goal of the clinician should be to achieve good stability and optimum support from the denture bearing area. Achieving very good retention in such cases may not always be possible. Pre-prosthetic management of mandibular poor foundation cases plays an important role. Gum massage to strengthen the tissues, warm salt water rinsing and discontinuing of ill-fitting denture may be considered. In certain cases use of a tissue conditioner may be necessary **(Tunkiwala & Ram, 2013).**

The prosthodontics management of patient with severe residual ridge resorption can be either with or without surgical intervention **(Benhamida et al., 2019).**

1.6.1 prosthesis without surgical intervention

As the residual ridges resorb, the tissues become unsupported and displaceable. So it's need to modifiy a When use of conventional impression techniques will result in a distorted impression. Therefore, the impression technique needs to be modified **(Benhamida et al., 2019)**.

A number of modified impression techniques for resorbed mandibular ridge have been suggested by various authors such as admixed, functional all green, and cocktail technique **(Winkler et al.,2009).**

The use of these impression techniques has the following advantages: they can be easily controlled to gain maximum coverage, they can be corrected readily, they can be used to accurately determine the extent of the mucobuccal reflections and they can be used to direct pressure toward the load-bearing areas, specifically, the buccal shelf and the slopes of residual ridges in the mandible **(Prithviraj et al., 2008).**

The other technique for increases retentive and stability of complete denture is neutral zone technique. It uses with patients with highly atrophic mandible. So it of the most effective techniques is to counteract the problems of positioning the posterior teeth leading to a stable denture **(El Maroush et al., 2019)**.

In order to preserve the alveolar ridge and reduce the amount of stress transferred, certain general principles must be kept in mind during fabrication of complete denture. This may be achieved by:

1-having broad area of coverage under the denture base (to reduce the force per unit area).

2-A decrease in the number of denture teeth.

3-Decrease in the buccolingual width of teeth.

4-Improved occlusal tooth design form (to decrease the amount of force required to penetrate a bolus of food) **(Rachmiel et al., 2014; Manish et al., 2015).**

During tooth setup the aim should be to reduce the number of inclined planes (to minimize dislodgement of dentures and shear forces) and achieve a centralization of occlusal contacts (to increase stability of dentures and to maximize compressive load).Accurate recording of maxillomandibular relationship will ensure optimum vertical rest dimension which will decrease the frequency and duration of tooth contacts, thereby giving adequate rest to the underlying ridges**(Benhamida et al., 2019)**.

1.6.2 Physiologic Impression Technique for Resorbed Mandibular Ridges

A procedure is described for the final impression of severely atrophied mandibular residual ridges especially for mandibular edentulous ridges with high muscle attachments. The objective is to develop a physiologic impression with maximum support of both hard and soft tissues. Tissues could be displaced during impression making and result in subsequent pathology, or they could be placed i.e. compression within the physiologic limits in order to maximize the support from the edentulous ridge. Close adaptation to the basal seat contributes to stability. This technique emphasizes on the concept of tissue placement and determination of the extent of mucobuccal denture extension which is achieved by the use of a close fitting tray and a viscous impression material. Final impression is made with an elastomeric impression material to capture the anatomic details of the tissues **(Herekar et al., 2013)**.

1.6.2.1 Technique of the physiologic impression

Preliminary impression was made with admixed technique. Impression compound and low fusing impression compound in the ratio of 3:7 parts by weight are placed in a bowl of water at 60°C and kneaded to a homogeneous mass that provides a working time of about 90 s. This homogenous mass is loaded, and the patient is made to do various tongue movements **(Figure1-1) (Daniel & Daniel, 2017).**

Figure (1-1): preliminary impression **(Daniel & Daniel, 2017)**

Spacer of 2 mm thickness was maintained using baseplate wax and the design included crest of the atrophied mandibular ridge with tissue stops of 3 mm × 3 mm in canine and molar regions. Custom tray was fabricated using cold cure acrylic material and was shortened up to 2 mm from the limiting border of preliminary cast. After checking the custom tray extension in the mouth, it was border molded using low fusing impression compound. Following border molding, incremental loading of softened low fusing impression compound on the anterior, middle and posterior third of the impression surface of custom tray was done. It was then seated onto the denture bearing area, labial and buccal borders were molded and the patients were asked to perform various tongue

movements to mold the lingual flange. Any excess low fusing impression compound on the periphery was trimmed with a Bard‑Parker Blade No. 15 **(Figure1 -2) (Daniel & Daniel, 2017).**

Figure (1 -2) : Incremental impression made with low fusing impression compound **(Daniel & Daniel, 2017)**

Trim away the material from the crest of the ridge providing the required relief. Roughen the impression surface by making grooves. This will enable mechanical retention of light body polyvinyl siloxane. Apply adhesive on the impression and tray borders and allow it to dry. Mix base and catalyst pastes of light body Poly Vinyl Siloxane impression material, spread it over the intaglio surface of the impression and obtain the final wash impression by performing lip, cheek movements and tongue movements. Allow the impression material to polymerize according to the manufacturer's recommendations. Remove, disinfect the impression and pour with dental stone (**figure 1-3) (Herekar et al., 2013)**.

Figure (1- 3): Final impression with light body impression material**(Daniel & Daniel, 2017)**

The goal of this technique is to provide maximum stability covering maximum denture bearing area selectively distributing the pressure over the entire denture bearing area. This is attributed to various steps contributing to impression making. First, the intimate contact of custom tray helps in distributing maximum forces to the buccal shelf area. This is achieved by the spacer design. Second, the viscosity of the low fusing impression compound removes any soft tissue folds and smoothens them over the mandibular bone, thus reducing the potential for discomfort arising from the "atrophic sandwich" of the mucosa between the denture and the bone **(McCord et al., 2000)**.

The drawbacks of this technique include discomfort due to heat used during functional molding with green stick impression compound. Furthermore, the brittleness of the material during scraping is also a disadvantage **(Anusavice et al., 2003).**

1.6.3 Neutral zone technique

According to the Glossary of Prosthodontic Terms the neutral zone is "the potential space between the lips and the 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."**(Driscoll et al., 2017).**

Prosthodontic management of compromised alveolar ridges requires specialized techniques starting from the impression procedure itself **(Gahan et al., 2005)**. Oral functions involve synergistic actions of tongue, lips, cheeks, and floor of the mouth, which are highly specific to an individual. Failure to recognize the importance of tooth position, flange form, and contour results in dentures which are unstable, howsoever, skillfully, they are constructed. Due to increased inter‑ridge distance in patients with resorbed alveolar ridges, tooth positioning becomes increasingly important in aiding the stability of dentures, so that the muscle activity of the attached and surrounding muscles imparts forces to stabilize rather than displace the dentures. The teeth, therefore, should be placed in the neutral zone, that is, the potential space between the lips and cheeks on one side and the tongue on the other, while all the lateral forces are made to be in a balanced state **(Narayane et al., 2020)**.

The neutral zone technique described by **Yi-Lin et al., (2013)** is simplified to record the physiological dynamics of oral and perioral muscle functions.The preliminary impressions of upper and lower arches and master impression of upper arch were performed using the conventional complete denture method. The upper recording base and wax rim were then fabricated. The lower individual tray was specially designed, with a resin rim on it **(Figure 1-4)**. They were made of autopolymerized tray resin. The rim was relatively narrow (3-5 mm) in the buccolingual dimension, and the height was designed in the

conventional way. The rim was built right on the central line of the alveolar ridge but somehow fabricated wider to have room to adjust. The individual tray and rim were then carefully examined and adjusted in the patient's mouth to reduce any overextension or interference from tongue movement and lip or cheek pressure using a fit checker. Any underextended border could be corrected by border molding with plastic impression compound if needed. The individual tray should be stable during speaking, swallowing, and mouth opening **(Fahmy et al., 2001).**

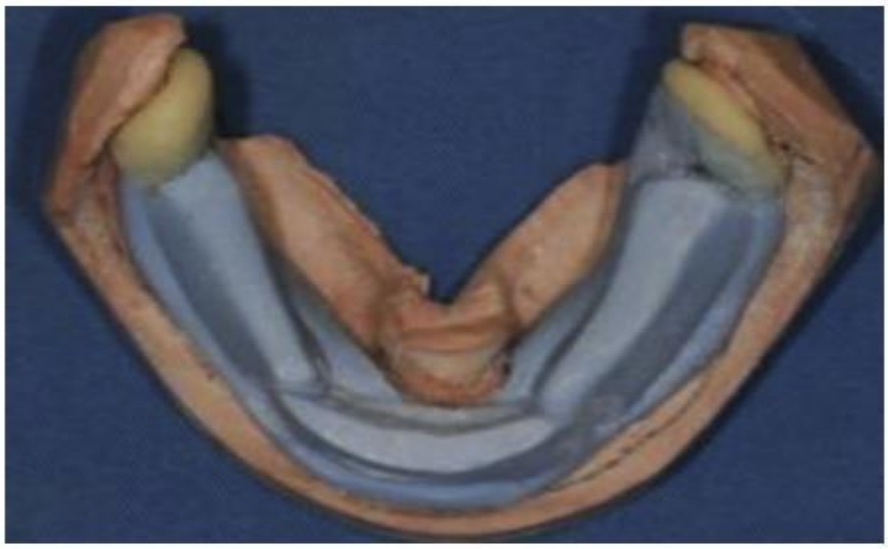

Figure (1-4): The lower arch individual tray with a resin rim. Overextension and interference were carefully checked and reduced intraorally for its stability in functions of speaking, swallowing, and mouth opening **(Yi-Lin *et al*., 2013).**

The upper recording base with wax rim was inserted. The occlusal plane, phonetics, and lip support were checked. The lower individual tray was then inserted to verify the vertical dimension of occlusion (VDO). The resin rim was adjusted to ensure it is in contact with the upper rim evenly at centric relationship in a proper VDO.

To record the neutral zone, the patient should be in a comfortable, upright position with the upper wax rim inserted. Polyether impression material was loaded on the buccal and lingual sides of the lower

individual tray after polyether adhesive was applied and dried. The individual tray was then rotated into the patient's mouth. Before the material sets, the patient was instructed to perform functional movements such as licking lips, sucking, puckering, smiling, grinning, swallowing, pronouncing some words, or combination of these. These actions should be repeated until the material has set. After setting, the displaced excess material was removed **(Figure 1-5)**. The extension and accuracy of the neutral zone impression area was assessed using a fit checker and then the borders were trimmed to a thickness of 2 mm **(Yi-Lin et al., 2013).**

Figure (1-5): Neutral zone impression with the polyether impression material **(Yi-Lin *et al*., 2013)**

The rubber base adhesive was applied on the tissue side and the border area of the tray. A final wash impression was accomplished with a polysulfide impression material. The patient was asked to repeat the rehearsed muscular movements. Therefore, the form of the neutral zone was refined and the tissue surface was recorded in an anatomic form **(Figure 1-6).**

Figure (1-6): Tissue-side final wash impression with the polysulfide impression material **(Yi-Lin et al., 2013)**

After beading and boxing, the lower master impression was poured. Before the impression was removed, tongue, lip, and cheek matrices were made of silicone putty material for preserving the neutral zone on the cast **(Figure 1-7).**

Figure (1-7): (A-C) Before the tray was removed, a silicone matrix was made to represent the neutral zone space **(Yi-Lin *et al*., 2013).**

Wax was poured into the space confined by the putty matrices to make a wax rim, which exactly represented the neutral zone on the newly formed baseplate on the lower cast. VDO verification, bite registration, and facebow transfer were then performed as with conventional complete denture methods.

The artificial teeth were positioned within the matrices. Zero degree teeth were chosen and arranged to balanced occlusion. Vertical dimension, centric relation, esthetics, and phonetics were rechecked during wax denture try-in. An external impression can be performed at this stage to refine the final wax contour of polishing surface if needed **(Yi-Lin et al., 2013).**

After processing, finishing, and polishing, the dentures were delivered to the patient and tested for stability, retention, intercuspal relation, esthetics, and phonetics (**Figure 1-8)**. Fit checker was used to check the neutral zone space.

Figure (1-8): (A-F) Final complete dentures. (E and F) Fit checker was used to check the neutral zone space **(Yi-Lin et al., 2013).**

1.6.4 Preprosthetic surgery

Preprosthetic surgery is defined as the surgical procedures designed to facilitate fabrication of prosthesis or to improve the prognosis of prosthodontic care **(Chari & Shaik, 2016)**. Preprosthetic surgery is done to provide a better anatomic environment and to create proper supporting structures for denture construction. Ultimate goal should be rehabilitation of the patient with restoration of the best possible masticatory function,

combined with restoration or improvement of dental and facial esthetics. To achieve this goal, maximum preservation of hard and soft tissues of the denture base is of utmost importance (**Bhuskute & Shet, 2019)**.

1.6.4.1 Objectives of preprosthodontic procedure

Correcting conditions that preclude optimal prosthetic function.

1. Hyperplastic replacement of resorbed ridges.
2. Unfavorably located frenular attachments.
3. Bony prominences, undercuts (**Bhuskute & Shet, 2019).**

I-Alveoloplasty

"Alveoloplasty" is the term used to describe the trimming and removal of the labiobuccal alveolar bone along with some interdental and interradicular bone and is carried out at the time of extraction of teeth and after extraction of teeth.

When surgery is planned on edentulous ridge, incision should be made on the crest of alveolar ridge; usually, the envelope flap would suffice, but releasing incision can be made on the labial side to provide a broad base to the flap **(Figure 1-9) (Devaki et al., 2012).**

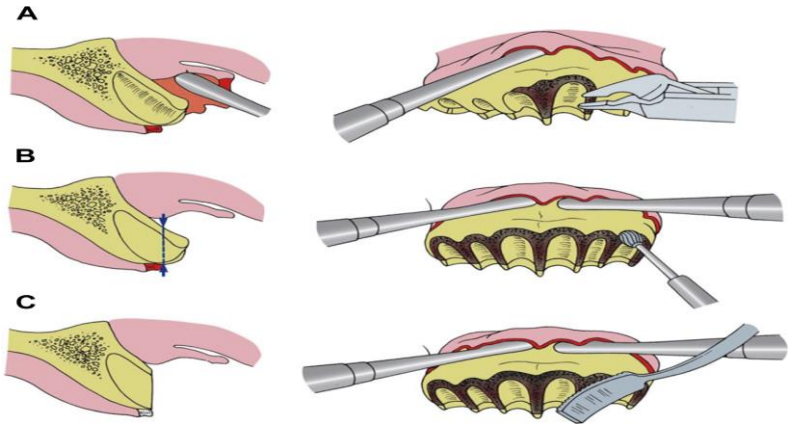

Figure (1-9): Alveoloplasty techniques using hand and rotary instruments. (A) Flap elevation, alveoloplasty using rongeurs. (B) Alveoloplasty using rotary instrumentation. (C) Final contouring and smoothing using a bone file **(Ephros et al., 2015).**

II-Removal of sharp ridge

Bony prominences, undercuts, and spiny ridges are usually removed to avoid undercuts and to make possible a border seal beyond them against the floor of the mouth. Place an incision on the crest of the ridge and elevate the mucoperiosteum as minimally as possible to maintain vestibular depth. Irregular and sharp bony edges are trimmed to a depth of 1–2 mm with the help of rongeurs, bone files, or burs, and the wound is closed with silk sutures **(Bhuskute & Shet, 2019)**.

III-Reduction of Genial Tubercle

Genial tubercles are the bony projections located on the lingual aspect of the mandible, two on either side of the midline, which gives attachment to the genial muscles. The two genial tubercles located superiorly are more prominent than the inferior ones due to the gross resorption of the mandibular ridge. This may elevate the ridge lingually, giving a shelf-like appearance and making the anterior lingual seal impossible. Genial tubercles are exposed by blunt dissection. Using bur, chisel, or rongeurs, the tubercle is removed, and the rough bony margins are smoothened using file **(Devaki et al., 2012)**.

IV-Prominent Mylohyoid Ridge

Resorption in ridge height of posterior mandible makes the mylohyoid ridge prominent and limits the extension of the denture in this area. This is a common area of painful denture irritation. At times, the tonicity of the mylohyoid ridge itself can cause problems with denture retention **(Chari & Shaik, 2016).**

V-Mandibular Tori

Mandibular tori are bony exophytic growths that are present on the lingual aspect of the mandible, opposite to the bicuspids. They present in early midlife and tend to grow with age. Mandibular tori occur in 6–7% of the population. The etiology of exostosis is multifactorial including genetic and functional influences **(Banerjee et al., 2018).**

Indication for removal of the mandibular tori are interfere with tongue positioning, speech interference, prosthodontic reconstruction, patient with poor oral hygiene around the lower posterior teeth, and traumatic ulceration from mastication **(Figure 1-10) (Mukherjee et al., 2018)**

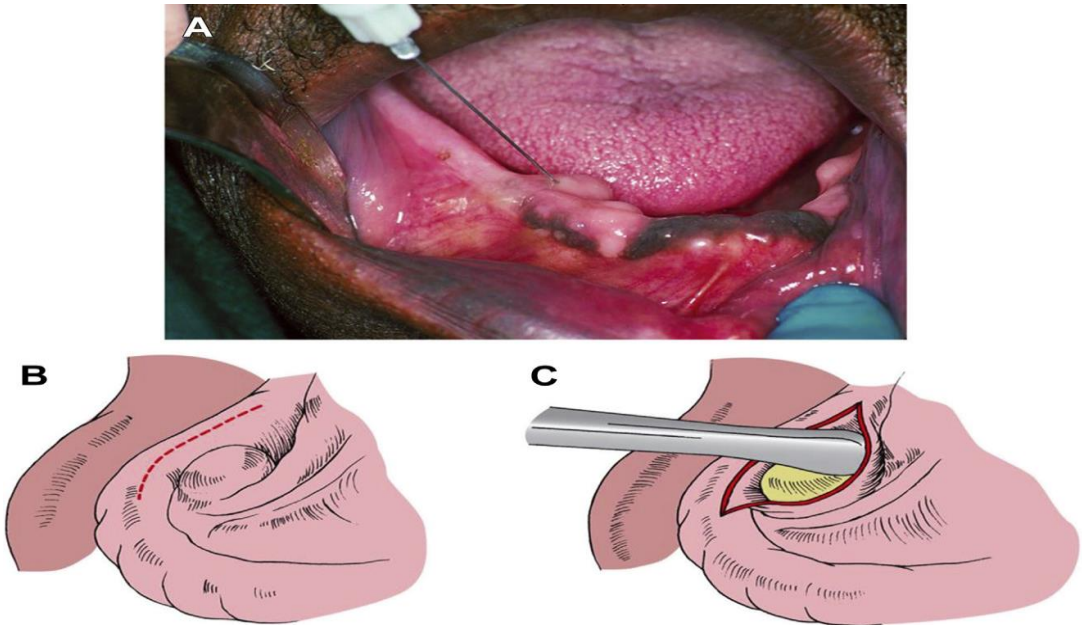

Figure (1-10): Mandibular torus removal. (A) Infiltration of local anesthesia at site to facilitate elevation of thin mucosa overlying a mandibular torus. (B) Incision placed over the alveolar crest. (C) Flap elevation to ensure adequate access and allow retractor placement to protect the floor of the mouth**(Ephros et al., 2015)**.

VI-Lingual Frenectomy

If the frenal attachment is near the crest of the lingual aspect, it will displace the denture. So the need for relief of the high attached frenum is needed.This procedure can be done under local anaesthesia or general anaesthesia. When local anaesthesia is used, bilateral lingual nerve block and infiltration are used. The tongue is grasped with traction sutures or forceps and the attachment of frenum to the ridge is cut and the wound is closed with sutures **(John et al., 2007).**

VII-Vestibuloplasty

Vestibuloplasty should be performed in case of the shallow vestibule to widen denture-bearing area. There are different techniques of vestibuloplasty. Most of them provide access from the buccal aspect of the mandible **(Chatterjee et al., 2018)**.

A-Kazanjian vestibuloplasty

Kazanjian vestibuloplasty is the prototype of vestibuloplasty procedure where the labial flap pedicled off the alveolar process is used to cover the alveolar bone side while the labial surface is allowed to heal by secondary epithelisation. The major drawback of this procedure is severe scarring of lip causing reduced lip flexibility **(Shrestha et al., 2020).**

B-Clark vestibuloplasty

Clark’s vestibuloplasty technique uses mucosa pedicled from the lip. Horizontal incision is performed from canine to canine between immobile gingiva and mobile gingiva.After supraperiosteal dissection, the mucosa is sutured at the depth of the vestibule. The denuded periosteum heals by secondary epithelialization **(Choudhari et al., 2018).**

C-Corn vestibuloplasty

This vestibuloplasty is similar to Clark's vestibuloplasty. Difference: Horizontal incision is through soft tissue/ mucosa and periosteum/to the mucoperiosteal flap is dissected, and the bone is exposed. Disadvantages: More painful procedure; the healing process is longer **(Chatterjee et al., 2018).**

D-Obwegeser vestibuloplasty

Vestibuloplasty described by Obwegeser is the method in which labial extension procedure and Trauner's procedure provide a maximal vestibular extension to both the buccal and lingual aspects of the mandible **(Chatterjee et al., 2018)**.

VIII-Ridge Augmentation

A-Superior border augmentation

It was described by Davis in the year 1970. This procedure is indicated when mental foramen is situated in the superior border. In this procedure, autogenous bone graft is used. The rib graft can be fixed to the superior border of the mandible. Two segments of the rib, about 15 cm long, are obtained from the 5^{th} and 9^{th} ribs. The rib is contoured by vertical scoring in the inner surface. The second rib is cut into small pieces to laterpack against the solid rib. Fixation is done by means of transosseous wiring or circumferential wiring.

The disadvantage of superior border augmentation are morbidity of the donor site, secondary surgical site, and necessity of the patient to withdraw denture till the surgical wound heals for period of 6–8 months **(Devaki et al., 2012)**.

B-Inferior border augmentation

This technique was first described by Sanders and Cox in the year 1986 for reconstruction of a resected mandible. This procedure is indicated to prevent and manage fractures of an atrophic mandible. In this procedure, mandible is divided buccolingually by a vertical osteotomy from external oblique ridge of one side of the mandible to the other side. The osteotomized lingual segment is pushed superiorly and fixed with the buccal segment using stainless steel wire in the lower border of the lingual segment**(Devaki et al., 2012).**

1.6.5 Overdenture

Overdenture is any removable dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of natural teeth, and/or dental implants. It is one of the most practical measures used in preventive dentistry; it is also called overlay denture, overlay prosthesis **(Taylor, 2017)**.

1.6.5.1 Indications of overdenture

1. Few remaining teeth are unsuitable for fixed or removable partial dentures.
2. Remaining teeth present with unhealthy periodontal conditions.
3. Patients with class II or class III Angle's classification - Esthetics & masticatory function improved.
4. Patients presenting abnormal jaw size large maxillary or mandibular bone defects.
5. The construction of over-denture is an alternative line of treatment to single dentures opposing a few natural teeth.

6. Patients presenting congenitally missing teeth and congenital defects such as cleft palate, microdontia, amelogenesis or dentinogenesis imperfecta, or partial anodontia.

7. Overdentures can be useful for patients with a severe ridge defect or bone resorption.

8. Patients who have unfavorable tongue positions and muscle attachment for a conventional removable prosthesis.

9. If the patient has a superficially placed mental nerve, then the preferential choice of treatment may be to leave certain teeth in place to prevent damage to the nerve and prescribe an overdenture for any aesthetic needs.

10. An overdenture can be prescribed for a patient who has just had a root canal treatment completed to protect the coronal seal of the tooth if they are waiting to have fixed prosthodontics carried out on the tooth. **(Bansal, Aras and Chitre, 2013).**

1.6.5.2 Overdenture Classification

Overdentures can be classified into:

1-Tooth supported.

2-Implant supported **(Krennmair et al., 2016).**

1. Tooth-supported overdenture:

A complete or partial removable denture supported by a tooth or retained roots that are intended to provide improved support, stability, and tactile and proprioceptive sensation and to reduce ridge resorption **(Krennmair et al., 2016).**

2. Implant-supported overdenture:

Edentulous patients with a sufficient amount of bony ridge on their jaws can use implant-supported overdenture. This type of overdenture gains

supports from both the dental implants and intraoral tissues. Having implant-supported overdenture provides better stability of prosthesis and reduces bone resorption. However, a conventional complete denture can be considered an alternative due to less treatment time needed **(Langer and Langer, 2000).**

The implant-retained overdenture is an acrylic resin removable denture, retained by implants, and may or may not be on the mucosa. The number and location of the implants, along with the various types of attachments, determine the variations in this type of prosthesis .This is a less invasive, cheaper, and equally effective treatment option when compared to the fixed implant-supported prosthesis **(Mundt et al., 2016).**

The choice between an implant-retained overdenture and a fixed implant supported prosthesis as an alternative to conventional dentures in edentulous mandibles suggests some questions, such as: **(Fitzpatrick, 2006).**

1. Implant survival.
2. Bone loss.
3. Patient satisfaction.
4. Quality of life as related to oral health.
5. Chewing efficiency.
6. The number of implants.
7. Cost

The advantages of implant-supported overdenture are:

1-Improved denture retention and denture stability and stable occlusion reduced alveolar bone resorption (anterior mandible alveolar ridge height reduction 0.5 mm over 5 years and long-term resorption0.1mm annually compared with 0.4 mm).

2-An implant overdenture provides stability to the prosthesis due to which the patient is consistently able to reproduce a determined centric occlusion.

3-An Implant Overdenture increases chewing efficacy by 20% as compared to a traditional complete denture.

4-Maximum occlusal force of a patient with a denture may improve up to 300% with an implant-supported prosthesis **(Jahangiri, 2011).**

CHAPTER TWO

CONCLUSION

CONCLUSION

Residual ridge resorption is a complex biophysical process and a common occurrence following extraction of teeth. Residual ridge reduction is one of the main causes of loss of denture stability and retention especially in mandibular complete dentures. The success of the complete denture relies on the fulfillment of the three basic properties which are retention, stability, and support. Mandibular dentures usually faced more difficulties in achieving these three properties than maxillary dentures because, the mandible ridge has a lesser residual ridge for retention and support and has greater resorption rate than the maxilla. Nowadays, different treatments for improving the denture stability and retention are suggested such as dental implant therapy and it depends on patient's overall health, economical condition and the patient's cooperation.

REFERENCES

REFERENCES

A

Al-Jabrah, O. A., & Al-Shumailan, Y. R. (2013). Association of complete denture wearing with the rate of reduction of mandibular residual ridge using digital panoramic radiography. *International Journal of Dental Research*, *2*(1), 20–25.

Alsaggaf, A., & Fenlon, M. R. (2020). A case control study to investigate the effects of denture wear on residual alveolar ridge resorption in edentulous patients. *Journal of Dentistry*, *98*, 103373.

Anusavice KJ, Phillips RW. Phillips' Science of Dental Materials. St. Louis, MO: Saunders; 2003. 250-1.

B

Banerjee S, Mukherjee S, Chatterjee D, Deb S, Swamy SN, M. A. (2018). Preprosthetic surgery - an overview. *International Journal of Preventive and Clinical Dental Research*, *5*(1), 149–152.

Bansal, S., Aras, M.A. and Chitre, V. (2013). Tooth Supported Overdenture Retained with Custom Attachments: A Case Report. The Journal of Indian Prosthodontic Society, 14(S1), pp.283–286.

Benhamida, S. A., El Maroush, M. A., Elgendy, A. A., & Elsaltani, M. H. (2019). Residual ridge resorption, the effect on prosthodontics management of edentulous patient: an article review. *International Journal of Scientific Research and Management*, *7*(09), 260–267.

Bhuskute, M., & K Shet, R. (2019). Preprosthetic surgery: An adjunct to complete denture therapy. *Journal of the International Clinical Dental Research Organization*, *11*(1), 49.

Burugupalli, P., & Nair, C. (2018). Changes in the form and structure of residual ridges : An Overview. *Tpdi*, *9*(2), 19–31.

C

Chari, H., & Shaik, K. (2016). Preprosthetic surgery: review of literature. *IJSS Case Reports & Reviews*, *3*(4), 419–424.

Choudhari, S., Rakshagan, V., & Jain, A. R. (2018). Evolution in preprosthetic surgery current trends: A review. *Drug Invention Today*, *10*(10), 2010–2016.

D

D., K. P., Mehra, D., & D., A. P. (2014). Prosthodontic Management of Compromised Ridges and Situations. *Journal of Health and Allied Sciences NU*, *04*(01), 141–148.

Daniel, S., & Daniel, A. Y. (2017). *Case Report A Modified Physiologic Impression Technique for Atrophic Mandibular Ridges*. 204–208.

Devaki, V., Balu, K., Ramesh, S., Arvind, R., & Venkatesan. (2012). Pre-prosthetic surgery: Mandible. *Journal of Pharmacy and Bioallied Sciences*, *4*(6), 414.

Devaki, V. N., Manonmani, P., Balu, K. J., & Aravind, R. (2012).

Clinical management of highly resorbed mandibular ridge without fibrous tissue. *Journal of Pharmacy and Bioallied Sciences*, *4*(SUPPL. 2-PART 1), 149–153.

Douglass, C. W., Shih, A., & Ostry, L. (2002). Will there be a need for complete dentures in the United States in 2020? *Journal of Prosthetic Dentistry*, *87*(1), 5–8.

Driscoll, C. F., Freilich, M. A., Guckes, A. D., Knoernschild, K. L., Mcgarry, T. J., Goldstein, G., Goodacre, C., Guckes, A., Mor-, S., Rosenstiel, S., & Vanblarcom, C. (2017). The Glossary of Prosthodontic Terms: Ninth Edition. *The Journal of Prosthetic Dentistry*, *117*(5).

E

Ephros, H., Klein, R., & Sallustio, A. (2015). Preprosthetic Surgery. *Oral and Maxillofacial Surgery Clinics of North America*, *27*(3), 459–472.

F

Fahmy, F. M., Kharat, D. U. (2001) A study of the importance of the neutral zone in complete dentures. J Prosthet Dent, 64, 459–62.

Fitzpatrick, B. (2006). Standard of care for the edentulous mandible: A systematic review. The Journal of Prosthetic Dentistry, 95(1), pp.71–78.

G

Gahan MJ, Walmsley AD. The neutral zone impression revisited. Br Dent J 2005;198:269-72.

Gupta, S., Singh, S. V, & Arya, D. (n.d.). *POLYMORPHISM 107 REVIEW Residual ridge resorption-a review of etiology*. 107–113.

H

Haikola, B., Oikarinen, K., Söderholm, A. L., Remes-Lyly, T., & Sipilä, K. (2008). Prevalence of edentulousness and related factors among elderly Finns. *Journal of Oral Rehabilitation*, *35*(11), 827–835.

Herekar, M., Sethi, M., Fernandes, A., & Kulkarni, H. (2013). *A Physiologic Impression Technique for Resorbed Mandibular Ridges*. *2*(2), 80–82.

Huumonen, S., Haikola, B., Oikarinen, K., Söderholm, A. L., Remes-Lyly, T., & Sipilä, K. (2012). Residual ridge resorption, lower denture st ability and subjective complaints among edentulous individuals. *Journal of Oral Rehabilitation*, *39*(5), 384–390.

J

Jahangiri, L. (2011). Clinical cases in prosthodontics. Ames, Iowa: Wiley-Blackwell.

K

Krennmair, S., Weinländer, M., Forstner, T., Krennmair, G. and Stimmelmayr, M. (2016). Factors affecting peri-implant bone resorption in four ׀Implant supported mandibular full-arch restorations: a 3-year prospective study. Journal of Clinical Periodontology, 43(1), pp.92–101.

L

Langer, Y. and Langer, A. (2000). Tooth-supported telescopic prostheses in compromised dentitions: A clinical report. The Journal

of Prosthetic Dentistry, 84(2), pp.129–132.

M

Manish K, Vinod K, Ravi G, Deepak M. Residual ridge resorption: a review. Journal of Science and Technology 2015; 1(4):124-128

Mundt, T., Al Jaghsi, A., Schwahn, B., Hilgert, J., Lucas, C., Biffar, R., Schwahn, C. and Heinemann, F. (2016). Immediate versus delayed loading of strategic mini dental implants for the stabilization of partial removable dental prostheses: a patient cluster randomized, parallel-group 3-year trial. BMC Oral Health, 17(1).

N

Narayane, Ka., Kattimani, P., Ranganathan, K., Mithran, A., Raj, S., Amalorpavam, V., & Nayyar, A. (2020). The concept of neutral zone and rehabilitation of severely resorbed alveolar ridges: A special case file. *Journal of the International Clinical Dental Research Organization*, *12*(1), 78.

P

Pan, S., Dagenais, M., Thomason, J. M., Awad, M., Emami, E., Kimoto, S., Wollin, S. D., & Feine, J. S. (2010). Does mandibular edentulous bone height affect prosthetic treatment success? *Journal of Dentistry*, *38*(11), 899–907.

Prithviraj, D. R., Singh, V., Kumar, S., & Shruti, D. P. (2008). *Conservative prosthodontic procedures to improve mandibular denture stability in an atrophic mandibular ridge*. *8*(4).

R

Rachmiel A, Leiser Y. The molecular and cellular events that take 1

place during craniofacial distraction osteogenesis. Plast Reconstr Surg Glob Open. 2014;2:e98.

S

Shrestha, B., Lamichhane, K. P., Pradhan, S., Gorkhali, R. S., & Koirala, P. K. (2020). Clark's Technique of Vestibuloplasty - A Case Report. *Journal of Nepalese Society of Periodontology and Oral Implantology*, *4*(2), 93–95.

S. Winkler, Essentials of Complete Denture Prosthodontics, AITBS, New Delhi, India, 2nd edition, 2009.

T

Tunkiwala, A., & Ram, S. (2013). Management of mandibular poor foundation: conventional complete dentures. *Dental Practice*, *11*(5), 34–37.

Taylor, T.D. (2017). American Board of Prosthodontics. Journal of Prosthodontics, 26(8), pp.696–697.

Y

Yi-Lin Yeh, Yu-Hwa Pan, Ya-Yi Chen, Neutral zone approach to denture fabrication for a severe mandibular ridge resorption patient: Systematic review and modern technique, Journal of Dental Sciences, Volume 8, Issue 4, 2013, 432- 438.

Z

Zmysłowska, E., Ledzion, S., & Jedrzejewski, K. (2007). Factors affecting mandibular residual ridge resorption in edentulous patients: A preliminary report. *Folia Morphologica*, *66*(4), 346–352.