

Managing the Bone Loss in Edentulous Mandible with Conservative Approach



Medical Science

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ABSTRACT

Residual ridge resorption (RRR) is a major disease entity that results in functional impairment of stomatognathic system. The loss of bone following the extraction of teeth at the sight of edentulous ridge has been characterized as a long term and irreversible process that often proceeds at an alarmingly rapid rate. This paper discusses a custom impression procedure method to deal with this clinical entity.

Introduction

Bone is considered to be the base which provides support for prosthesis. In the physiological sense, it is an area where forces created while biting and chewing foods are transmitted. In the course of life continuous bone rebuilding occurs. In older people the life span and proliferation of osteoclasts is significantly decreased, which results in domination of the resorptive processes over osteogenesis.¹ Bone loss is considered to commence in human at 35–40 years of age, after peak bone mass has been achieved, and the atrophic processes then continue with varying intensity, accelerating in peri-menopausal women as compared to men. The basic problem is non-physiological pressure, which is created while transforming masticatory forces through dentures, their plate and the mucous membrane on the periosteum and the bone.² The thickness and elasticity of the mucosa become, to a great extent, pressure regulators in this case. 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.¹ Progressive bone loss without proper prosthetic treatment and rehabilitation of the masticatory organ can contribute to numerous unfavourable consequences.³ Edentulism results in impaired function of the masticatory system.

Conservative management of severely resorbed mandible

Resorbed mandible in geriatric patients can be managed conservatively by use of complete denture fabricated using impression technique for severely resorbed residual ridge. Years of edentulism can leave denture wearers with severely atrophied mandibular ridges. Making accurate initial impressions for denture fabrication can be difficult with such patients. Through the 1960s and 1970s, complete denture construction curricula in many dental schools included instruction in the use of modelling compound as a useful impression material.⁸ Even though the current generation of impression materials provides alternatives, making an initial impression still can be difficult when patients have significant resorption. Making impressions with cake compound remains a technique that can provide accurate initial impressions. When an impression is made with modelling compound, the thick consistency of the warmed material gently pushes the soft tissues into their natural position.⁹ The resulting impression generally is overextended, with soft tissues in the proper anatomic place. However, the clinician can fabricate a well adapted custom tray on the cast made from this impression and trim it appropriately for border moulding with stick compound in preparation for making the final impression. In some cases, this may be the only means of making an accurate initial impression.¹⁰⁻¹²

CLINICAL PROCEDURE

An anatomically correct aluminium compound impression tray was selected. A piece of cake of impression compound was placed in a 140 F water bath until it softens. The cake compound varies by softening temperature, which is denoted by the color

of the compound as the red compound has a softening temperature of 132 to 133 F, while the gray compound has a softening temperature of 128 to 130 degrees F, the green compound has a softening temperature of 122 to 124 F. The softened compound was placed in the impression tray and trimming of the excess from the tongue space was done with a laboratory knife. The compound was moulded to the general shape of the ridge with your fingers and returned to the water bath until the compound had softened completely. The tray was removed from the water bath, allowing time for the material to temper before placing it in the patient's mouth. The tray was placed in the patient's mouth and gently pressed to seat the tray. The patient was asked to protrude the tongue and lift it to help prevent soft-tissue impingement. To prevent distortion of the compound, the tray was removed only after the compound has cooled. The impression can be rewarmed and seated again to facilitate definition of the mandibular anatomy. The initial impression then was poured in dental stone to make the primary cast on which a custom tray can be fabricated. This impression technique resulted in an overextended initial impression in resorbed ridges. The custom tray was fabricated on the primary cast obtained from this impression and complete denture was fabricated following conventional technique.

DISCUSSION

Various studies have discussed the factors affecting mandibular ridge resorption.⁴⁻⁹ No association was found between the age or gender of patients and the grade of mandibular alveolar resorption. Atwood and Coy also pointed out the absence of any close association between a patient's age and the intensity of mandibular alveolar resorption. Slightly different results were reported by Rusiniak-Kubik et al., indicating an increase in mandibular residual ridge resorption in the course of the life of an edentulous patient and double the incidence of severe atrophy in females as compared with males. A correlation with sex was also shown by Kordatzis et al. and Solar et al., who revealed that female gender was an independent risk factor for more severe bone resorption. However, in the study by Atwood and Coy mandibular alveolar resorption was shown to have a loose association with gender.

According to numerous authors, the duration of edentulousness is one of the most important factors contributing to the severity of mandibular bone loss.¹⁰⁻¹⁴ It is considered that alveolar ridge resorption progresses most rapidly during the first six months and lasts for two years following tooth extraction, although it may continue throughout life in some patients, thus leading to the destruction of the bone structure of the alveolar process. In the study by Karaagaciou and Ozkan bone resorption progressed more rapidly in the initial period of edentulousness and slowed down with time. Parkinson also found a decreasing rate of mandibular bone resorption in the course of edentulousness and showed a relationship between the duration of toothlessness and the grade of resorption intensity. In the present study the duration of edentulism was found to affect the degree of

mandibular bone loss. The length of this period negatively correlated with the value of the radiological IC/IM index as a marker of mandibular bone resorption. Of the local biochemical factors which determine bone loss in edentulous patients, attention should be paid to endotoxins from dental plaque formed on the dentures. This process is augmented by bad oral hygiene, especially during the 24-hour use of dentures. It has been demonstrated that bone loss is strongly correlated with dental plaque accumulation. The results of the present study do not confirm this correlation. No direct relationship was found between mandibular residual ridge resorption and oral hygiene, denture care or history of periodontal disease. Of the systemic biochemical factors which affect mandibular bone resorption, disorders of calcium/ phosphate metabolism and hormonal disturbances head the list. Of all the systemic factors associated with mandibular bone loss in edentulous patients, osteoporosis is considered the most important. Edentulism and osteoporosis are common pathogenic processes in the elderly. They appear independently but their common feature is bone resorption, occurring as a chronic and irreversible process. Studies conducted by Gołębiewska et al. in edentulous postmenopausal women have revealed significant alveolar resorption in all the groups examined. The most severe loss of the cortical bone of the mandible was observed in females with osteoporosis. In this group the highest percentage of severe resorption of mandibular cortical bone was found. Osteoporosis significantly affected residual ridge loss of the edentulous mandible in the women examined. Similar results were observed by Czajkowska et al., a more severe grade of bone base destruction being found in those patients with osteoporosis than in those without it; these authors considered clinical features of the masticatory organ to be a criterion for the early detection of osteoporosis. Concomitant endocrine disorders also contribute to alveolar mandibular resorption in edentulous patients. Hyperparathyroidism, hyperthyroidism and oestrogen deficiency are considered the most harmful disorders in this process. A correlation between parathyroid hormone levels and bone mass loss and residual mandibular resorption was observed and reported by Lekkas. Using an animal model, Nishimura et al. demonstrated the effect of systemic oestrogen deficiency on alveolar resorption.¹² The mechanism of this phenomenon was confirmed in further experimental studies, which revealed that oestrogens induce apoptosis of osteoclasts. It is conceivable that oestrogen deficiency can prolong the life span of osteoclasts and, at the same time, contribute to more intense bone resorption in postmenopausal women. No correlation between osteoporosis or endocrine disorders and grade of bone resorption was found in the present study. However, it seems that this may be due to the relatively small study group and the resulting small number of patients with established osteoporosis and diseases of the thyroid gland. Appropriate diet and abstention from smoking and excessive alcohol intake are also significant factors in maintaining the good

condition of the bones, including the bone mass of the mandible. In the present study no correlation between these factors and the grade of mandibular bone resorption was found. It seems, however, that although a single factor had no particular influence, there is a cumulative effect when they are taken together. A diet rich in calcium and phosphorus, with proper proportions between these two elements and supplementation with vitamin D3, is of great significance for inhibiting bone resorption. It has been confirmed in an animal model using a scanning electron microscope that alveolar bone resorption associated with features of demineralisation occurs in rats with calcium deficiency. The beneficial effect of oral administration of calcium and vitamin D3 on mandibular bone mass in postmenopausal women was confirmed by the results of a study by Kribbs, who assessed the two-year use of 1000 mg of calcium and 400 IU of vitamin D3 daily.¹⁰ In 83% of women mandibular bone mass was not diminished despite the passage of two years, and an increase was even observed. The results of the present study confirm the association between total serum calcium level and grade of mandibular residual ridge resorption.

Physical factors are the last parameter considered and evaluated in the present study. In particular, the role of denture use in the mechanism of residual ridge resorption in edentulous patients is discussed. The use of complete dentures can have a particularly disadvantageous effect on the masticatory organ. It seems that overly good adherence of dentures to the denture bearing area can lead to augmented bone atrophy. According to Majewski, an even distribution of masticatory forces via the denture base and a proper course of the occlusion surface are essential in the prophylaxis of residual ridge resorption. Studies carried out using an animal model have shown the threshold value of pressure in the induction of bone resorption for a continuous or intermittent type of pressure. The continuous pressure threshold accounts for 20–40% of the intermittent pressure value, which demonstrates that exerting continuous pressure is more harmful than intermittent pressure. Thus it seems possible to determine the borderline threshold value at which bone resorption would not occur. The 24-hour use of dentures has a particularly bad influence on the residual ridge. In the present study the length of denture use was assessed as a possible factor for mandibular bone mass loss in edentulous patients. No relation was found between these parameters however, probably because of the relatively small size of the group.

CONCLUSION

The use of cake modelling compound can be helpful in making accurate initial impressions when patients have significant mandibular ridge resorption after years of edentulism. The technique described is a simple method of capturing the oral tissues in their correct position.

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