Effect of Different Framework Materials on the Supporting Structures of Mandibular Kennedy Class II Removable Partial Dentures

THESIS

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INTRODUCTION

Restoration of esthetics is an important function of removable partial denture and it determines the success of the treatment. The goal of achieving optimal esthetics, while maintaining retentive integrity, stability, and protecting the health of the tooth is the most difficult task. [(1)]

Thermoplastic resins have been used in dental medicine for fifty years. In the meantime, their use has spread due to their superior characteristics. Their ongoing development has yielded new classes of more and more advanced materials and technologies, which make possible the manufacturing of dentures with better properties then traditional dentures.

The key to the functional advantages of the thermoplastic materials for standard removable partial dentures is in the flexibility of the material that helps to shift the burden of force control from the design features of the appliance to the properties of the base material. The stress distribution in the rigid partial denture is controlled by structural elements of the design; specifically the relationship of the retentive clasp, occlusal rests, reciprocal arm, minor connectors, and guide planes.

Acetal resin is one of the materials that used to replace metal clasps. This material had superior esthetic and Biocompatible which make it considered in the treatment of patients who are allergic to Co-Cr alloys or acrylic, but also it should provide appropriate retention when it used as alternative clasp to many others like Co-Cr, gold, acrylic removable prostheses. Also it should have enough mechanical properties to withstand forces and environment of oral cavity and have appropriate life time within this environment because clasp of any removable prosthesis will subjected to many forces and cyclic bending during insertion, removal and during mastication which make the retentive clasp arm the most part to be damaged.

Thermoplastic resins have many advantages over the conventional powder-liquid systems, they provide excellent esthetics with tooth or tissue colored materials and are very comfortable for the patient. These are very stable, resist thermal polymer unzipping, have high fatigue endurance, high creep resistance, excellent wear characteristics & solvent resistance. They are non-porous so no growth of bacteria, and even if it is non-porous, it still retains a slight amount of moisture to keep it comfortable against gums. They are unbreakable, flexible & light weight. Thermoplastic resins are a safe alternative to conventional resins because of very little or no monomer content. [(2)]

Over the years, several methods has been employed to diagnosis, evaluate, and balance occlusal forces, however none of them accurately detect and assess simultaneous contact, and measure both the biting time and force. The computerized occlusal analysis system T-Scan introduced in 1987 helps in measuring occlusal biting forces, and aid in obtaining consistent and useful occlusal data for evaluating occlusal contacts for removable prostheses.

Functional occlusal stability, oral comfort and satisfactory esthetics and preservation of the abutment supporting structures are important factors for a successful treatment with removable partial dentures. Although numerous researches have been conducted evaluating the influence of thermoplastic removable partial denture on the abutment bone loss, studies on its effect on occlusal load distribution is absent from the literature.

REVIEW OF LITERATURE

Posterior free end edentulous areas are more prevalent among population. Absence of posterior abutments to support and retain partial dentures affects the prognosis of prostheses. A problem of support, retention and stability is usually associated with distal extension removable partial dentures. [3, 4]

Problems associated with Kennedy class II cases

One of the most challenging situations requiring treatment with removable partial dentures is cases classified as Kennedy class II. Being unilateral and free end with abutments only on one side of the edentulous area creates a long lever arm resulting in an unstable removable prosthesis. [5]

Other problems associated with the unilateral distal extension base are support and retention. The problem of retention and stability is usually solved by designing cross arch retention and stabilization. However, the problem of support is considerable because of the composite nature of the supporting structures. Hence, many designs and principles modalities were introduced to overcome these problems. [4]

Problem of support:

Distal extension partial dentures including those restoring Kennedy class II are unique in that support is derived from both unyielding abutment teeth and the comparatively yielding or resilient mucosa covering the residual ridge. Resilient tissues, being unable to provide proper support for the denture base comparable to that offered by the abutment teeth, are displaced by the occlusal load. This problem of support is further complicated if patients have opposing

natural teeth by which far greater force is exerted than being completely edentulous. This fact is evidenced by the damage occurring to an edentulous ridge when opposed by a few remaining teeth in the opposite arch. (6)

Due to the absence of posterior abutment, the unilateral distal extension removable partial denture lacks the advantage of total tooth support. It is therefore dependent on the residual ridge for a portion of its support. (7)

The behavior of supporting mucosa is viscoelastic in nature. Under occlusal load, the mucosa is displaced and when the loading stops, the mucosa returns to its resting form leading to movement of the denture base. (8)

The mucosa covering the residual ridge is 20-25 times more displaceable than the abutment teeth. For this reason, the distal extension removable partial denture moves under occlusal loading even with the most accurately fitting bases. (7)

This leads to torque on abutments and resorption of the supporting alveolar ridge, movement of a distal extension base towards the ridge depends on factors including the resiliency of the mucosa covering the ridge, the quality of the residual ridge, the accuracy and extension of the denture base and the total functional load applied. (3)

Since the distal extension edentulous ridge bears part of the masticatory load; ridge resorption is likely to occur. Resorption of the ridge decreases the fit of the partial denture base, leading to more denture base movement. This results in increasing the stresses on the residual ridge and more torque on the abutment teeth. (9)

The inevitable denture base movement may also cause irritation to the mucosa covering the residual ridge resulting in formation of flabby ridge. This impairs the articulation of teeth and may lead to loss of occlusal contact. [10]

Obtaining satisfactory function is also a problem when partial dentures are supported by both hard dental tissues and resilient mucosa, due to inevitable movement of the denture base during function. [11]

The unilateral distal extension removable partial dentures my cause harm in two ways; first due to direct transmission of the loads of occlusion to the supporting mucosa and hence to the underlying bone leading to residual ridge resorption, second due to indirect transmission of loads to the abutment teeth via movement of the removable partial dentures framework causing torque of the distal abutments. [12, 13]

Load on the abutments teeth tends to be high on unilateral extension base removable partial dentures [14]

The double and differential system of support of the distal-extension removable partial dentures induces obvious stress and torque to abutment teeth resulting in bone resorption, both around the abutment and on the residual ridge. Therefore, attempts should be made to reduce or distribute the functional load when designing class II cases. [15]

The distal extension base partial denture is subjected to forces which may cause movement of the denture. This movement could be vertical in tissueward or occlusal direction and horizontal in anteroposterior or lateral direction. [10]

The denture may also rotate around an anterior vertical axis, a horizontal axis along the sagittal plane and an anteroposterior axis along the

residual ridge. The uncontrolled movement of the denture results in potentially damaging cantilever forces to the abutment teeth. [16, 17]

Masticatory load applied to distal extension removable partial dentures results in non axial and rotational forces due to pivoting of the prosthesis on the abutments closest to the extension base. The result is torque effect on abutment acting in both anteroposterior and buccolingual directions, causing premature breakdown of its supporting bony tissues. [16, 18]

The periodontium of abutment teeth permits the tooth to move physiologically in three directions: vertically, mesio-distally and buccolingual. It was reported that the tooth periodontium can withstand axial forces without damaging effect, while lateral forces cause periodontal breakdown. [19]

Partial denture having one or more free end denture bases must thus be designed so that movement of the unsupported and unretained end will be prevented or minimized. [6]

The extent and direction of movement of distal extension removable partial dentures during function are influenced by the nature of the supporting structures and the design of the prosthesis. Since functional forces are transmitted to abutment teeth by rests and direct retainers, optimum design based on biomechanical principles helps in preserving the distal extension base supporting structures. [20]

A basic distal extension denture design should thus incorporate proper bracing, retentive and supporting elements to prevent movement of the denture and reduce the stresses transmitted to the supporting structures. [21]

Movement and rotation of a distal extension base towards the tissue should be counteracted by proper design accomplishing adequate support.