Effect of Single Mandibular Mini Implant Supported Overdenture Versus Single Mandibular Conventional Implant Supported Overdenture on the Supporting Structures

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LIST OF THE CONTENTS

List of Figures

List of Figures (Cont.)

List of Tables

Introduction

The construction of single mandibular denture opposing a dentate maxillary arch imposes a great challenge to the clinician. The situation is often compounded by the finding of severe mandibular residual ridge resorption making conventional treatment unwise. (1)

A conventional lower single denture usually suffers from improper support, reduced retention and inadequate stability. Also, the forces transmitted by the opposing natural dentition enhance the rate of ridge resorption and may also lead to frequent denture fracture. (2)

The use of dental implants to support and/or retain lower single denture is recommended as treatment modality due to the previously reported better prognosis compared to conventional single dentures. However the placement of conventional dental implants is not always possible.

The construction and modifications of dental implants have shown rapid and continuous development. Recently, dental implants having comparatively small diameter and known as mini implants have been introduced. This encourages the use of these mini implants in narrow ridges to overcome difficulties encountered by conventional implants.

Proposed advantages of using mini dental implants for stabilization of complete dentures include reduced bleeding, decreased postoperative discomfort, shortenedhealing time, placement into narrow ridges and immediate loading.

The introduction of cone-beam computed tomography (CBCT) for the maxillofacial imaging provided opportunities for dental practitioners to

request multiplanar imaging. Currently CBCT is used during implant treatment-planning to measure accurately the height of bone available for implant placement to avoid serious problems e.g. compromising vital structure such as the inferior alveolar nerve during placement of implants.

Implant stability is considered to play a major role in the success of osseointegration. There are several techniques to assess stability of implants. Implant mobility testing using the periotest device is a well established, non invasive technique for assessing implant stability.

The use of mini implants is still under investigations and the dental literature lacks knowledge as regards to its application in different conditions. Hence, this study was conducted to evaluate the effect of using mini implants to support mandibular single dentures on the supporting structures.

Review of Literature

I-Single Complete Dentures

Many patients become edentulous in one arch while retaining some or all their natural teeth in the opposing arch. Several difficulties are encountered in providing a successful, single complete denture treatment. Regrettably, this services thought to be as only half as difficult and time consuming as the construction of opposing complete dentures.[3]

Single complete dentures may be opposed by natural teeth, fixed restorations, or a removable partial denture. Each of these situations may present difficulties which must be recognized and thoroughly assessed before definitive treatment begins. [3]

A- Problems of Single Denture

The single complete denture is usually problematic for both the patient and the prosthodontist. Several problems are usually encountered with single arch edentulism. [1]

The natural teeth which oppose an edentulous arch may be malpositioned, tilted, rotated or over erupted thus assuming positions that present exessively steep cuspal inclination. Failure to alter these conditions will often prevent the development of a bilateral balanced occlusion in eccentric positions. [4]

In several clinical situations, the arrangement of the denture anterior teeth to fulfill esthetic and phonetic requirements makes the development of

balanced occlusion impossible. However, bilateral balanced occlusion is most desirable for a complete denture in order to promote optimum stability.[3]

Various problems involved in fabrication of the maxillary complete denture opposing natural teeth include absence of opposing proper occlusal plane, excessively steep cuspal inclinations and unfavorable inclination of the occlusal plane. Excessive forces induced by opposing teeth on the opposed denture, presence of severly resorbed residual ridge, presence of flabby ridge and change in the position of mandible. Also, the difficulty to achieve harmonious occlusion, denture retention and stability and the repeated midline fracture. [5]

A complete lower denture opposing upper natural teeth is usually problematic because the lower ridge is usually weaker compared to the maxillary ridge due to its vulnerability to a higher and more rapid rate of bone resorption. Also a smaller basal seat area is available for the support of the lower denture, thus more stress per unit area is usually expected. The greater amount of stress per unit area exerted through the natural upper teeth decreases the retention and stability of the lower denture. This usually results in rapid loss of supporting mandibular bone. [3, 6]

A completely edentulous lower ridge restored with a complete unserviced denture opposing an upper removable partial denture is also problematic. The clinical picture is almost the same as described for complete lower dentures opposing upper natural teeth. When few remaining maxillary teeth oppose a completely edentulous lower arch, the advantages of retaining the natural teeth are outweighed by the disadvantages of having the lower ridge destroyed. [7]

Once a fixed restoration is placed in a dental arch, the restored arch can be thought of as natural teeth opposing a complete denture. The construction and placement of fixed restorations can correct many occlusal disharmonies that may have existed previously. The occlusion between the denture teeth and the fixed restorations is harmonized on an articulator while the patterns for the castings are being developed. (5)

Fracturing the denture base is another common complication of single denture because the denture is usually opposed by natural teeth or fixed restorations. The resulting high occlusal force combined with the usual base thickness resulting sometimes in base fracture. (8)

One of the problems encountered during single denture construction is the difficulty of obtaining good esthetics because the opposing anterior natural teeth are still present, also when selecting the artificial teeth material, the acrylic teeth abraded by the opposed natural teeth and the porcelain teeth will abrade the opposing natural teeth.(7)

Combination syndrome

The combination syndrome also known as anterior hyperfunction syndrome. When an edentulous maxilla is opposed by natural mandibular anterior teeth, including loss of bone from the anterior portion of the maxillary ridge, overgrowth of the tuberosities, papillary hyperplasia of the hard palatal mucosa, extrusion of mandibular anterior teeth, and loss of alveolar bone and ridge height beneath the mandibular removable partial denture bases. (9)

Ellsworth Kelly(10) was the first person to use the term "combination syndrome." He followed a small group of patients wearing a complete maxillary denture opposed by mandibular anterior teeth and a distal extension removable

partial denture (RPD). Of the 6 patients followed up for 3 years, all showed a reduction of the anterior bone in the maxilla along with enlarged tuberosities. For 5 patients there was an increased bone level of the tuberosities.

One of the explanations of this condition is a chronic pressure from the lower anterior teeth is directed toward the anterior portion of the maxillary denture. This repetitive force cause considerable resorption of the anterior residual ridge. [11,12]

Kelly[10] discussed various possibilities to avoid combination syndrome, including extraction of the mandibular teeth, but did not advocate this solution. Instead, he proposed using the roots of anterior mandibular teeth to support an over denture. He also mentioned the option of using endodontic implants to preserve questionable roots for support in the posterior part of the mandible.

A few years later, further characteristics were added to the combination syndrome such as loss of vertical dimension of occlusion, occlusal plane discrepancy, anterior spatial repositioning of the mandible, poor adaptation of the prostheses, epulis fissuratum, and periodontal changes. However, these changes are not generally associated with combination syndrome. The early loss of bone from the anterior part of the maxillary jaw is the key to the other changes of the combination syndrome. [13]

B- Considerations taken during single denture construction

The need for reduction of traumatic forces transmitted through the prosthesis has long been recognized and studies have shown that, either a soft acrylic resin or silicone rubber can serve as a stress distributor and absorb some of the forces applied to the teeth. These dentures permit reaction to impact forces which allows independent movement in function unlike the conventional dentures. [14]

For successful single denture construction, oral conditions that compromise the treatment should be outlined and corrected first before the actual treatment is planned. [6]

1- Modification of the natural teeth

One of the techniques involves, altering the occlusal surfaces of the teeth on the stone cast as necessary to provide a balanced occlusion. The recon toured surfaces are marked on the cast. These marks serve as a guide for making the same changes on the natural teeth in the mouth. [3]

Another technique used a clear acrylic template which was fabricated over the modified stone teeth of the cast then coated with pressure indicating paste to identify interferences in natural teeth, the natural teeth were modified and the process was repeated until the template seats properly. [15]

Another technique used a metal U shape occlusal template that was slightly convex on the lower surface that was placed on the occlusal surface of the natural teeth to identify the interfering cusps. Then these cusps were modified on a stone cast and marked. The cast was used as a guide for modifying the natural teeth. [16]

2- Obtaining balanced occlusion

Enhancing the stability of single denture is accomplished by obtaining balanced occlusion or/ and by using implants and attachements. [8]

Single complete dentures should have balanced occlusion to avoid unfavorable leverages that develop when the natural teeth oppose a complete denture promoting poor stability and retention, as well as early fracture of the prosthesis and concomitant patient dissatisfaction. [17]