Effect of three CAD/CAM cement retained crown materials with two load directions on strain transmitted to implant fixture

(an *in vitro* study)

A thesis submitted to the faculty of Dentistry, Ain Shams University for the partial fulfilment of requirements of the Master's degree in Fixed Prosthodontics

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Dedication

To the soul of my Father and To my dear Mother who I would not be who I am today without their support and always believing in me.

To my beloved sisters and brother.

To my soul mate and my beloved husband who supports me in every step in my life.

To my dear lovely daughter.

To all my friends and colleagues.

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Tooth loss causes major biologic and esthetic problems for patient. Prosthetic solutions to such problem made a great challenge for prosthodontists to be conservative with remaining dentition. Classical treatment modalities are not satisfactory for patient and they are less conservative without respecting time frame expectations by patient and also do not fulfil current high esthetic demands.

Implant is the treatment of choice for restoration of a missing tooth as it is the most conservative treatment option with superior esthetic results.

Implant is inserted into bone and left without load (non functioning) till osseointergration occur and then could be restored with a functioning restoration.

Recently immediate loading of final restoration become an option for fulfilling high esthetic demands. The term immediate loading donates immediate placement of prosthesis within 48 hours of implant insertion but without occlusion with antagonists.

To minimize the risk of implant failure after their placement dental implants are kept load free for 3 to 8 months to establish osseointergration (conventional loading). It would be beneficial if the healing period could be shortened without jeopardizing implant success.

Nowadays implants are loaded early and even immediately, and it would be useful to know if there is a difference in success rates between immediately and early loaded implants compared with conventionally loaded implants.

Different materials are used for fabrication of fixed prostheses for restoration of dental implants.

Use of new materials that could apply less load on implant during function with resilience values equivalent to resilience values of bone to allow osseointegration, would be preferable in fabrication of coronal restoration of implant.

The novel high performance composite PEEK (polyetheretherketone), with its notable mechanical properties, is a polymer from the main group of PAEK (polyaryletherketone). It is biocompatible and chemically stable to nearly all organic and inorganic chemicals. Due to its excellent physical and biological properties, this composite material is used both in general medicine and in dentistry as implant, provisional abutment and implant supported bar or clamp material. But PEEK might also be a suitable material for fixed dental prostheses (FDPs), especially in load bearing areas with a reported mean load-bearing capacity of 1,383 N for 3-unit PEEK FDPs.

Resin nano ceramics are new class of CAD/CAM materials with unique functionality. A resin nano ceramic material has an elastic modulus that's comparable to dentin—which is much lower than what brittle glass ceramic materials or PFM veneering porcelain. This enables better absorption of occlusal forces and reduce stress to restoration. This is especially advantageous for crowns over implants.

Having these new materials in the market is important to assess their performance for immediate loading on implant.

Review of Literature

Review of Literature

Edentulism is a debilitating and irreversible condition and is described as the "final marker of disease burden for oral health". Although the prevalence of complete tooth loss has declined over the last decade, edentulism remains a major disease worldwide, especially among older adults. various factors affect prevalence of edentulism like education, economic circumstances, lifestyle, oral health knowledge and beliefs and attitudes to dental care[(1)]

Edentulism has a series of deleterious consequences for oral and general health .[(2)]

Replacing missing teeth is much more than just cosmetic. When you lose a tooth and it is not replaced, the rest of your teeth undergo drifting. In severe cases the mouth's entire bite pattern can become misaligned, causing bite problems and increased stress on the jaw joints. The bone and gingival tissues around the missing tooth will eventually shrink if the tooth is not replaced; this makes it a lot more challenging to create a natural looking and well fitting replacement.[(3)]

Implant Vs conventional methods

Replacing a missing tooth is a long term (lifetime) investment. During the last decade, implantology has become an indispensible part of mainstream dentistry, helping dentists to improve the quality of life of large patient populations. Whilst implant treatment could often be a convenient alternative to conventional treatment options, in certain cases,

it is the treatment of first choice for the rehabilitation of severe functional, anatomical or aesthetic problems arising from tooth loss. This is probably most striking in the treatment of the severely atrophic mandible.(4)

Dental Implants

According to Encyclopedia of Surgery, dental implants are surgically fixed substitutes for roots of missing teeth. If embedded in the jawbone, they act as anchors for a replacement tooth, also known as a crown, or a full set of replacement teeth. (5)

According to the Academy of Prosthodontics 2005 dental implant is defined as; "A prosthodontic device of alloplastic material, implanted into the oral tissues beneath the mucosal and/or periosteal layers and / or within the bone to provide retention and support for fixed or removable prostheses".(6)

While the American Dental Association (ADA) Organization defined implants as; material inserted or grafted into tissue. "A device specially designed to be placed surgically within or on the mandibular or maxillary bone".(7)

Osseointegration

Osseointegration is a biological concept firstly introduced in the 1960's. Since its introduction, the term has been defined and redefined from different points of view, the common factor being an inanimate metallic structure anchored long-term in living bone under functional loading. The host response to implants inserted in living bone involves a

series of events at cellular and molecular levels, ideally leading to an intimate apposition of bone at implant surface.

Albrektsson et al[8] defined osseointegration as direct functional and structural connection between living bone and the surface of a load-bearing implant.

Steineman[9] stated that osseointegration is a bony attachment with resistance to shear and tensile forces.

Zarb and Albrektsson[10] provided another definition as a process in which a clinically asymptomatic rigid fixation of alloplastic material is achieved and maintained in bone during functional loading. The term osseointegration is not limited to describing initial bony implant anchorage but is presently interpreted as a clinical descriptor of implant survival. Throughout the period of implant loading, the surrounding living bone is undergoing a continuous active remodeling and adaptation with direct on-growth to the implant surface.

According to the Glossary of dental implants osseointegration is defined as "The procedure by which a contact is established without interposition of non-bone tissue between normal remodeled bone and an implant entailing a sustained transfer and distribution of load from the implant to and within the bone tissue. [11]

Factors affecting the success of osseous-integration

There are some factors affecting the long term success of osseointegrated dental implant .