Stresses Induced by Different Implant Treatment Protocols on the Supporting Structures of Lower Edentulous Ridge

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Dedication

This study is dedicated to my parents, ***ho had provided me with love, support, and motivation, may they rest in peace.***

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Acknowledgment

In the beginning, I want to thank ***God*** *for helping me and answering my prayers, without God I would not have accomplished my work.*

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List of Abbreviations

Abb.	Full term

A-P .....*Anterior-Posterior*

Cdlp .....*Continuous Digital Light Projection*

FEA .....*Finite Element Analysis Method*

LSD.....*Least Significant Difference*

PEA .....*Photoelastic Analysis Method*

PFM .....*Porcelain Fused to Metal*

SD .....*Standard Deviation*

SPSS .....*Statistical Package for Social Science*

ABSTRACT

Three nearly identical complete acrylic dentures were construction on educational models. Three computer generated 3D models were fabricated using liquid photo-polymerized resin, cured in a layered manner by using LASER beam. An educational stone model was scanned via 3Shape desktop scanner (3Shape dental Denmark). Then an STL file was generated. In this STL file four implant beds were designed and two grooves were designed at the lingual and distal aspect of the posterior implants, a third groove was also designed at the lingual aspect of the anterior implants to receive the strain gauge. A key index with 2 mm thickness and 2 mm offset with tissue stops was designed for the purpose of creating a space for the mucosa simulator representing the future mucosa. The STL files were ready to be directly sent to the additive manufacturing device ULTRA 3SP, the Envision TEC (Ferndale, MI) Perfactory to print the casts using liquid photo-polymerized resin, cured in a layered manner by using LASER beam.

Self-cure acrylic resin was used to fix the implants in their implant beds and multiunit abutments were attached to the dentures which were converted into fixed hybrid prosthesis:

Universal Testing machine (LLOYD Universal Testing Machine, U.K.) was used for applying unilateral vertical static loads ranging between 0-100 Newton.

Keywords: Least Significant Difference - Photoelastic Analysis Method - Porcelain Fused to Metal

INTRODUCTION

Dental implant has become increasingly important in oral rehabilitation of edentulous individuals with resorbed mandibular ridge. Implant supported denture enhances masticatory function and proprioception. It reduces trauma to the underlying tissues, thereby reducing rate of bone resorption. It maintains occlusion and vertical dimension and attains more patient tolerance.

Implant treatment options may range from the use of removable implant supported over denture to the creation of fixed implant supported prosthesis. An alternative to fixed prosthesis is the fixed detachable prosthesis (Screw-Retained Dentures). The treatment choice depends on the patient's anatomical limitations and the patient preference.

Screw-Retained Dentures offer a fixed implant solution for edentulous patients desiring a stable and esthetic replacement for removable prostheses. Furthermore they may be successfully used in combination of tilted and axially placed implants in the posterior part or resorbed dental arch. In addition, complete denture that is borne totally by implants installed in the interforaminal area results in considerable delay in the resorption process of the posterior mandibular ridge and may even contribute to increase in the amount of posterior bone height even when no posterior implants are inserted.

Various material combinations including metal/acrylic, metal/ceramic, and zirconia/ceramic have been used for constructing fixed detachable prosthesis. The all-acrylic fixed detachable prosthesis has great number of

advantages including reducing the impact force of dynamic occlusal load, being less expensive to fabricate and high esthetic restorations.

The fixed detachable prosthesis can be made on a variable number of implants, with a minimum of four, although there ideally should be placed the biggest number of implants that is possible. However, in the completely edentulous mandible problems such as minimum bone volume, poor bone quality, and the need for bone-grafting procedures prior to implant placement create some challenging conditions.

Over the years, various strategies have been proposed to overcome the dimensional limitations of the bone available for implant placement. The All-on-Four treatment concept and short implants have been proposed to overcome the anatomic and physiologic limitations of implant placement.

The All-on-Four treatment concept involves the use of four implants restored with straight and angled multiunit abutments, which support a provisional fixed and immediately loaded full-arch prosthesis placed on the same day of surgery. The All-on-Four treatment has been developed to maximize the use of available bone and allows immediate function.

With the introduction of short implants, dental implant rehabilitation for resorbed ridges is a less complex, less traumatic and safer treatment option for edentulous patients showing bone height limitations. Biomechanically, short implants might be disadvantageous specially when combined with poor bone quality and high occlusal loads. However, the majority of the stress concentration is distributed at the level of the first few threads to the crestal cortical bone when an implant is

loaded and that an implant with a larger diameter helps to reduce the maximum stress/strain values at the bone-implant interface.

Although anteriorly placed implants have been the traditional method to provide support for fixed detachable prosthesis, the use of short implants installed in the posterior part of the mandible and the All-on-Four treatment concept and their effect on stress distribution was the point of concern in the late years.

REVIEW OF LITERATURE

Edentulism

Edentulism is a debilitating and irreversible condition and is described as the "final marker of disease burden for oral health". It is a state of partial or complete loss of teeth. A person may lose one or more but not all teeth and becomes partially edentulous or may lose the whole set of natural teeth and becomes completely edentulous. [1]

Edentulism is mostly the result of caries and periodontitis, and has the potential to affect an individual's quality of life significantly. Several systemic diseases and conditions as diabetes and bone diseases, osteoporosis and cyst and tumors may contribute to loss of teeth. Also, medications required to control systemic disorders may have an adverse effect on oral tissues resulting in tooth loss. Non disease factors contributing to loss of teeth include patient's attitude, trauma, oral care measures, and behavior of patients, dental attendance and frequency of dental follow up service, socioeconomic status, health care and insurance and finally aging. [2]

Although the prevalence of complete tooth loss has declined over the last decade, edentulism remains a major disease worldwide, especially among older adults. Currently, there is much speculation among dental educators that the need for complete dentures will decline markedly in the future and that complete denture training should be removed from the dental curriculum. Estimates based on national epidemiologic survey data