

Clinical evaluation of two different implant designs for immediate loading in fresh extraction sockets

Thesis

**SUBMITTED FOR PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR MASTER DEGREE OF ORAL
MEDICINE AND PERIODONTOLOGY**

BY

Ramy Rafik el Batanony

B.D.S (M.U.S.T)

**DEPARTMENT OF ORAL MEDICINE AND
PERIODONTOLOGY**

CAIRO UNIVERSITY

2010

Supervisors

Prof. Dr. Amr Zahran

Professor of oral medicine and periodontology

Faculty of oral and dental medicine

Cairo University

Assistant Prof. Dr.Hisham Samy Sadek

Assistant Professor of oral medicine and periodontology

Faculty of oral and dental medicine

Cairo University

Researcher Dr.Basma Mostafa Zaky

Researcher in the department of oral medicine and surgery

National Research Center

ACKNOWLEDGEMENT

First of all, I thank GOD for His Great Help to fulfill this work.

I would like to express that I gained a great honor being under the supervision of Dr. *Amr Zahran*, Professor of Oral Medicine and Periodontology , Faculty of Oral and Dental medicine, Cairo University for his generous help, guidance, kind care and support through every step in this research.

I would like to thank Dr. *Hisham Samy Sadek*, Assistant Professor of Oral Medicine and Periodontology, Cairo University for his valuable supervision.

Also I would like to thank Dr. *Basma Mostafa Zaky*, researcher in the National research center, for her great help and care.

Words cannot express my respect and grateful thanks for Dr. *Mahmoud El Refaee*, Head of the department of oral medicine and periodontology , Cairo university for his fatherly encouragement and endless concern.

I would like to thank the Department of Oral Medicine and Periodontology, Faculty of Oral and Dental Medicine, Cairo University, for giving me permission to commence this thesis in the first instance, to do the necessary research work and to use departmental data.

Finally, I would not forget to thank the staff members of *Prof. AMR ZAHARAN* dental clinic.

DEDICATION

This work is gratefully dedicated to:

My mother, my father and brother

For their love, care and prayers

My beautiful lovely wife, for her great support and patience

My godfather Dr. Hany Habashy who really taught me like a father, I
wish he is proud of me now. R.I.P

LIST OF CONTENTS

	Page Number
Introduction and Review of literature.....	1
Aim of the Study.....	33
Materials and Methods.....	34
Results.....	63
Discussion.....	85
Summary.....	92
Conclusion.....	94
References.....	95
الملخص العربى	...

رسالة مقدمة لكلية طب الفم و الاسنان جامعة القاهرة
توطئة للحصول على درجة الماجستير فى طب الفم و علاج الثة

رسالة مقدمة من

الطبيب/رامى رفيق الباتانوى

بكالوريوس طب الفم و الاسنان جامعة مصر للعلوم والتكنولوجيا

كلية طب الفم و الاسنان جامعة القاهرة

Abstract:

This study compared the clinical performance of the OsteocareTM Midi (post type) versus the Maxi Z one-piece for immediate placement and loading by a provisional restoration. 20 implants were placed in 10 patients and were restricted to the upper anterior and premolar region. Implants were evaluated at 3 and 6 months postoperative. The surface area of all implants was measured, the bleeding index (PBI), the probing depth (PD), the gingival index (GI), Periotest M value, crestal bone level and bone density were checked clinically. The results showed 100% success rate with higher initial stability with higher implant surface area. In conclusion, the two implant designs can be immediately placed and loaded.

Keywords: Dental implants, immediate implant, immediate loading, two implant designs.

هذه الدراسة قد اجريت على المقارنه السريره بين Osteocare midi post type Maxi Z one- piece للتحميل المباشر باستعاضه مؤقتة بعد الخلع.

وضعت عشرون غرسه لعشره مرضى و كانت تقتصر على منطقه الاسنان الاماميه و الضواحك من القوس العلوى و قد تم تقييم الغرسات على مدار ثلاثه و سته اشهر بعد الجراحه.

قد تم قياس مسط الغرسه، مؤشر النزيف ، مؤشر العمق ، مؤشر اللثه ، مستوى و كثافه العظم.

اظهرت النتائج ان نسبة النجاح % يعطى مع ارتفاع مساحه الزرعه.

فى الختام يمكن استخدام التصميمين فى حالات التحميل المباشر بعد الخلع مباشره.

Introduction and Review of Literature

Several factors contribute to partial and complete edentulism, where caries, periodontal disease and trauma are the most commonly blamed reasons among these factors. Many trials have been made since the beginning of history till the present time, to restore missing teeth ranging from the most primitive ideas to much more sophisticated treatment modalities (*Hobkirk et al 2003*).

The elusive dream of replacing missing teeth with artificial analogs has been part of dentistry for thousands of years. Radiographs made for Egyptian Pharaohs showed periodontal disease and substantial tooth loss. The Etruscans produced the first pontics, using simple gold bands, as early as 630 BC. A separate tradition of dental prosthesis, with wires made of either gold or silver, evolved in the eastern Mediterranean around 400 BC and finally a fine dark stone shaped like a tooth was found implanted in a Mayan skull in central America from 600 AD (*Becker 1995*).

One of the most important significant scientific breakthroughs in clinical dentistry was undoubtedly the introduction of osseointegrated implants for anchorage of fixed bridges 40 years ago. Before the advent of implants, the only alternative treatment was to replace missing teeth with tooth-supported crowns and bridges, or removable dentures, although fixed appliances may be well accepted, not all patients can adapt successfully to removable dentures and in many cases experience functional and/or psychological problems (*Fischer 2008*).

The coincidental discovery by Dr. Branemark of the tenacious affinity between bone and titanium oxide, termed osseointegration, propelled dentistry into a new age of reconstructive dentistry. In 1969 Branemark published landmark research documenting the successful osseointegration of endosseous titanium implants. Since then, these methods for surgical placement of dental implants have had a profound influence on the practice of dentistry. Implants have become the treatment of choice in many, if not most, situations when missing teeth require replacement. In many circumstances, implants are the alternative to many fixed or removable appliances (**Gue et al 2010**). The success of implant has been attributed to their firm bone anchorage referred to as osseointegration or functional ankylosis which has been defined as the direct structural connection between bone and the surface of a load-carrying implant at the light microscopic level (**Branemark 1995**).

Several types of dental implant systems are available which are classified according to the shape and their relation to the bony housing. They include subperiosteal, transosteal and endosseous implants. The most frequently used implants are the endosseous implants which include a range of sizes, shapes, coating and prosthetic components. Implant length and width can be chosen to fit the available bone while the prosthetic component can be selected in size and angle to accommodate the final restoration (**Binon 2000**).

Endosseous root-form implants are the easiest to be inserted as they simulate the general size and form of the root of a normal tooth, they can be placed in the previous locations of the natural roots making them very versatile for replacing one or more teeth. The body

geometry of the endosseous implant is characteristically cylindrical in shape. Initially 3 basic shapes were available; a threaded screw, a press-fit cylinder and a hollow basket cylinder. The classical distinction was the presence or absence of threads and a solid or hollow cylinder. Development of the root-form implant over the past 20 years has resulted in a variety of different body geometries. The impetus for change was driven by the desire for surgical simplicity, greater predictability in poor-quality bone, immediate rather than delayed placement, improved stress distribution, better initial stability, and marketing distinction. A variety of features have been added to the classical geometric distinction to form an endless variety of geometric shapes. Additional distinctions can be made on the basis of steps, ledges, threads, vents, grooves, and the presence of an internal hollow recess. Threaded screws can be characterized as straight, tapered, conical/tapered, ovoid, and expanding. There are several thread designs which includes the buttress or (reverse buttress), v-shaped and rectangular. Thread patterns have also been modified and now range from microthreads near the neck of the implant and broad macrothreads on the mid-body. Also there is a variety of altered thread-pitch to induce self-tapping and bone compression and small limited-length threads for initial stability. The implant body can also be distinguished by the presence or absence of a cervical collar, which can vary in width and angle, and the presence of a flared or straight neck (**Deporter 2009**).

Root-form endosseous implants are classified according to their shape into:

The Screw Implants:

Screw implants are the most commonly used implants design, they possess different configurations of threads, they may be solid or with vents, grooves or internal hollow recess. Also the body geometry may be straight, tapered, conical/tapered, ovoid or expanding. In general, the threads are used to maximize initial contact, improve initial stability, increase surface area, help dissipation of interfacial stress, and provide a great mean of proprioception for the dentist who places the implant. Implant body design with threaded features has the ability to convert occlusal loads into more favorable compressive loads at the surrounding bone interface. Therefore thread shape is particularly important when considering long-term load transfer to the surrounding bone interface (*Binon 2000 and Millan et al 2000*).

In general, the threaded portion of the implant features variable thread pitch (the distance measured between the peaks of two adjacent threads) and depth (difference between the major and the minor diameters of the implant body). The greater the thread depth, the greater the surface area of the implant body if all other factors are equal. The angle as well as the self tapping features can be combined to create a countless implant design (*Kong et al 2008*).

The original Brånemark screw, introduced in 1965, had a V-shaped thread pattern as a mean of placement into a pre-tapped osteotomy. The design was modified in 1983 as a self-tapping implant for placement in soft bone in a non-pretapped osteotomy site. Manufacturers

have also modified the basic V-thread and body shape for simpler and more efficient placement. On the other hand manufacturers use a reverse buttress thread with a different thread pitch and shallower depth for better load distribution. Although surgical success rates of more than 95% have generally been achieved in most bone densities, subsequent success following loading appears to be related to bone density. Reports indicate that the biomechanical environment has a strong influence on the long-term maintenance of the implant-to-bone interface. The interface can easily be compromised by high stress concentrations that are not dissipated through the body of the implant. Recent attention has been directed to the design features that address variations in occlusal loads and bone densities. Square threads, with a thread angle of 3 degrees, have been proposed to decrease the shear forces by a factor of 10 and increase the compressive load, since bone responds more favorably to this type of load distribution. Although theoretical mathematical models project a more functional load distribution surface area, controlled clinical studies are needed to validate the biomechanically enhanced implant design. Another recent approach has been the introduction of a rounded thread design for immediate loading. This was reported to increase surface loading area and provide more uniform stress distribution. Prospective clinical trials are necessary before any definitive conclusions can be drawn. It is appropriate and necessary that biomechanical concepts and principles are now being applied to the design of dental implants to enhance the clinical success (*Neugebauer et al 2009*).

The Tapered Implants:

Tapered implants were initially designed especially to serve for immediate implant placement after tooth extraction as they have a tapered apical end which simulates the form of a natural root. Original endosseous implants were parallel in design. However, the original design was not suitable for all applications. Tapered implants have been used to improve esthetics and facilitate implant placement between adjacent natural teeth this might be advantageous when single implant is placed between two teeth with convergent roots (*Garber et al 2001, Glauser et al 2004 and Sullivan et al 2004*).

The Mini and Midi implants:

The Mini and Midi one-piece implants are machined from a piece of titanium alloy that incorporates both the implant body and an integral post or ball fixed abutment in a single component. These implants are designed to have a high load “Buttress” thread that has the advantage of allowing for the compression and expansion of the implant site to achieve high stability in even poor quality bone. Both types have grit-blasted and acid-etched (GBA) surface treatment. The conical macro-design of the Mini and Midi implant allows their placement in limited tooth-to-tooth spacing and atrophic ridges they also enhance the bone quality by allowing for the compression of the low quality bone (*Zahran 2008*).

The Maxi Z implants:

Maxi Z implants are either two-piece which means that the fixture and abutment are two separate components or one-piece in which the two components are fabricated as a single unit. Maxi Z two-piece and

Maxi Z one-piece implants have buttress form threads with grit-blasted and acid-etched surface. The tapered body geometry of these implants has the ability to distribute forces into the surrounding bone, thereby creating a uniform compaction in adjacent osteotomy walls when compared with parallel-walled implants. Thus, when inserted, it creates a lateral compression of the spongy bone, enhancing the bone quality. This advantage can be seen especially with anatomic constraints, including ridges with concavities or narrow ridges. The unique design of the Maxi Z implants allows their placement with a minimally invasive flapless procedure without the risk of labial perforation as the decrease in diameter toward the apical region accommodates for the labial concavities. The wide range of diameters have broaden the indications of their use to include the thin poor quality bone as the tapered design automatically expand the bone, and large extraction sockets by filling the jumping gaps with a minimal need for grafting materials. The design of the Maxi Z two-piece and the Maxi Z one-piece implants is tailored for immediate loading and allow for the provision of same day restorations following the concept of "a tooth in a day" (*Zahran and Gauld 2007*).

The surfaces of dental implants present a wide range of surface composition and texture. The chemical modifications of implant surface have a major influence on early inflammatory events around the implants. It was proved that roughened implant surfaces improve the mechanical anchorage in bone than to smoother polished surfaces and are more attractive to osteoblastic activity, which in turn improves the osseointegration (*Coelho et al 2010*).