EFFECT OF NANOSTRUCTURED TITANIUM IMPLANTS ON THE SUPPORTING STRUCTURES OF IMPLANT SUPPORTED MANDIBULAR OVERDENTURES

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بسم الله الرحمن الرحيم

الرحمن * علم القرآن * خلق

الإنسان * علمه البيان

صدق الله العظيم

الأية (1-4) من سورة الرحمن

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Contents

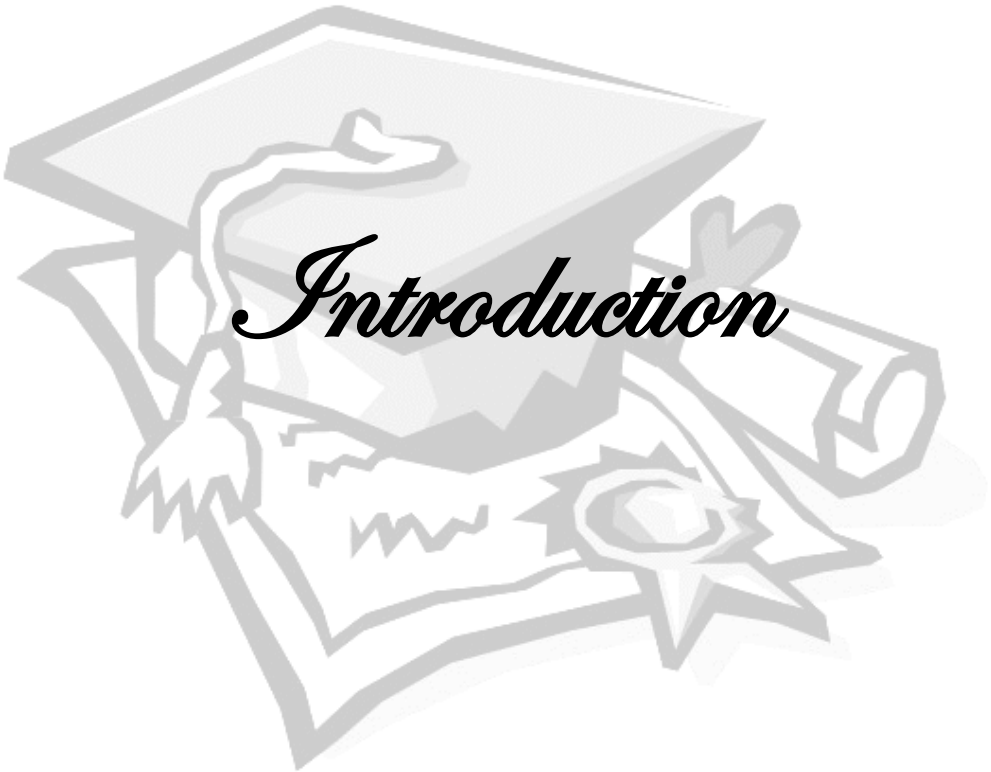
List of figures

List of tables

TO MY PARENTS:

I would like to dedicate this to my parents. I wouldn't have reached this point in my life without your love, help and support. Thank you for taking good care of me and helping me become the person I am today.

Yasmine G. Thabet



Introduction

Introduction

The prevalence of edentulism has decreased in the past few years due to the improvement of conservative dental treatment modalities as well as the greater frequency of their use. However, the expansion of the elderly population results in an increase in the need of various forms of oral health care.

Removable complete dentures have been a traditional and common way to restore edentulous patients for years. However, the progressive bone resorption of the edentulous alveolar ridge is the main concern when rehabilitation of the edentulous patient using a removable complete denture is considered. [1]

Severe atrophy of the inferior alveolar process and underlying basal bone often results in problems with lower dentures. These problems include insufficient retention of the lower denture, intolerance to loading by the mucosa, pain, difficulties with eating and speech, loss of soft-tissue support, and altered facial appearance. Moreover the dentures are affected by reduced salivary flow, decreased tongue motor control, reduced bite force, and diminished oral sensory function. [2, 3, 4]

The introduction of dental implants has improved the quality of life for edentulous patients. A conventional complete mandibular denture is less favorable than a complete maxillary denture in terms of retention. However, the use of two implants to retain the denture significantly improves the prognosis of mandibular edentulism. [5, 6]

The success of an implant is determined by many factors, among which bone quality and quantity are extremely important. [7] Poor bone

quality, especially low bone density, was considered as a major cause that prolongs the bone-implant healing period or even causes implant failure. [8]

The physicochemical characteristics of the dental implant surface, such as roughness, topography, chemistry, and electrical charge affect the biological reactions occurring at the interface of the tissues and the implant. [9]

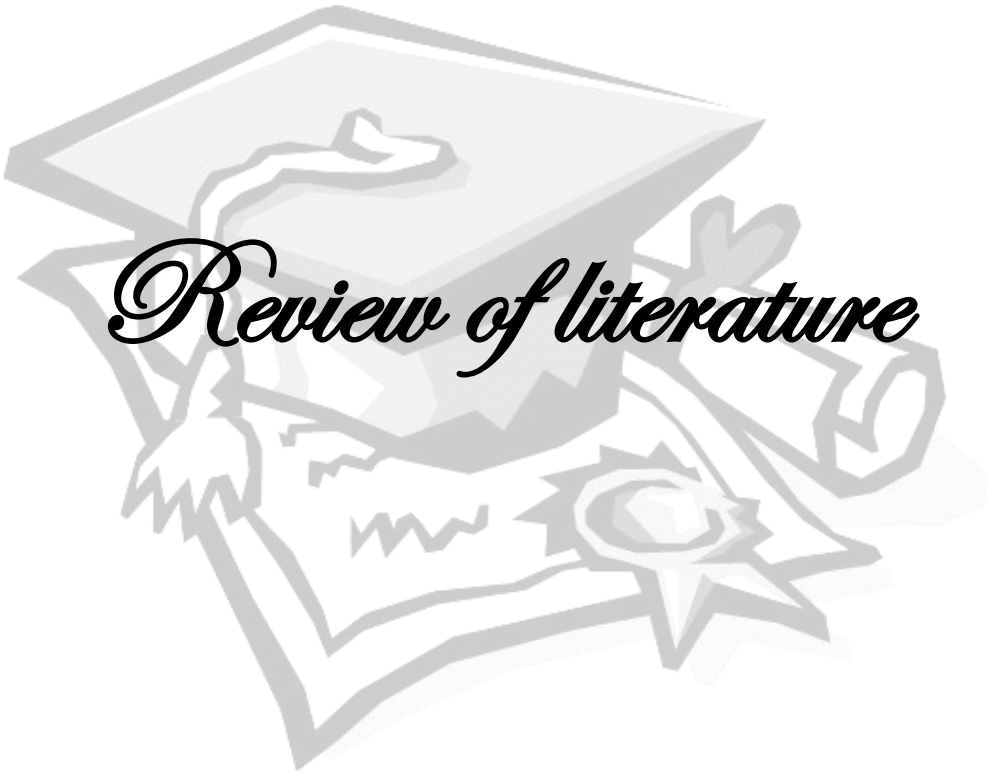
Numerous reports demonstrated that surface roughness of titanium implants affects the rate of osseointegration through the speed and amount of bone tissue formed at the interface. Comparison of the behavior of different cell types on materials shows that they are influenced by surface roughness. [10]

Methods for altering surface texture can be classified into techniques that add particles on the biomaterial (additive mechanisms) and techniques that remove material from the surface (subtraction mechanisms). Examples of additive processes are: hydroxyapatite (HA) and calcium phosphate (CaP) coatings, titanium plasma-spraying and ion deposition. Examples of subtraction processes are: electro- or mechanical polishing, grit-blasting, acid-etching, grit-blasting followed by acid-etching and oxidation. [11]

Nanostucturing technology creates unique physical, chemical, mechanical and biological properties of various materials. [12] The alteration process that created nanostructured materials demonstrated significantly accelerated bone-implant integration. [13]

Although long-term clinical studies have been conducted to evaluate the effect of different surface treatments on osseointegration, there is lack of research comparing dual acid etched versus nanostructured titanium *implants.*

Review of literature



membrane from prosthetic restorations affect the metabolism of the underlying tissues by obstructing blood flow and initiating residual ridge resorption. [22] Mucosal inflammation can also cause resorption via the generation of arachidonic acid, metabolites or interleukins. [23]

In patients with complete dentures, the degree of mandibular resorption is more than that in the maxilla which is attributed to the fact that the supporting surface for the complete lower denture is smaller and thus the stresses on it is greater. Consequently the majority of edentulous patients complain of impaired function of the lower dentures. [21, 24]

Management of edentulism:

For many decades complete tissue-supported removable prostheses have been regarded as the treatment of choice for edentulous patients. The primary reason for this was the absence of a viable alternative. The treatment outcome of rehabilitation with complete dentures cannot be predicted, and there is a wide variation in the patient response to this treatment modality.

Despite the fact that complete dentures are known to have poor masticatory capability, patients seem to accept this as part of the aging process. The most common complaint is the 'loosening' of the dentures which is often due to the continual resorption of the alveolar ridge. Moreover, patients complain of intolerance to loading by the mucosa, pain, difficulties with eating and speech, loss of soft-tissue support, and altered facial appearance. [25, 26]

Principles of denture construction must be followed during fabrication to reduce the stress transmission and help preserve the alveolar ridge. This may be achieved by having broad area of coverage under the

Local and anatomical factors have the most influence on residual ridge resorption. Lackof mechanical stress, absence or presence of dentures, number of years of denture use, number of sets of dentures and muscle tone are known functional factors. Anatomical factors include facial form, original size of mandible, original depth of sockets, local bone quality, blood supply and muscle attachments. Inflammatory factors include trauma at extraction, pre-existing or residual infection, local inflammatory mediators and denture hygiene. Finally, age, gender, bone regulatory hormones, diseases such as diabetes, hyperparathyroidism, systemic osteoporosis, and corticosteroid therapy are systemic factors. [18-21]

Atrophic edentulous ridges are associated with anatomical problems that often impair the predictable results of traditional dental therapy. [14] The continuous resorption of the alveolar processes leads to prominence of the mylohyoid ridge and the superior genial tubercles. Moreover, it may cause dehiscence of the inferior alveolar canal, increased risk of mandibular body fracture from advanced bone loss, thinning of mucosa with high sensitivity to abrasion, close muscle attachments to the crest of the ridge and more active role of the tongue in mastication. [14]

Bone resorption has adverse effects on esthetics as it causes decreased facial height, deepening of facial grooves, thinning of the vermillion border and loss of tone in the muscles of facial expression. It also causes rotation of the chin forward thus gives a prognathic appearance to the patient. [14]

It was observed that patients wearing complete dentures presented smaller edentulous ridges than edentulous patients with no denture treatment especially in the mandible. [21] Compressive forces directed onto the mucous