

***Stress Assessment Of Recent BioHPP
Abutments And Telescopic Implant Retained
Over Denture On The Supporting Structure***

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Dedication

To my great father,

my amazing mom,

my loving big family,

and my superhero husband,

thank you for your endless love and support.

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Introduction

Edentulism has been an annoying dental problem to both patients and prosthodontists due to its important impact on the patient and the community regarding functional and social limitations. Although the prevalence of an edentulous condition is decreasing, the great number of edentulous people warrants the continuing efforts of basic and clinical research on removable partial dentures. A complete denture fabrication is the common treatment modality used for edentulous patients but there have been a well known adverse effects on the health of both the oral and the denture supporting tissues from wearing a complete denture ⁽¹⁾.

The revolutionary introduction of implants in dentistry has done a marvellous impact in the treatment options in completely edentulous patients. The edentulous mandible is always a challenge to be restored successfully. Therefore the implant overdenture treatment option is often recommended. In the McGill Consensus Statement of 2002, two endosseous implants in the canine region are recommended as a first choice of treatment option ⁽²⁾.

For more improvement in the retention and stability of implant overdentures, many types of attachments have been used. There are different types of attachments, like stud, bar, magnets and telescopic attachment commonly used ⁽³⁻⁵⁾.

Telescopic overdentures have a lot of advantages, including their verstality, hygiene, esthetics and superior retention and stability. Retention and stability of telescopic overdentures which were introduced in the 1970s, are directly related to the number and the distribution of the

abutments along the dental arch and the taper of the wall of the primary coping⁽⁶⁻⁸⁾.

Conventional Chrome–cobalt alloy, Titanium and Zirconium have been the material of choice for dentures, bridges and implant-superstructures, as mandibular removable overdentures are typically fabricated with acrylic resin prosthetic teeth processed on a rigid acrylic resin base that may be reinforced with a metal frame but for some time the evolution of Polymers such as PEEK Optima or BioHPP especially for the dental industry has lead to an increase of applications of the material⁽⁹⁾.

BioHPP has what is called off-peak property as its E-modulus lying in the range of 4000 MPa resembling the elasticity of human bone (e.g. in the mandible)which pretty much compensate for the torsion of bone and the flexural strength of 3.1 GPS, stop material fracture which opens up a wide range of indications in term of metal free restoration. The chewing forces are therefore cushioned with the so called off-peak property, even with implant-supported bridges. It can be used as a framework material for bridges, which makes it a possible alternative to traditional metal alloys or zirconium dioxide⁽⁹⁾.

So this study is conducted to evaluate the ability of BioHPP when used as an alternative framework material in implant supported prosthesis to decrease the forces falling on the supporting implants and compare it to the conventional used cobalt-chromium frameworks.

Review of literature

Edentulism and its effects:

Edentulism is defined as having no teeth, it can be the result of multiple factors such as dental caries and periodontal disease ⁽¹⁰⁾.

Over the last 20 years, the number of old people retaining their natural teeth is in increase so the edentulism percentage has decreased in each age group in most western countries. Otherwise in less developed countries there is an increase in the rate of total edentulism ⁽¹¹⁻¹⁴⁾.

Though the prevalence of edentulism has decreased over the last decades, there will be a relevant proportion of edentulous individuals in the ageing societies worldwide ⁽¹⁵⁾.

Complete edentulism is usually a slowly developing condition that occurs because of dental neglect, although there are some instances when trauma or systemic disease may contribute to the creation of the same condition. Regardless of the etiology, the dentally debilitated patient generally experiences deficiencies in the physiologic functions of speech, deglutition, and mastication. A major reason for patient procrastination in seeing a dentist can be due to a psychologic impairment related to dental care ⁽¹⁶⁾.

Teeth loss affects alveolar bone health maintenance, which subsequently starts the resorption of residual ridge. In addition, teeth loss results in dropping of the biting force with following decrease in masticatory function, which eventually leads to gastro-intestinal troubles⁽¹⁶⁾.

Alveolar bone resorption resulting from teeth loss, is an inevitable ongoing process which affects mandible four times more than maxilla which eventually leads to a reduction in the height of alveolar bone and the size of denture bearing area and it is undoubtedly the main cause of lack of the mandibular complete dentures retention and stability⁽¹⁷⁾.

Although edentulism is not a life-threatening condition, it has a serious impact on the individuals and the community regarding social and functional limitations also on the use of public resources⁽¹⁵⁾.

Oral debilitation, even when a substantial number of teeth remain, is difficult to manage. Periodontally hopeless teeth cannot serve as functional abutments for either fixed or removable prostheses. As natural teeth are lost and the patient becomes edentulous, conventional complete dentures are a common treatment option. Despite strict adherence to accepted denture fabrication techniques, complete denture wearers generally continue to experience deterioration of the supporting alveolar bone and now after several researches no one can deny that, complete dentures wearing has several adverse effects on both oral and denture supporting tissues health^(1,16,18).

In comparison to individuals with a natural dentition, complete denture wearers show a notably lower chewing efficiency. They possess shorter chewing cycles, less bite force and muscle activity when compared to dentate patients. Patients may develop para-functional movements, which eventually results in inflamed, swollen and hypertrophied tissues. Denture mobility resulting from ill fitness on such regions continuously increases the problem⁽¹⁹⁻²²⁾.

Most of complete denture wearers are facing mastication difficulty with mandibular dentures due to decreased area of coverage, approximation to muscles attachments and the tongue activity, which leads to prosthesis instability ⁽²³⁾.

Implant supported overdentures:

Last defence line usually taken in an attempt to keep the patient from being edentulous is overdentures supported by either natural teeth or implants. An overdenture is a prosthesis that overlies and partially supported by natural teeth, tooth roots or dental implants ^(24,25).

Patients reported that overdentures offer better functional activities than the conventional mucosa-supported complete dentures. Also less bone resorption, more retention and stability were also reported ^(24,26).

An alternative to the complete removable denture is the use of endosseous implants as support for a removable or fixed prosthesis. The use of dental implants has become an increasingly popular and predictable method of providing prosthesis support, retention, and stability ^(16,27).

Implant-supported prostheses can nowadays undoubtedly be considered a main option in restorative dentistry encouraged by well documented success-rates and clinical long term stability, the indication for dental implants was gradually extended to groups of patients who were originally considered at risk, such as patients with compromised general health, rare disorders, irradiated bone or who were simply of old age. A rough estimate indicates that, on a global level, only about one in

every thousand totally and partially edentulous people have benefited from treatment with implant-supported prostheses ^(1,28,29).

For edentulous persons, implant supported overdentures provide a substantial benefit from functional, psycho-social and structural points of view when compared to a conventional complete denture. In the anatomically unfavourable situation of an edentulous mandible, implant supported dental prosthesis is the recommended treatment method to ensure sufficient prosthetic rehabilitation ^(30,31).

Dental implants must fulfil certain criteria arising from special demands of function. Those criteria include biocompatibility, adequate mechanical strength, optimum soft and hard tissue integration and transmission of functional forces to bone within physiological limits ^(32,33).

Advantages of implant-retained prosthesis over complete dentures:

Improved retention and stability, improved masticatory function, preservation of the residual bone, improvement of oral sensory function, reduction of the prosthesis volume and improved patient general satisfaction are considered advantages of implant-retained prosthesis over complete dentures ^(27,34).

Branemark and colleagues proposed the concept of dental implant and bone osseointegration over 40 years ago, but total acceptance of implant based therapy has been hampered by the cost of treatment and limited access to professional care. Since the early studies, dental implants have been used to treat partial edentulism, replace single teeth, and facilitate overdenture applications. As experience has accumulated with osseointegrated implants and longterm success rates have climbed,