ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2016; 2(2): 169-171
www.allresearchjournal.com
Received: 12-12-2015
Accepted: 15-01-2016

Tiwari Arun Kumar
Post- graduate student, Department of Prosthodontics, CPGIDS, Lucknow, India.

Ahmad Naeem
Senior Lecturer, Department of Prosthodontics, CPGIDS, Lucknow, India.

Verma AK
Professor & HOD, Department of Prosthodontics, CPGIDS, Lucknow, India.

Ali Mariyam
Professor, Department of Prosthodontics, CPGIDS, Lucknow, India.

Deo Krishna
Senior Lecturer, Department Of Prosthodontics, CPGIDS, Lucknow, India.

Pandey Kaushik Kumar
Senior Lecturer, Department of Prosthodontics, CPGIDS, Lucknow, India.

Correspondence
Tiwari Arun Kumar
Post- graduate student, Department of Prosthodontics, CPGIDS, Lucknow, India.

Residual ridge resorption: The unstoppable

Tiwari Arun Kumar, Ahmad Naeem, Verma AK, Ali Mariyam, Deo Krishna, Pandey Kaushik Kumar

Abstract
Residual ridge is a term used to describe the shape of the clinical alveolar ridge after healing of bone and soft tissues after tooth extractions. In the present article, a review on Residual ridge resorption is being presented and analyzed.

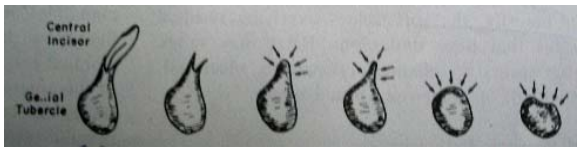
Keywords: Residual ridge, Resorption, Blood clot, Osteoporosis

Introduction
After tooth extraction, cascade of inflammatory reaction activated, extraction socket is temporarily closed by blood clot. Within first week, epithelial tissue begins its proliferation and migration. Within 2 weeks, active bone formation is seen at the bottom of the socket. About 6 months the socket is filled with newly formed bone. Even after the healing of wounds, the residual ridge alveolar bone undergoes a life-long catabolic remodeling. The size of the residual ridge is reduced most rapidly in the first 6 months, but the bone resorption activity of residual ridge continues throughout life at a slower rate, resulting in removal of a large amount of jaw structure. This unique phenomenon has been described as residual ridge reduction (RRR). Initiation of RRR is always preceded by loss of teeth and of their periodontal membranes, which has the ability to form bone. The RRR phenomenon is easily observed clinically after tooth extraction, but the sequence of biologic events is not well-understood. A frequent lay expression for RRR is *"gum have shrunk"* [1, 2]

General Features: RRR is chronic, progressive and irreversible. The rate is fastest in the first 6 months after extraction. Rate is variable between different persons, also within the same person at different times & within the same person at different sites. Has a multifactorial cause; Anatomic factor, Prosthetic factor, Metabolic and systemic factor, Functional factor.

Literature Review: After the age of 40 years, the bone mineral density (BMD) of the skeleton decreases. Decreased physical activity, lowered secretion of estrogen, diet, race and heredity may all play a role in age-related bone loss. Studies show that in some phases of alveolar resorption generalized mineral loss from the skeleton affects the speed of RRR and bone density of the jaws. According to Siebert [3] the age-related increase in cortical porosity and thinning occurs primarily in the alveolar process, whereas the basal portion remains more intact. Von Wowen [4] determined that edentulous patients wearing dentures had, on average, smaller residual ridges than those not wearing dentures. Increased residual ridge resorption seen in denture wearers was attributed to pressure from the prosthesis.
Atwood and Coy found a mean annual bone loss of 0.4 mm in the mandible and 0.1 mm in the maxilla. The differential residual ridge resorption seen between the maxilla and the mandible has been attributed to the mandible providing a smaller surface area of support for the denture. The alveolar bone in the posterior part of the mandible is slightly more at risk to resorption. The difference in occlusal forces between the anterior and posterior region may be responsible. Crum and Rooney [5] measured a mean vertical bone loss in the anterior of the mandible of 5.2 mm after 5 years for immediate dentures compared with 0.6 mm for immediate over dentures. The increased stability that resulted from the use of over dentures may limit lateral forces placed on residual bone. Teeth that support FPDs do not experience

significantly greater rates of marginal bone loss than uninvolved teeth. The use of endosseous implants to support fixed or removable prostheses has been shown to pressure adjacent remaining alveolar bone. People feel that RRR is a complex oral disease with identifiable characteristics and unwanted sequence afflicting millions of people.



Gross Pathology of RRR: The primary structural change in the reduction of residual ridges is the loss of bone. The superimposition of portions of tracings of lateral cephalograms with the maxilla and mandible in the following diagram clearly shows the gross reduction of bone in size and shape that occurs on the external surface on the labial, crestal, and lingual aspects of the residual ridge. In order to provide a simplified method for categorizing the most common residual ridge configurations, a system of six orders of residual ridge from has been described by Atwood (1963) [6].

ORDER I - Pre extraction.
ORDER II – Post extraction.
ORDER III – High, Well-rounded
ORDER IV – Knife edge
ORDER V – Low, well rounded
ORDER VI – Depressed.

I II III IV V VI

Another gross finding is that external cortical surface of the maxilla and mandible are uniformly smooth and the crestal areas of residual ridges show many porosities and imperfections. RRR does not stop with residual ridge but may extend below the apices of the teeth, leaving only a thin cortical plate on the inferior border of the mandible or no alveolar process on the upper jaw. Sometimes a knife edge ridge may be marked by redundant or inflamed soft tissues. Therefore one should always palpate for accurate determination of amount of underlying bone. Lateral cephalometric radiographs provide most accurate method for determining the amount and rate of RRR over a period of time. The panoramic radiographic technique described by Wical and Swoope is a simple, useful method but provides gross estimate of the amount of RRR.

Microscopic Pathology: Several microscopic studies have revealed evidence of osteoclastic activity on the external surface of the crest of residual ridges. The scalloped margins of howships lacunae sometimes contain visible osteoclasts. There is presence of smooth periosteal lamellar bone on the lingual, inferior and labial surfaces of the mandible. But total absence of such lamellations on the crest of the residual ridge. The bony content of the residual ridge is medullary type of trabecular bone. No studies have shown any periosteal lamellar bone over the crest of the residual ridges, but several have shown new bone formation and reversal lines inside the residual ridge. The Mucoperiosteum have shown varying degrees of keritinization, acanthosis and edema.

Pathophysiology of RRR: Normally bone undergoes constant remodeling throughout life through the processes of bone resorption and bone formation. During growth, bone formation exceeds bone resorption. Osteoporosis is a generalized disease of bone in which bone resorption exceeds bone formation. In periodontal disease, there is localized destruction of the bone around teeth, perhaps due to certain local pathologic processes. RRR is a localized pathologic loss of bone that is not built back by simply removing the causative factors. Yet the physiologic process of internal bone remodeling goes on even in the presence of this pathologic external osteoclastic activity. Structurally, the configuration of endosteal bone is dependent upon the configuration of the bony surface on which the inward endosteal bone growth is deposited. Convoluted whorled appearance of endosteal bone – if bone growth is in trabecular area. Even, regular, uninterrupted circumferential lamellae – if bone is laid on smooth cortical bone. If endosteal bone growth fails to keep pace with external osteoclastic activity, one would end up with an absence of a cortical layer and exposure of the medullary layer to the external surface of the bone, resulting in defects on the crest of the ridge.

Epidemiology of RRR: There have been no large-scale studies of RRR in man. Most studies to date have been longitudinal cephalometric studies of a relatively few subjects. Such studies are time consuming, expensive and not really good examples of epidemiologic methodology. Panoramic method could be used to screen large population's in future epidemiologic studies of RRR.

Etiology of RRR: It is postulated that RRR is a multifactorial biomechanical disease that results from a combination of anatomic, metabolic, and mechanical determinants. All these factors may vary from one patient to other. These different cofactors may combine in an infinite variety of ways, thus explaining the variations in RRR between patients.

Anatomic Factors: It is postulated that RRR varies with the quantity and quality of the bone of the residual ridges. More the amount of bone → More RRR will be present but the amount of bone is not a good prognosticator of the rate of RRR because sometimes large ridges resorb rapidly and some knife-edge ridges may remain with little change for long periods of time. Evaluating the present status of the residual ridge gives a fair amount of clue about the resorption pattern. The residual ridges which are high and well-rounded for several years will continue to do so. If it has resorbed in short time, it will resorbs at a higher rate. The other factor to be considered is the density of the ridge. But the density at any given moment does not signify the current metabolic activity of the bone, and bone can be resorbed by osteoclastic activity regardless of its degree of calcification. Another way to evaluate the anatomic factor is to consider the mechanical factor that would be favorable to stability and retention of a denture. Thus, large well-rounded ridges and broad plates would seem to be favorable anatomic factors.

Metabolic Factors: It is postulated that RRR varies directly with certain systemic or localized bone resorptive factors and inversely with certain bone formation factors. RRR is a localized loss of bone on the crest of the residual ridge therefore, certain local bone resorbing factors could be very important. It is possible that some of the local biochemical

factors that have been studied in relation to periodontal disease could play an important role in RRR. These factors include: Endotoxins from dental plaque, Osteoclast activating factor (OAF), Prostaglandins, Human gingival bone-resorption stimulating factor, Heparin acts as a cofactor in bone resorption which is produced form mast cells, found close to the bone margins, Trauma – (especially under ill – fitting dentures), which leads to increased or decreased vascularity and changes in oxygen tension. Systemic factors influence the balance between normal bone formation and bone resorption. Some studies have shown no correlation between the rate of RRR and the presence of osteoporosis whereas there is a hypothesis that osteoporosis could be a contributing factor to the rate of RRR. One can say is that RRR involves bone cells that are under the influences of both local and systemic factors that very likely can affect the rate of RRR.

Mechanical Factors: It is clear that, bone that is "used" by regular physical activity will tend to strengthen within certain limits, while bone that is in "disuse" will tend to atrophy. Some postulate RRR as an inevitable "Disuse atrophy" others postulate RRR is an "abuse" bone resorption due to excessive forces transmitted through dentures. Both hypotheses sound correct because some patients have little or no RRR and some have severe RRR with or without denture. Brewer has shown that normal functional masticating and swallowing contacts between dentures average less than 15 minutes per working day. Ohashi *et al* have demonstrated that swallowing forces averaged 11.4 pounds. Cutright *et al* calculated that 1500 empty swallows per 24 hours amount to 3500 to 4200 lbs of loading per day. Both positive and negative forces from activities such as smoking, talking, biting should also be considered. Any Para functional forces from clenching and grinding should also be considered. There is tendency for more RRR in mandible than maxilla. Woelfel *et al* [7]. found that maxillary denture area is 4.2 sq. inch while the mandibular denture has got 2.3 sq inch. The ratio is 1.8:1. So the amount of bone absorption is more in mandible. The amount of force applied to the bone may be affected inversely by the "damping effect" or energy absorption. This co-factor may be expressed as the "damping effect" may take place in mucoperiosteum, which is considered viscoelastic material. This varies from individual to individual and the absorption quality of the individual may influence the rate of RRR.

Frost [8] stated that "bones which are subjected largely to compression load and experience no significant bending loads are composed largely of cancellous bone, which is ideally constructed for the absorption and dissipation of energy. Maxillary ridge is more cancellous than mandible and therefore may be a factor in the differences in the RRR of the jaws. Frost pointed that parallel the trabeculae are to the direction of compression deformation → maximum is the resistance to deformation. Stronger these trabeculae are → the greater is the resistance. Devan recommended that "neutrocentric" concept of occlusion, which features several techniques to achieve compression loading of the residual ridges and to minimize any tension or shear load, which are thought to be less favorable than compression loads.

Conclusion: Bone resorption of residual ridge is common. The rate of resorption varies among different individuals and within the same individual at different times. Reduction of residual ridges needs to be recognized for what it is: a major unsolved oral disease which causes physical, psychological, and economic problems for millions of people all over the world. RRR is a chronic, progressive, irreversible, and disabling disease, probably of multifactorial origin. At present time, the relative importance of various co-factors is not known. Much is known about the pathology and the pathophysiology of this oral disease, but we need to know much more about its pathogenesis, epidemiology, and etiology. The ultimate goal of research of RRR is to find better methods of prevention or control of the disease. More research in RRR is required in order to provide the best possible oral health care for edentulous patients.

Conflict of Interest: Nil
Source of Support: Nil

References:

1. Lammie GA. Reduction of the edentulous ridges. Journal of Prosthetic Dentistry 1960; 10:605-11.
2. Sobolik CF. Alveolar bone resorption. Journal of Prosthetic Dentistry. 1960; 10:612-9.
3. Siebert. Some clinical factors related to the rate of resorption of residual ridge. Journal of Prosthetic Dentistry. 1962; 12:411-50.
4. Won Woven. Bone resorption and prosthodontics. Journal of Prosthetic Dentistry. 1973; 29:471-13.
5. Crum H, Rooney R. Changes in the trabecular pattern of the mandible following the loss of teeth. Journal of Prosthetic Dentistry 1958; 8:685-97.
6. Atwood DA. The effect of prosthodontic treatment on alveolar bone loss: A review of the literature. Journal of Prosthetic Dentistry. 1998; 80:362-4.
7. Woelfel. The effects of complete denture on alveolar mucosa. Journal of Prosthetic Dentistry 1963; 13:103-7.
8. Frost. The remodeling of the edentulous mandible Journal of Prosthetic Dentistry. 1976; 36:685.