Effect of the Degree of Palatal Coverage of Implant Retained Maxillary Overdenture on the Mandibular Residual Ridge

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Introduction

Edentulism is a debilitating, irreversible condition and described as the "final marker of disease burden for oral health". Edentulism was found to have a significant effect on residual ridge resorption. For many decades treatment of edentulous patients was done using conventional complete removable dentures. Although this treatment option is the most common, yet at times it can be a difficult and challenging intervention. Residual ridge resorption and mucosal reactions such as denture stomatitis, traumatic ulcers and flabby ridges are the most common problems that complete denture wearers face.[1]

In the seventh year stage, mandibular residual ridge resorption was seen to be four times greater than maxillary residual ridge resorption owing to the position of muscles' attachments and the amount of supporting area in each arch. Maxillary conventional dentures with complete palatal coverage have great supporting area gained mainly from the palate; on the contrary mandibular conventional dentures' supporting area is very limited. Maxillary dentures with complete palatal coverage may cause gagging and may affect phonation, hygiene, taste sensation and even mastication. These disadvantages of complete palatal coverage adversely affect patients' satisfaction and tolerance to conventional maxillary complete dentures as a treatment option for edentulous maxilla. Several attempts were done to remove or decrease palatal coverage of maxillary complete dentures without jeopardizing their retention.[2]

Implant-retained overdentures can provide an effective treatment modality for edentulous patients and in particular those who have persistent problems in using conventional prosthesis.[3]

Implant-retained overdentures are supported, retained, and stabilized by both implants and mucosa; therefore they generally require fewer implants than fixed implant prostheses. In the maxilla, four endosseous implants, are considered the minimum number needed for overdenture.[4] So retention can be gained mechanically by implants' attachments rather than physically by extended palatal coverage and thus palatal coverage can be removed or decreased without affecting retention.[5]

Complete or partial palatalal coverage of maxillary implant retained overdenture affects the maxillary supporting area[6], but the question is does this degree affects the amount of mandibular residual ridge bone resorption in case of implant retained overdenture or not?

Review of Literature

Edentulism is considered a physical impairment due to loss of important parts of the body. After extraction of each tooth, the empty alveolar socket begins to fill with blood, then it coagulates forming blood clot and being organized forming the new bone. Mucco-periosteal tissues cover the new bone which reduces in size under the periosteum in a process called residual ridge resorption.[7]

The amount of alveolar bone resorption depends on many factors such as age, sex, facial symmetry, oral hygiene, metabolism, general health, parafunctional habits and systemic diseases. In maxilla, the outer buccal cortical plate is thinner than inner palatal cortical plate so, resorption takes place upward and inward resulting in a decreased size of maxilla from all directions, and the denture bearing area becomes reduced. In the mandible, migration of the residual ridge takes place lingually and inferiorely in the anterior region and buccally in the posterior region. Consequently maxillary and mandibular denture bearing areas are both reduced with decrease in the area of the attached mucosa. Keratinized mucosa will be lost, and non-keratinized mucosa will atrophy.[7]

Alteration in jaw relationship arises, where the prosthodontist is faced with problems in establishing the correct vertical dimension. This will be accompanied by complications in the temporo-mandibular joint and reduction in biting force efficiency. In general, masticatory efficiency, speech and esthetics are affected which causes a psychological distress to the patient and decreases quality of life.[8]

I- Problems facing conventional complete denture:

For many decades conventional complete acrylic dentures were the only treatment modality for edentulous cases. Many edentulous patients wearing conventional complete dentures are dissatisfied with their prosthesis. Neuromuscular coordination takes time to adapt for this new situation, but common problems have encountered in most cases. Problems of retention, stability, occlusion and appearance may aggravate the condition rather treating it if an unsatisfactory denture was constructed. An ill-fitting denture may also progress the process of bone resorption.[9]

Wearing complete dentures may have adverse effects on both oral and general health of complete denture wearers. These effects can be divided into direct and indirect reactions. Direct reactions include residual ridge resorption and mucosal reactions, such as denture stomatitis, denture irritation mucosal hyperplasia, traumatic ulcers, and flabby ridges. It has also been suggested that there might be a strong link between oral carcinoma existence and chronic denture irritation, but no undeniable evidence appears to exist.[7]

Direct reactions may also include other conditions related to wearing a relatively large unnatural prosthesis, such as altered taste sensation, burning mouth syndrome, and gagging reflex. Indirect reactions are related to the huge difference in masticatory function between complete denture wearer and dentate personnel. Biting forces are reduced with the risk of masticatory muscles atrophy. The reduced masticatory ability may lead to changes in selecting food components with risks of impaired nutritional status, especially in the elderly complete denture wearers.[8]

The most common complaint is loosening of the dentures, which is often due to the continual resorption of the residual alveolar ridge. Moreover, patients are complaining from intolerance to loading by the mucosa, pain, difficulties with eating and speech, loss of soft-tissue support, and altered facial appearance. Measuring masticatory function, such as biting force and the ability to comminute a test food are substantially reduced in complete denture wearers in comparison with people with natural dentition, as well as with implant-supported prostheses. Retention and stability problems often cause complaints of masticatory function in complete denture wearers. The ability of denture wearers to break down food is very poor when compared with dentate persons. Complete denture wearers need on average four to six times and even more number of chewing strokes more than persons with natural dentition need to achieve the same degree of pulverization. [7]

The biting force of edentulous patients obtained with maximum clenching ranges from 77 to 135 N, whereas the average biting force for dentate persons varies from 306 to 847 N, which means that the masticatory performance of complete denture wearers is less than 20% of that of persons with a natural dentition. Thus, denture wearers might have difficulties in chewing and incising food. As a consequence, full denture wearers select only smaller food particles to chew at a time. We conclude that complete dentures are poor substitutes for natural teeth even with clinically satisfactory results making edentulous persons handicapped in masticatory function. Although the objective masticatory performance of complete denture wearers was reported to be low, approximately 80% of the complete denture wearers considered their self-assessed chewing ability to be good.[10]

II- Treatment options for edentulous patients:

Several attempts were made to overcome problems with conventional complete dentures. Starting with impression taking, different impression techniques such as functional impression technique, dynamic impression technique and butterfly impressions were used to overcome problems of retention. Arrangement of teeth according to the neutral zone record with lingualized concept of occlusion can improve denture stability. The use of metallic denture bases can improve denture stability and retention.[11]

Many opinions have claimed that preservation of the remaining natural teeth or roots utilizing them in constructing overdentures can serve well in improving denture support and retention. Also soft tissue and bony undercuts can considerably improve the same features. Preparations could be done to the remaining dentition to accommodate the fitting surfaces of the dentures.[12]

Implants also have been used extensively in the last decade in the rehabilitation of edentulous patients. Besides providing retention, dental implants help in decreasing the impact of tissue borne edentulous prosthesis. They slow the rate of residual ridge resorption, increase the masticatory efficiency and improve the stability and retention of dentures. [13–17]

Dental implants:

Endosteal implants are the most commonly used implants worldwide; they are manufactured in a variety of widths, lengths, designs and materials. Among endosteal implants, root form implants are now the first and most realistic choice in selecting implants as they offer great stress distribution