



Effect of Reinforcement by Nano-Zirconia on the Supporting Structures and Fracture Resistance of Lower Overdenture Implant Supported Denture Base

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَقَالُوا الْحَمْدُ لِلَّهِ
الَّذِي هَدانا لِهَذَا
وَمَا كُنَّا لِنَهْتَدِيَ لَوْلَا أَنْ هَدانا اللَّهُ^ص

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Introduction

The prosthetic management of the edentulous patient has long been a major challenge for prosthodontics. Maxillary and mandibular dentures have been the traditional standard for providing care for edentulous patients. However, most of the patients are unsatisfied with their mandibular dentures, most probably due to retention and stability problems together with discomfort.

The rehabilitation of edentulous patients with implant-retained overdenture offers considerable functional and psychological advantages. It has been shown that the two implant supported mandibular overdenture provides significant improvement of treatment outcomes as compared to conventional dentures. Implant supported overdentures improve masticatory function and proprioception. It reduces the rate of bone resorption, therefore, maintaining occlusion and vertical dimension. ⁽¹⁾

The diameter of standard root form implant is 3.75mm requiring at least 6mm of bone in the facio-lingual direction. Recently, root form small diameter mini-implants ranging in diameter from 1.8mm to slightly more than 2mm have been used to support conventional dentures with atrophied mandible without the need for bone grafting.

Recently, prosthetic rehabilitation with mini-implant has become an accepted treatment modality because of the high success rates. It is highly indicated when inadequate width of bone is present for placement of standard diameter implants as in knife-edge ridges. ⁽²⁾

The use of mini implants has been suggested in order to reduce trauma compared to standard-sized implants. They are placed with minimal invasive surgery and can be immediately loaded. Mini-implants have the added advantages of reduced bleeding, decreased post operative discomfort and shortened healing time. However, the decreased diameter of mini implants increases the risk of implant fracture due to implant over loading. It was thus recommended to increase the number of implants to improve initial stability. ⁽³⁾

Despite advantages of overdentures, denture base fracture is a common disadvantage with overdentures due to the space occupied by the abutments and the retentive elements of the denture, leaving a comparatively weak denture base. Thus, acrylic resin denture base reinforcement adjacent to abutments can reduce strain and prevent deformation and fracture of overdentures. ⁽⁴⁾

Attempts have been made to modify Polymethyl methacrylate resin to improve the fracture resistance of denture bases. The use of high strength resin, wire reinforcement and adding various fiber fillers have been proposed. ⁽⁵⁾

Recently, much attention has been directed toward the incorporation of inorganic nanoparticles into acrylic resin bases. One of the most recent introductions to the dental ceramics is zirconia due to its biocompatibility, improved mechanical properties and its esthetic white color. It thus seemed beneficial to enhance the fracture resistance of implant supported and retained overdenture bases by incorporating zirconia oxide nano particles.

However, the dental literature lacks information concerning the effect of nano zirconia oxide reinforced overdenture base on peri-implant bone loss and on overdenture base fracture. Hence, this study was proposed in an attempt to clarify the efficiency of nano zirconia oxide in the reinforcement of mini-implant supported and retained overdenture bases.

Review of Literature

I- Edentulism

Edentulism, defined as total tooth loss, is a debilitating and irreversible disease.⁽⁶⁾

Although the prevalence of complete tooth loss has declined over the last decade, edentulism remains a major disease worldwide, especially among older adults. Studies showed that edentulism is closely associated with socioeconomic factors and is more prevalent in poor populations. Other factors contributing to the prevalence of complete tooth loss are age, education, access to dental care, dentist/population ratios, and insurance coverage.⁽⁷⁻⁹⁾

Tooth loss is mainly attributed to dental caries and gum disease. However, factors that lead to tooth extraction are not always dental in origin. The complex interactions between dental diseases, tendency to use dental care, dental attitude and affordability of non-extraction treatment have been related to the incidence of tooth loss.⁽¹⁰⁾

Partial edentulism is defined as partial loss of teeth. It leads to several drawbacks including clinical challenges and lifestyle compromises. Clinically, partial edentulism results in drifting and tilting of adjacent teeth, super eruption of opposing teeth, altered speech, changes in facial appearance and temporo-mandibular joint disorders. Also, the loss and continuing degradation of the alveolar bone, the adjacent teeth and also the supporting structures will influence the difficulty to achieve an adequate restoration in a partially edentulous patient. On the lifestyle compromises, partial edentulism