The effect of implants in kennedy class I modification I restored with anterior splint bar attachment

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By

Rasha Ibrahim Kamel

B.D.S (2003)

Faculty of Dentistry
Ain Shams University

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SUPERVISORS

Prof. Dr. Ingy Talaat Lebshtien

Professor of prosthodontics and Chairman of

Prosthodontic Department

Faculty of Dentistry

Ain Shams University

Dr. Rami Maher Ghali.

Lecturer of Prosthodontics

Prosthodontic Department

Faculty of Dentistry

Ain Shams University

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This simulation study was conducted to evaluate the effect of implants on stress distribution in Kennedy (Class I) with anterior modification restored with anterior splint bar attachment. It was evaluated using strain gauge analaysis.

Two identical acrylic mandibular models with the canines, first and second premolars as abutment teeth were used for this study.

These models replicate the anatomic features of the teeth and their investing structures.

The abutments were reduced to 5-6mm in height to provide sufficient tooth reduction.

Two implants four mm in diameter and ten mm in length were placed in the second molar area in one model then two standard abutments were screwed to their corresponding implants and prepared to attain a dome shaped abutment of 3-4 mm approximately in height.

Two mandibular overdentures were constructed retained anteriorly by splint bar and one of them supported posteriorly by two implants.

Four channel strain meter was used to asses and record the strains induced mesial to the canine, distal to the second premolar, 7mm and 15mm distal to the second premolar.

List of contents

List of Figures

List of Tables

Introduction

Removable partial denture still remains a valuable treatment option for the majority of patients.

Distal extension removable partial dentures are defined as “the dentures that are supported and retained by natural teeth at one end of the denture base and in which a portion of the functional load is carried by the residual ridge”. [(1)]

Removable partial dentures restoring free end saddles are subjected to vertical, horizontal and torsional forces that may become an adverse during functional and Para functional activities.

The problem of disparity of support in distal extension prosthesis has always been a challenge for the prosthodontist, the problem arises from the lack of posterior abutment and the difference in the elastic behavior of supporting structures, the abutment teeth and the ridge.[(2, 3)]

The difference between the tissue supporting the denture base and the abutment teeth, torque force exerted on the abutment teeth, posterior movement of the denture, presence of unsightly clasp on the terminal abutment and the absence of direct retention for the posterior denture base are among these problems.

The difference between the 500µ resilience of the residual ridge tissue and 20µ of the teeth permitted by the periodontal ligaments presents the disparity of support that is contrast to the uniform support in case of tooth supported removable partial denture.

Distal extension edentulous base with anterior modification area that restored with removable partial denture is not satisfactory for the view point of biomechanics. The addition of an anterior segment to this distal extension partial denture will result in teeter-tooter action with inevitable torque and damage to the supporting structures.[(4)]

It has been reported that it is better to replace missing anterior segment with fixed restoration rather than being included in the partial denture.

However, in some situations it is found that it is necessary to replace the missing anterior teeth with a removable partial denture rather than the fixed restoration as due to the length of the edentulous span, loss of large amount of the residual ridge by resorption, accident or surgery resulting into much vertical space preventing the use of fixed restoration or in which esthetics requirements can be better met through the use of teeth added to the denture framework.

Extracronal attachments may be useful in distal extension cases compared with the conventional clasp

assemblies; extracronal attachments provide superior retention and esthetics. They also contribute to distribute the occlusal forces better to the supporting structures if space or springs are incorporated into their design.

Mc Givney and Carr recommended that a distal abutment should be preserved whenever possible. [5] Recently, it has been reported that free standing single dental implants can be used to solve problems with mandibular bilateral distal extension in removable partial denture if posterior abutment had been lost.

Removable partial dentures that incorporate osseointegrated implants have provided satisfactory alternatives to conventional partial dentures. An effective approach in the implant supported overdentures offers improved retention, stability, support, function and comfort. [6,7]

Review of literature

Distal Extension removable partial dentures

Removable partial denture (RPD) classifications have been proposed to identify potential combinations of teeth to ridges. Mandibular removable partial denture are more common than maxillary removable partial denture and the class I mandibular RPD continues from the time (of Anderson et al.s) to be the most common type of RPD for either arches. The greater number of mandibular RPDs, compared with maxillary RPDs, is probably related to the general pattern of tooth loss and the problems associated with mandibular complete dentures.[8,9]

The structures that supports mandibular distal extension removable partial denture differ markedly in their viscoelastic response to loading. The differential between the resilience of the residual ridge tissues 500 pm and the 20 pm of the teeth permitted by the periodontal ligament' presents a disparity of support that is in contrast to the uniform support accorded a tooth-supported removable partial denture. Hence the denture tends to rotate about its most distal abutments, inducing heavy tensional stresses on the abutment teeth, and possible traumatization of the ridges. For this reason, it was advised to reduce base movement by enhancing and maintaining denture base support. [9]

Design philosophies aimed at minimizing this rotational movement have appeared regularly in the dental literature over the past 50 years.

Despite the evolution in treatment resources available for partially edentulous patients, removable partial dentures (RPDs) continue to be the treatment of choice for patients, especially those with distal extension bases, financial concerns, and technical and biologic conditions that contraindicate treatment with fixed prostheses or implant supported prostheses.[10,11]

In a study of histopathological changes in denture supporting tissues in relation to continuous pressure exerted through an experimental denture base. A high correlation was observed between the possibility of the existence of threshold for bone resorption and intensity of the continuous pressure.[12]

It is more important to preserve the remaining oral structures rather than to restore the missing teeth. However, the preservation of denture supporting structures and the surrounding oral tissues requires a biomechanically designed restoration. The control of forces falling on the removable partial denture by properly directing, distributing and reducing these forces is necessary when designing removable partial dentures.[7]