Immediate implant loading in functional and non – functional occlusion using a Resin Nano - Ceramic crown material (In Vivo Study)

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Dedication

I would like to dedicate this to my family, friends, colleagues, and mentors. It is a blessing to be surrounded by people who want to see me grow and become a better person. I have gained something from everyone I met along my journey, and for this I would like to thank each and every one of them.

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Introduction

The first use of titanium as an implant material was by Bothe, Beaton, and Davenport in 1940. They were the first to observe how close the titanium screws grew to bone and they were the first to describe this phenomena, which would later be termed osseointegration [(1)]. In the following decades many different implant systems constructed from different materials and designs and with different surgical techniques emerged on the scene. The success rate of these different systems was extremely variable and the follow-up and documentation of these studies were both scarce and lacking in scientific evidence [(2)]. Due to this lack in scientific data dental implants were not approved for routine dental use until the 1980's [(3)]. A large part of the approval for dental implants is due to Dr. Per – Ingvar Branemark, a Swedish physician who experimented with titanium screws in patients and provided the most well documented and successful studies of that era [(4)]. To date, Dr. Branemark's innovation and research have formed the basis for modern dental implantology.

Branemark's technique highlighted the importance of the two stage surgical approach, allowing the implant and the bone to heal with no mechanical or microbial disturbances. Another important aspect is the low rotary speed drilling with profuse irrigation at the osteotomy site to respect the bone cells. He also advocated a healing period of 3-8 months before second stage surgery [(3)] and placement of the restoration.

Although Branemark's technique was proven to be successful over the years, clinicians and patients alike have felt the need to reduce these long procedures and waiting periods. Therefore, immediately loading dental

implants in functional and non – functional occlusion has been investigated in the last couple of decades and has proven to be successful under certain conditions [5]. One of these conditions is using a resilient temporary crown material, to act as a shock absorber, for immediate restoration of the implant. But temporary crown materials may fracture and stain easily, which is a hassle for the patient and the clinician.

New hybrid ceramic materials have been introduced into the market in the last few years. They have both ceramic and composite components. They can potentially have the advantages of ceramic materials, such as fracture and stain resistance, while also having enough resiliency to act as a shock absorber on immediately loaded implants.

Review of literature

Immediate loading

The original Branemark two - stage surgical protocol has become accepted as the standard for implant treatment because it is a safe, predictable, and reliable treatment modality [6]. The rationale for the Branemark protocol was to submerge the implant under no force or loading in a bacteria – free environment without apical migration of the oral epithelium [7].

Nevertheless, clinicians have attempted since then to shorten the clinical time and procedures by proposing a one stage surgical protocol with loading of the implant with a restoration immediately after surgery [8].

In 1986 *Babush et al* [9] placed 514 implants in 128 patients in the anterior part of the mandible to support overdentures. Twenty implants failed during the 5.5 - year follow-up period, responding to a success rate of 96.1%. All of the twenty failed implants failed during the first year, most of them during the first six months.

In 1997 *Chiapasco et al* [10] wrote a multicenter retrospective study on immediately loaded implants inserted in the anterior part of the mandible of 226 patients. In total, 904 implants were placed with a mean follow-up of 8.6 years. The success rate was 96.9%.

In 2003 *Rocci et al* [11] conducted a 3 - year clinical study on 97 implants placed in the anterior maxilla of 46 patients. 25 fixed partial prostheses and

27 single restorations were immediately loaded using prefabricated provisional restorations. Nine implants failed with a cumulative survival rate of 91%. The authors noted that the failures increased in cases of single tooth restorations and in smokers.

In 2010 *Hartog et al* [12] compared the outcome of immediate non-occlusal loaded implants versus conventionally loaded implants. 62 implants were placed in the maxillary esthetic zone. The outcomes measured were radiographic marginal bone level changes, survival, soft tissue aspects, esthetics, and patient satisfaction. No significant difference was found between both groups. One implant was lost in the immediately loaded group for a survival rate of 96.8%, while no implants were lost in the conventionally loaded group.

Terminology

Cochran et al [13] published their recommendations on loading protocols after a detailed review of the implant literature, which led to the definition of implant loading terminology.

- Immediate restoration (immediate provisionalisation): the restoration is delivered within 48 hours of implant placement but not in occlusion with the opposing dentition.
- Immediate loading: the restoration is placed within 48 hours of implant placement with occlusal contact of the opposing dentition.
- Early loading: the implant is placed in function (occlusion) with the opposing dentition within 48 hours to 3 months of implant placement.
- Conventional loading: the restoration is placed within 3-6 months after placement of the implant.

Advantages of immediate loading

- Reduction in overall treatment time [14,15].
- Reduction in alveolar ridge resorption [16,17].
- Psychological benefits resulting in increased patient acceptance [18-19].
- Quicker return of function [20].
- Superior soft tissue profile [21-22].
- Reduced surgical trauma [23].

Guidelines for immediate loading

Immediate loading has become a viable treatment modality but several factors should be considered before deciding on this procedure instead of the conventional loading protocol. These factors are; surgical factors, host factors, implant factors, and occlusal factors [24].

1. Surgical factors

Primary stability: is the biometric stability immediately after implant insertion, and is one of the most critical factors in determining the long-term success of dental implants [25]. Adequate primary stability will reduce micromotion, which can induce fibrous tissue formation at the implant-bone interface, thereby preventing proper osseointegration and resulting in bone resorption [26]. An insertion torque of at least 25 N/cm is considered the minimal required torque for adequate primary stability [27,28].

Surgical technique: adequate cooling during drilling is necessary to avoid osteonecrosis and fibrous tissue formation. Temperatures above 47 C can result in heat necrosis [29].