

MANAGEMENT OF HIGHLY RESORBED MANDIBULAR RIDGE

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ABSTRACT:

Gross mandibular atrophy has been described as a 'multifactorial biomechanical disease' resulting from a combination of anatomic, metabolic and mechanical determinants varying with time from patient to patient in an infinite number of combinations.

As the height of the edentulous ridge diminishes mandibular denture begin to function improperly. Severe resorption of the mandibular alveolar ridge contributes to instability and discomfort of the convention acrylic resin denture.

Dealing with this situation requires clinical skills and knowledge. Treatment options are used in the form of prosthodontic applications and surgical procedures. A number of surgical procedures afford substantial assistance in treatment and the oral surgeon has a deep appreciation of the problems facing the prosthodontist.

Key words: Resorbed, mandibular, ridge.

INTRODUCTION:

Edentulous conditions of long standing from the loss of natural teeth often result in bone and tissue changes, the severity of which depends upon the length of time these missing teeth are replaced. Concern must be directed toward these group of patients. The patient should be made to understand that although the ridge changes may occur more slowly after 8 to 12 months, resorption continues for the rest of patient's life. Dealing with a highly resorbed mandibular ridge requires clinical skills and knowledge.

REVIEW:

Many techniques have been developed to deal with problem of the compromised ridge. In the 1930s ^[1], Page and Jones

advocated the principle of "mucostatics". Schollosser in 1950 ^[2] has implicated ill-fitting dentures and associated trauma to oral tissues as the primary causes of rapid destruction of the denture bearing structures. Tuckfield ^[3] in 1953 wrote, "The unfortunate mandibular denture, often having to rest upon a very poor ridge or no ridge at all" is the real problem. G. Tryde et al ^[4] treated a number of patients with extreme resorption of the mandibular residual ridge. They have told that "the shape of the osseous structures in these patients offers little possibility of retention and stability of complete dentures. Furthermore, muscle attachments are located near the crest of the residual ridge and consequently, the dislocating effect of the muscles on the denture is great."

Atwood ^[5] in 1971 has stated, “because RRR is chronic and progressive, it results in repeated mucosal, functional, psychologic, esthetic, and economic problems for denture patients. Because it is cumulative, the patient with this disease becomes more and more dentally handicapped, ultimately a “dental cripple.”

Tallgren in 1972 ^[6] told that the “continuing resorption over years, the prosthetic replacement of the lost tissues will give rise to increasing treatment problems and may cause the patient extreme difficulties in management of the dentures. The continuing resorption, especially of the lower ridge, therefore, constitutes a serious prosthodontic problem.”

Hobkirk in 1973 ^[7] wrote, “The basic problem of patients with gross alveolar resorption is that the gross alveolar resorption is that the dentures, now lacking stability, are at the whim of muscular and occlusal forces and tend to slide over the mucosa, leading to trauma which it is often unable to resist, especially if the patient is elderly. Occasionally prosthodontists encounter a further problem in patients with very thin residual lower alveolar ridges against which the denture presses the oral mucosa. Such patients can often be more difficult to treat than those with no alveolar process”.

Atwood ^[1] in 1971 wrote **Pathogenesis of RRR** Immediately following the extraction (order II), any sharp edges remaining are rounded off by external osteoclastic

resorption, leaving a high well rounded residual ridge (order III). As resorption continues from the labial and lingual aspects, the crest of the ridge becomes increasingly narrow ultimately becoming knife-edged (order IV). As the process continues, the knife-edge becomes shorter and eventually disappears, leaving a low well rounded or flat ridge (order V). Eventually this too resorbs, leaving a depressed ridge (order VI).

Dr. A. Gupta et al ^[8] in 2010 wrote, “RRR does not stop with residual ridge, but may go well below where apices of teeth were, sometimes leaving only a thin cortical plate on the inferior border of the mandible or virtually no maxillary alveolar process of the upper jaw.

Atwood in 1971 ^[1] told about possible factors: The *anatomic* factors include such things as the size and shape of the ridge, the type of bone, and the type of mucoperiosteum. The *metabolic* factors include such things as age, sex, hormonal balance, osteoporosis. The *functional* factors include the frequency, direction, and amount of force applied to the ridge. The *prosthetic* factors include the type of denture base, the form and type of teeth, the interocclusal distance, and the like. For further convenience, since the functional factors must function through the prosthetic factors, they may be grouped together as mechanical factors.

PRINCIPLES OF MANAGEMENT:

Hobkirk in 1973 ^[7] wrote about “principles of management. Before commencing treatment of those patients exhibiting

marked loss of alveolar bone, two important factors must be considered. First, there is the attitude of the patient to the dental problems. Second, there is the role of systemic disease as an etiologic factor in gross alveolar resorption.

Early management: Advances in health care have increased longevity, resulting in a large number of long term denture wearers. Younger patients have better ridges and/or co-ordination and can usually wear mandibular dentures successfully, no matter how poorly they are made.”^[9]

B. Levin^[10] says that “the highly resorbed mandibular ridge is commonly observed, especially in older patients. Older patients have thinner, atrophic mucosa and a lower threshold of pain. Many denture wearers have little or no difficulties at first but then often experience increased problems as their ridges and general health deteriorate.” Older patients have ‘diminished resiliency of tissues and muscle tonicity accompanied with poor adaptive capacity.’^[11]

PREVENTIVE PROSTHODONTICS^[12]

The greatest way to preserve the mandibular anterior ridge comes from the maintenance of one or more endodontically treated roots and the placement of an overdenture. The advantages of the overdenture over the conventional denture are: (1) soft tissues of the residual ridges are spared abuse due to support of abutment teeth, (2) the denture has more horizontal stability, (3)

there is increased vertical stability during functional loading, resulting in improved masticatory performance, (4) natural teeth that are unacceptable as abutments for conventional dentures can be maintained as supporting elements in complete overdentures, and (5) patient acceptance is excellent.

A preventive approach to preserve the residual alveolar ridge from resorption that can be taken, if the patient approaches the Prosthodontist before extraction of all natural teeth. But if the patient visits the Prosthodontist when the resorption has already taken place, Prosthodontic management of such patient should be done with great care and should be given thorough consideration.^[13]

Several methods have been proposed to prevent resorption:

- 1) Overdentures using retained vital and endodontically treated non-vital teeth abutments
- 2) Submerged roots to preserve alveolar ridge structure^[11]
- 3) Different types of implants

Others are:

1. Improving stress potential.

Systemically-Improving nutrition with multivitamins for the patients with difficulty in swallowing, neuromuscular disorder. Nutritional proteins- Class I and II for repair and maintenance. Calcium supplementation by osteocalcium,

calciosteline or natural sources like milk, eggs, green leafy vegetables.

Locally-Improve tissue tone by eliminating inflammation and improving blood circulation by glycerine with 15% tannic acid as an astringent and warm saline gargles.^[14]

2.Clinical procedures

MANAGEMENT IN PROSTHODONTICS:

Oral examination: ^[15] A thorough examination of an edentulous patient includes a detailed history and psychologic assessment of the patient along with a visual and digital survey of the oral cavity. It is significant in history of the patient especially in case of old denture wearer as it helps in assessing the psychology of the patient which in turn reflects the patient's attitude towards accepting a denture. It plays an important role in the success of any prosthetic appliance delivered to the patient.

Radiographic examination: Intracranial radiographs are taken in order to observe the density of the residual ridges.A C.T.scan of the maxilla and the mandible helps to determine the quantity of bone in the residual ridges.

Mouth Preparation: Hobkirk ^[7] stated in 1973 that mouth preparation is important as modification of the fitting and occlusal surfaces of the patient's dentures is often required. The fabrication of stable and retentive dentures is facilitated if attention is directed to the three main denture surfaces described by Brill and associates ^[4] as 1) the pressure-receiving,

2) the secondary supporting, and 3) the pressure-transmitting surfaces.

Methods:

1) Selection of trays for primary impression

2) Impression

Primary-material with technique

Custom tray-modification and border moulding with material

Secondary-technique and material

Jaw relation

Teeth

Occlusion

Denture

3) Neutral Zone

4) Special dentures

Trays: Meena A.A. in 1991 ^[13] suggested using stock trays. A.M.Sofou et al in 2004 ^[16] advocated use of a customized stock tray. Aluminum impression tray is suggested by M. A. Pyle in 1999 ^[17]. Alexandre Malachias et al in 2005 ^[18] described modified functional impression technique where muscular zone record is obtained with the patient's help, by asking him to make specific muscular movements of the lips, cheeks, tongue and jaws (open/closure and lateral). A.Gupta et al in 2010 ^[19] and Manisha et al in 2011 ^[20] wrote that lead trays can be an alternative for the conventional trays, because due to density and contour of the lead trays the

impression of this area can be made more easily as compared to conventional stock trays.

IMPRESSIONS:

PRIMARY: Arthur S. Freeze in 1956 [21] suggested using low heat modeling plastic. It is softened and placed in soft metal impression tray which is then seated in the patient's mouth. The patient is instructed to run his tongue along his lips, suck in his cheeks, pull in his lips and open and close his mouth. The preliminary impression is removed, chilled, boxed and a stone cast is poured. Kubalek in 1966 [22] suggested alginate (irreversible hydrocolloid), modeling plastic, or a reversible hydrocolloid for the preliminary impression. R.L. DeFranco and A.S. Sallustio [23] in 1995 told about physiologic impression. The impression may be made in either the open- or closed-mouth position. Mc Cord and Tyson [24] in 1997 wrote about viscous admix of impression compound and tracing compound removes any soft tissue folds and smoothes them over the mandibular bone; this reduces the potential for discomfort arising from the 'atrophic sandwich', i.e. the creased mucosa lying between the denture base and the mandibular bone.

Praveen G. et al in 2011 [25] described "Cocktail" technique that refers to the combination of different impression techniques. Preliminary impression is made using patient's previous denture with irreversible hydrocolloid by open mouth technique.

CUSTOM TRAY : The technique given by Lott and Levin in 1966 [26] utilizes a special tray and instrument to create partial vacuum, which automatically centers the tray. The object is to reduce the stress on any given tissue by increasing the load-bearing area. The idea is a perfect negative likeness, which would render the terms "basal seat" and "denture foundation" synonymous. To realize the ideal, the form of the tissues must be recorded both vertically and laterally so that all surfaces can bear an equal load.

R.L. DeFranco and A.S. Sallustio in 1995 [23] wrote that border extensions are developed with tissue-conditioning material. Lingual borders are developed with mouth open and patient makes essential tongue movements (placement in the cheek and wiping the upper lip). Also patient is instructed to border-mold the material physiologically by producing "OOO" and "EEE" sounds while biting on occlusal rim. (the first application of conditioning material should be of thicker consistency to gain maximum extension).

Alexander Malachias et al in 2005 [18] gave the modified functional impression technique. In the technique muscular zone record is obtained with the patient's help, by asking him to make specific muscular movements of the lips, cheeks, tongue and jaws (open/closure and lateral). The use of an individual tray is necessary for this technique. The borders of this tray should be established in such a way that the patient's muscular movements are free from them during the

impression procedure. Kian M.Tan et al^[27] in 2009 wrote that a special tray is made with window in region of displaceable tissue.Border moulding is done with low fusing impression compound.Lakshman Rao et al in 2010^[28] wrote that the tray was carefully border molded with putty consistency of polyvinyl siloxane (Speedex, Coltene) in a single step.

Praveen G. et al in 2011^[29] wrote that customized tray is fabricated with autopolymerising acrylic resin according to Dynamic Impression Technique.

SECONDARY: Klein E.I in 1957^[30] wrote final impression is made using ZnOE paste(Free-flowing paste will allow the soft tissue along the crest of the ridge to place itself).W.W.Chase in 1961^[31] have suggested use of tissue conditioning materials.It was stated that the tissue-conditioning procedure is a positive factor in doctor-patient relationship. B.Levin in 1984^[10] wrote about making a final impression with an elastomeric material.Finger manipulations and exaggerated tongue movements were used to prevent overextensions.

R.L.DeFranco and A.S.Sallustio^[23] in 1995 wrote that final impression is made with a polysulfide rubber impression material with mouth open and using standard border-moulding procedures(this process minimizes pressure that occurs during closed-mouth phase and provides excellent surface detail and better compatibility with dental stone.Greatest disadvantage of this procedure is amount of time necessary to develop final impression. Kian M Tan et al in 2009^[27]

gave modified fluid wax impression-a functional impression technique, such as fluid wax, to capture the primary and secondary load-bearing areas without distortion of the residual ridge.In the mandible, the alveolar ridge serves as a secondary load-bearing area, with the buccal shelves serving as the primary load-bearing area.Fluid wax is adapted all over the intaglio surface, including the borders.While the wax sets intraorally, light body is injected through the window.A final accurate impression is achieved.Lakshman Rao et al in 2010^[28] made final impression by a technique known as “the sectional or the two tray technique.”From the patient’s mouth, the mobile tissues were identified and marked onto the study cast and the special tray was cut away from that areas.An impression was made with light body polyvinyl siloxane (Speedex, Coltene).The impression was removed, excess material was trimmed off and impression was resealed.A stock tray was then used to make an alginate impression over the impression tray in the mouth, so as to support the secondary impression.Praveen G. et al in 2011^[25] wrote that McCord and Tyson’s technique for flat mandibular ridges is followed for definitive impression .

JAW RELATION:

Watt and MacGregor in 1976^[32] told that the provision of a generous freeway space is said to decrease the frequency and duration of functional and particularly parafunctional tooth contact. In cases of marked ridge loss the vertical dimension

may be further reduced in order to place the occlusal table closer to the alveolar ridge and create a more stable lower denture by reduction in the height of the denture.

R.A. Williamson et al in 2004 [33] wrote that consistent, repeatable, and easily verified centric relation recording may be achieved through using an intraoral gothic arch-tracing device.

NEUTRAL ZONE:

Lamie in 1956 [34] argued that in aging patients, mandibular posterior denture teeth should be arranged over the buccal shelf to provide increased tongue space and to facilitate the development of vertical facial denture polished surfaces, against which an effective facial seal can be achieved and maintained.

Beresin, Scheisser and Bril et al in 1976 and 1965 [35] respectively wrote that modelling compound is used to fabricate occlusion rims and these rims are then molded intraorally according to the muscle function-recording of neutral zone. The final impression is made with the closed mouth technique. Finally obtaining the impression of the polished surfaces and establishing their contours in the wax up. Impression compound is molded and placed on the bases. Neutral zone is recorded by moulding material according to muscle function intraorally. Slow setting medium viscosity silicone impression material is coated on all the surfaces. Silicone impression is then removed-buccal and labial matrices (surfaces) are replaced.

Other techniques used are using different designs of impression trays, injecting alginate into the denture space, impression tray is stabilized by biting and using alginate and polysulfide.

TEETH: M. Kothavade in 2001 [14] stated that zero degree or nonanatomic teeth are used for they eliminate horizontal forces and give greater comfort to patient. Bucco-lingually narrow posterior teeth reduce masticatory forces per unit area of ridge. Acrylic teeth are preferred to porcelain teeth as former are easy to adjust and will act as cushion transmitting less forces to supporting structures.

OCCCLUSION: In 1966 [33] J.P. Frush described occlusion in geometric terms as one-dimensional (linear), two-dimensional (flat plane), and three-dimensional (cusped). Linear occlusion was promoted as an occlusal scheme that led to increased stability of denture bases by minimizing the lateral forces applied to those bases. Prithviraj et al in 2008 [36] wrote about neutrocentric occlusion which was developed by De Van.

DENTURE: B. Levin in 1984 [10] stated that the dentures should be completed in a routine fashion except the lower recording base which should have the same extensions and bulk as final base. The size of lower base needs to be discussed and explained at each subsequent visit and it is very important to constantly reinforce the fact that the new lower denture will be larger.

OTHER METHODS- SPECIAL DENTURES:

In 1957^[36], Faber advocated using metal bases for snugness of fit of the mandibular denture. Although, multi-suction cup lined denture, resurrected by Dr. Jermyn in 1963^[37], offered a successful, economic and noninvasive way for enhancing denture retention, they sometimes stand helpless in overcoming problems of reduced supporting surface area as in mandibular dentures. In these situations ultrasuction denture appear to offer a better solution. Y.V.Omprakash et al in 2004^[38] wrote that hollow dentures act as a continuous reline. Their advantages over conventional dentures are: preservation of remaining residual ridge by optimal distribution of applied load over an increased area, improved patient comfort because of smooth flexible tissue surface, better support, retention and stability because of close adaptation, prevention of chronic soreness from hard denture surface. These dentures with shock absorbing effect thus fulfill a valuable role.

SURGICAL: S.J.Behrman in 1961^[39] wrote that all surgical correction of the edentulous mouth prior to the reception of complete dentures must be done under the direction of the prosthodontist. He is the architect and must indicate what he would like to have done. There must, of course, be some degree of receptiveness on the part of the prosthodontist. By an interchange of ideas, the patient will be served best. Both the oral surgeon and prosthodontist must remember that surgical intervention should be kept to a minimum. Hobkirk in 1973^[7] considered surgical procedures: 1) removal of local

prosthetic problems such as high frenal attachments, 2) increase in the height of the alveolus, 3) repositioning of the attachments of the soft tissues to the jaws, so increasing the denture-bearing area, and 4) insertion of subperiosteal implant dentures. Increasing the height of the alveolar ridge has been attempted with the use of cartilage homografts, bone autografts, freeze-dried bone, and silicone rubber enclosed in knitted Dacron. Extension of denture-bearing area done by mylohyoid ridge resection and Edlan flap procedure. The best approach to surgical management is a joint one, with prosthodontist and oral surgeon working together.

CONCLUSION:

Good rapport with patient is the call of the day because sometimes due to poor psychologic management major problems are encountered. Good patient management is based on the establishment of good communication and good dentist-patient relations.^[40] This is initiated when the patient visits the dentist and continues throughout the treatment.

If the prosthodontist is to successfully treat the patient possessing a poor mandibular alveolar ridge, it becomes necessary to understand the limitations of the patient, the available prosthodontic techniques, the limitations of the oral surgeon, and the capabilities of the laboratory technician.

Treatment may include the routine or the more sophisticated prosthodontic

techniques using advanced instrumentation or the help of the oral surgeon to do extension procedures, augmentation procedures, or implant procedures. Although definitely more

challenging, the severely resorbed mandibular ridge can be restored to a level of masticatory function and satisfaction to the patient.

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