Clinical Evaluation of Flapless Free Hand Immediate Implant Placement in Fresh Extraction Sockets

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Abstract

Background: The procedure of the flapless free hand, implant placement in fresh extraction socket in conjunction with immediate loading has many challenges and needs documentation. This paper is a retrospective study for documentation of the procedure using a new design of one-piece implants.

Methods: Sixty two tapered one-piece implants were placed in 62 patients (27 males and 35 females with a mean age of 44.3 years) immediately after extraction of a single anterior tooth or premolar. All the implants were placed using the free hand flapless technique and immediately restored with a provisional acrylic resin restoration. The patients were evaluated at 6- and 12-month intervals. Clinical criteria were survival rate, Periotest M values and crestal bone level.

Results: The overall survival rate was 100% and the overall mean bone loss was 0.59mm (SD ±0.33; range 0.03-1.28mm) and 0.70mm (SD ±0.35; range 0.06-1.04mm) after 6 months and 12 months respectively. The average Periotest M values were -2.35 (SD ±0.99; range -0.5 to -4.7) as measured immediately after implant placement, while the values were -2.72 (SD ±0.70; range -1.8 to -3.8) and -3.18 (SD ±0.83; range -1.9 to -4.9) after 6 months and 12 months respectively.

Conclusion: The flapless, free hand immediate post-extraction implant placement and loading using tapered one-piece implants is a highly successful treatment modality and the prognosis depends on proper treatment planning and case selection.

KEY WORDS: Dental implants, immediate implant, extraction

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INTRODUCTION

The original protocol, as described by Branemark and colleagues, required a two-stage surgical protocol: the surgical placement and surgical uncovering of an implant. They suggested a healing period of 3-6 months after tooth extraction to allow for bone filling and contouring before implant placement.[1,2] Investigations showed that significant bone volume changes of the alveolar process take place following tooth extraction.[3,4] Schropp et al 2003 reported a 50% reduction in bucco-lingual width of the extraction socket over a period of twelve months with two thirds of the reduction taking place during the first three months and a reduction of crestal bone level ranging from 0.7 to 1.5 mm after four to six months.[5] Thus, immediate post extraction implant placement into fresh extraction sockets is considered a predictable and accepted procedure of preserving the alveolar dimensions, with its consequences of better crown-implant ratio, improved soft tissue esthetics and favorable inter-arch relationship.[6-10] Immediate implant placement has also been reported to have the advantage of reducing the treatment time required and the reduction of the number of surgical interventions.[11-13] Many implantologists are very trustful of 2-stage implant placement procedures as they are unaware of the successful concept of immediate loading which began more than 40 years ago.[14] With the evolution of implant design regarding the development of improved surface treatments and thread designs which has the purpose of achieving better primary stability and osseointegration, immediate loading became more popular and many authors have reported a high success rate with this technique.[15-19]

According to recent researches, we have three options of implant loading: Conventional staged loading protocol in which the implant is loaded after insertion by 3-8 months,[20] immediate loading protocol involves the loading of the implants immediately after insertion or within a week after placement,[21-23] while early loading protocol allows the implant to be loaded after insertion by 1 week to 2 months.[24,25]

The combination of immediate post-extraction placement with immediate loading of dental implants has the advantage of shortening the treatment time and increasing case acceptance and reported to be safe in terms of survival rates and esthetics.[24,26,27]

Although most of the literature describes the need initially to raise a flap for implant placement, many studies have demonstrated that flap reflection often results in gingival recession and bone resorption around natural teeth.[28] When soft tissue flaps are reflected for implant placement, blood supply from the soft tissue to the bone (supraperiosteal blood supply) is removed, thus leaving poorly vascularized cortical bone, prompting bone resorption during the initial healing phase.[29] To minimize the possibility of postoperative peri-implant tissue loss and to overcome the challenge of soft tissue management during or after surgery, the concept of flapless implant surgery has been introduced and clinically applied to both delayed and immediate loading cases.[9,13,30-32]

However, some prerequisites for the flapless implant surgery have been reported; these include sufficient bone width and height since direct visualization of bone is limited, adequate keratinized soft tissue in order to be esthetically pleasing, an absence of significant tis-

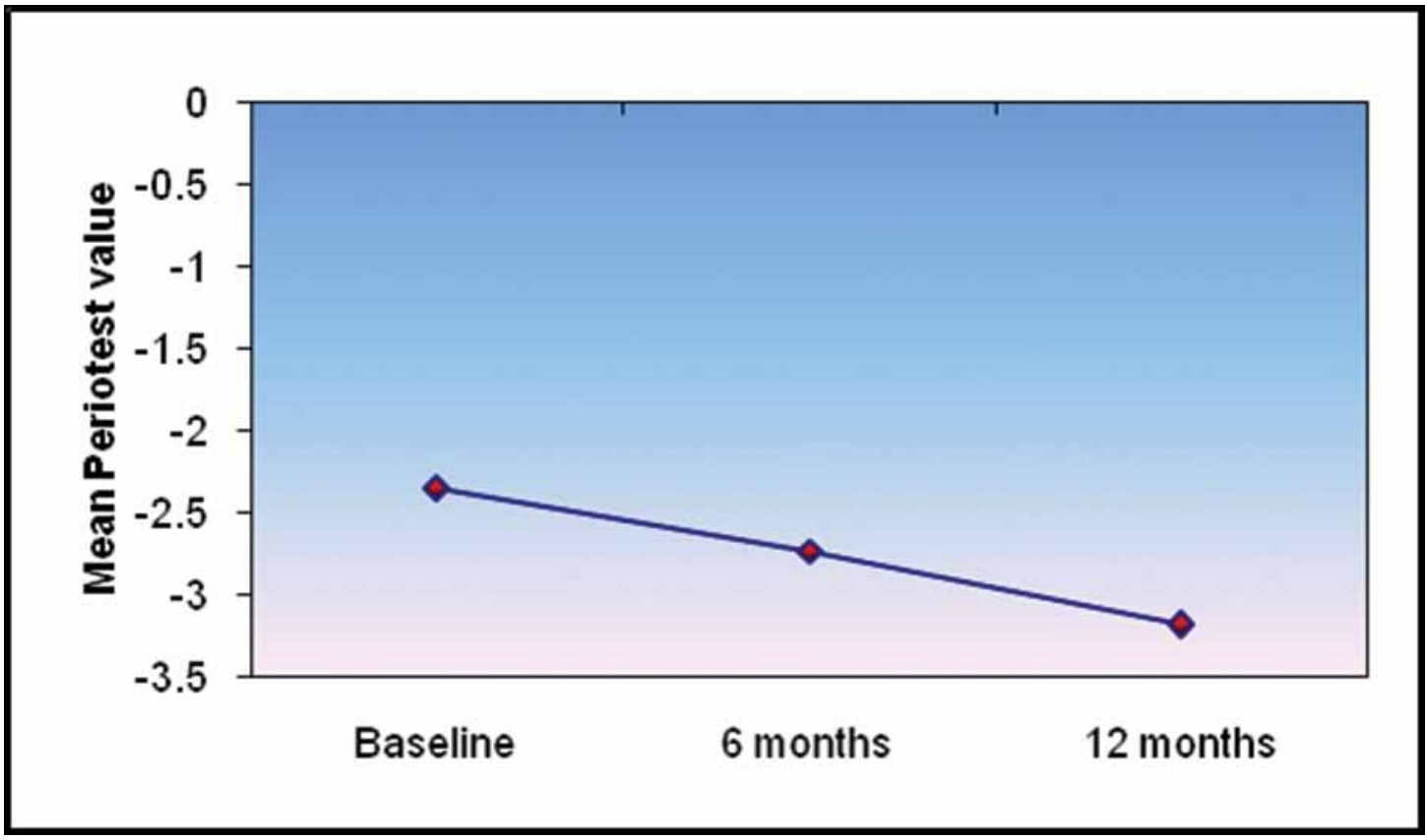

Figure 1: Periotest M values over time.

sue undercuts to prevent tissue dehiscence or fenestration, and finally the correct angulation of the implant drills for fear of perforating the cortical plates especially the buccal aspect resulting in dehiscence or fenestration.[10,33]

The new Maxi Z one-piece implants have tapered macro- design with tapered-end and mimic the shape of the natural single rooted tooth. The tapered shape of the implant allows for nearly complete fill of the extraction socket space, leaving the minimal peri-implant bony defect or space between the wall of the socket and the body of the implant (jumping distance). This implant system allows for simultaneous expansion and compression of the bone by creating a small opening through the cortex using under-sized drilling, followed by slow and gradual insertion of the implant into the socket. Each turn will smoothly displace the bone, thereby improving the bone quality by condensing the bone. The self-tapping design together with the buttress thread design enables the clinician to place the implant into an under-sized osteotomy, making the surgery less traumatic, and also contributes to achieving high initial stability which is essential for the success of immediate placement and immediate loading of dental implants.[13]

MATERIALS AND METHODS

Patients

A total of 62 patients, including 27 males and

Figure 2: Preoperative clinical picture.

Figure 3: Immediate postextraction implant placement.

35 females, were consecutively included in this study between September 2007 and October 2008. The average age at the time of implant placement was 44.3 years (range 24-79 years). The patients were required to be in good general health, and had no condition that might jeopardize the outcome of the treatment. All patients had a single anterior tooth or premolar indicated for extraction due to root fractures, endodontic failure, non restorable crown fracture and periodontal disease. The patients were thoroughly informed of the immediate loading protocol and of all the risks associated with this type of procedure. They all gave their full informed consent. The treatment planning for the patients included extraction of the hopeless teeth and the immediate placement of one-piece implants of proper diameter and length and followed by delivery of acrylic resin provisional restorations immediately after placement.

Pre-Surgical Evaluation

Pre-surgical evaluation was carried out with panoramic radiographs, periapical radiographs and cone beam volumetric tomography (CBVT) whenever indicated.

Implants

Sixty two Maxi Z one-piece implants (Osteo-Care™ Implant System, London, United Kingdom) were used in this study. The Maxi Z one-piece implant has a tapered design with tapered-end which allows for bone compression during insertion through under-sized osteotomy. Also it has a unique "buttress" thread design that allows for maximum bone to implant contact, resulting in the achievement of high initial stability in poor quality bone. This implant has grit-blasted and acid etched surface treatment.

Surgical Protocol

All implant surgeries were performed under local anesthesia. All the extractions were done atraumatically and no flaps were designed before or after teeth extraction. Presence of intact buccal plate of bone was considered crucial for the immediate post-extraction implant placement procedure. The integrity of buc-

Figure 4: The provisional acrylic crown.

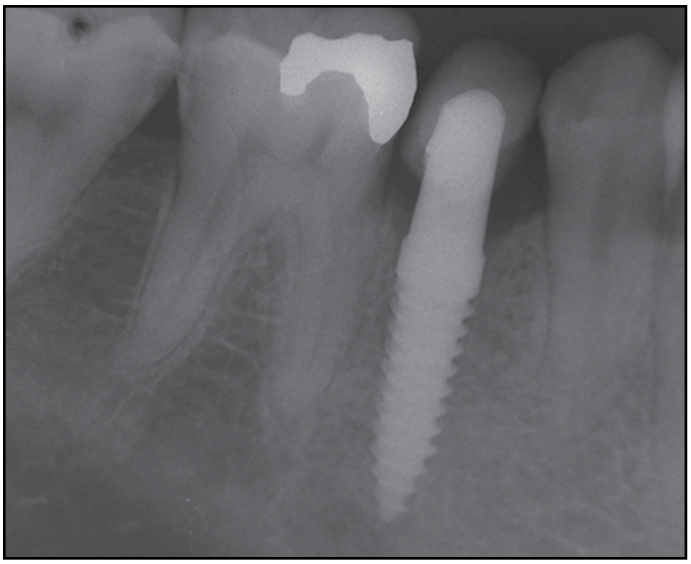

Figure 5: Immediate postoperative periapical radiograph.

cal plate of bone was assessed by an osteotomy probe through the extraction socket. Any socket with buccal dehiscence or fenestration was excluded from the study. Flapless, free-handed implant surgery was used for all the osteotomy preparations and implant placements.

Osteotomy Preparation

The profile pilot drill with a diameter of 1.3mm

Figure 6: The final ceramo-metal restoration.

was used at the center of the apex of the socket which was used as a guide to make the initial osteotomy and extended 3-5 mm beyond the socket level. According to the bone density beyond the socket level, another 2 sequential wider drills (2.2 and 2.75mm) were used in cases with hard bone to facilitate easier insertion of the implant without exerting undue pressure on the bone. All the drilling procedures were done under copious irrigation using saline to prevent heat generation and damage of the bone.

Implant Placement

After choosing the proper implant diameter and length to occlude the extraction socket space without leaving a peri-implant defect (jumping gap) of more than 1.5mm, the implant was removed from its protective pouch and manually placed with its tapered tip to engage the opening of the under-sized osteotomy through the extraction socket. Then the hex driver and the ratchet wrench were used to complete the seating of the implant. The first thread of the implant was placed 3mm below the crestal bone of the

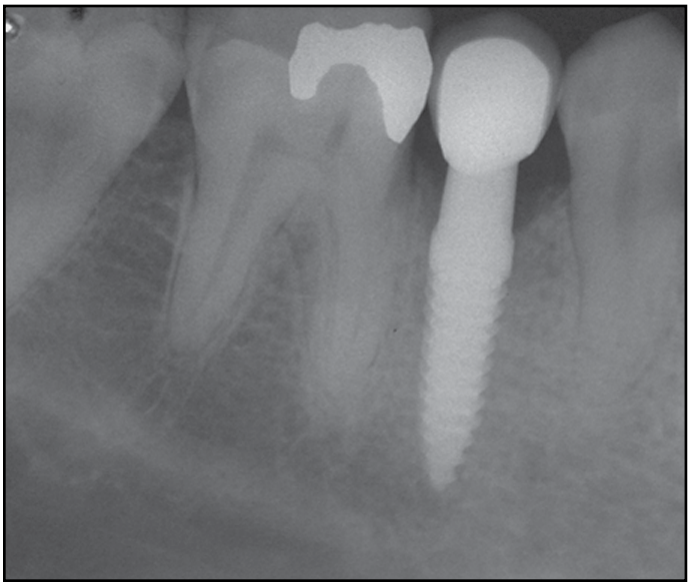

Figure 7: 12 months postoperative periapical radiograph.

socket as confirmed by the periapical radiograph.

Implant Stability

Attaining primary stability of over 30 Ncm was considered crucial with all the placed implants in the extraction sockets to allow for the immediate loading protocol. Primary stability of the implants was evaluated by the torque wrench. The implant stability was checked also by the Periotest M (Medizinntechnik Gulden, Bensheim, Germany).

Abutment Preparation

High speed diamond or carbide burs were used to adjust the angulation and height of the abutment, if necessary. The abutment preparation was done under a copious stream of water irrigation to prevent overheating.

Immediate Loading

Once the abutment preparation and impression taking were completed, the provisional acrylic resin restoration was fabricated either in the laboratory or by the dentist chair-side. The provisional acrylic resin crown was then temporarily cemented to the prepared abutment of the implant. The provisional crown was carefully adjusted out of direct occlusal contacts (non functional occlusion).

Final Restorations

After a healing period of 6 months, the acrylic resin provisional crowns were removed, and replaced by definitive ceramo-metal restorations.

Follow-up

The patients were evaluated at 6 and 12months intervals. The following criteria were applied to evaluate the implant success: Implant success was calculated according to the following parameters: absence of mobility, absence of painful symptoms or paresthesia, absence of radiolucency during radiographic evaluation, and absence of progressive marginal bone loss (bone resorption in measurement areas not greater than 1mm, during the first year of implant positioning).[34]

Radiographic evaluation of the crestal bone was evaluated with conventional and digital radiographs taken immediately after implant placement and after 6 and 12 months of the follow-up period. Conventional radiographs were photographed with a digital camera. Each radiograph was calibrated using the known length of the implants. The lower corner of the collar was used as a reference point for measurements at the mesial and distal side of the implant. Measurements were done using the UTHSCSA image tool version 3.0 (developed in the Department of Dental Diagnostic Science at The University of Texas Health Science Center, San Antonio, Texas).

The Periotest-M was used to evaluate the clinical stability. Periotest M values (PT) of (0 to -8) were considered the ideal values that denote successful osseointegration. The measurements were repeated at the 6 and 12 months follow-up period.

Statistical Analysis

Data were presented as minimum, maximum, means, standard deviation (SD) and standard error (SE) values. Paired t-test was used to study the changes by time in each variable. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with SPSS 16.0® (Statistical Package for Scientific Studies) for Windows.

RESULTS

Complete soft tissue healing was generally uneventful in all patients and showed no postoperative inconveniences during the study period. Twenty one patients experienced no postoperative pain, 32 patients had mild pain, 8 patients had moderate pain and one patient experienced severe pain. The surgeon scored 7 patients as having slight edema. The patients in general, reported the minimal need for analgesics. The provisional acrylic resin crowns became loose in three patients and were carefully re-cemented the same day.

All the 62 one-piece implants were successfully osseointegrated as revealed by clinical and radiographic examinations. Implant survival rate of 100% was attested. The overall mean marginal bone loss was 0.59mm (SD ±0.33; range 0.03-1.28mm) and 0.70mm (SD ±0.35; range 0.06-1.04mm) after 6 months and 12 months respectively.

The average Periotest M values (PT) for all the implants were -2.35 (SD ±0.99; range -0.5 to -4.7) as measured immediately after implant placement, while the values were -2.72 (SD ±0.70; range -1.8 to -3.8) and -3.18 (SD ±0.83; range -1.9 to -4.9) after 6 months and 12 months respectively. There was a statistically significant decrease in the mean Periotest M values after 6 months, after 12 months and through the follow-up period (6 months-12 months) ($P \leq 0.05$) (figure 1).

DISCUSSION

The flapless, free hand implant placement in fresh extraction socket in conjunction with immediate loading is relatively a new technique. This technique is increasingly gaining popularity as an attractive advantage for both patients and clinicians alike. Today, quick delivery of implant-supported restorations immediately after extraction can be considered the standard of care in case of a missing tooth or missing teeth. Many clinicians, however, are unaware that the concept of immediate loading by using titanium one-piece implants as well as flapless surgery is actually not new and began in the early sixties of the last century.[14,35,36]

For a long period of time, the success documented for Brånemark's protocol convinced clinicians that this was the only acceptable protocol. Recently, the evolution of the science of Dental Implantology yielded technological breakthroughs of the macro and the micro-design of the dental implants, including improved implant shape, thread patterns and surface treatments that have demonstrably fostered greater primary stability and faster osseointegration. These modern implants were designed for the immediate loading procedures and were applied to rehabilitate the partially eden-

tulous patients with high predictability.[17] In parallel with the recent technical advances of the implant designs, the better understanding of biology had led to shifting towards the minimally invasive or the atraumatic flapless surgical procedures.[9,29,35] The appropriate patient selection, single-stage surgery, immediate loading, and flapless site preparation are dependable treatment approaches that offer favorable long-term prognosis.[28,33]

On the other hand, some clinical reports evaluated the success of immediately loaded dental implants that were placed in fresh extraction sites versus healed bony sites and demonstrated controversial results,[20,37] others considered the flapless implant placement as a "blind" surgical procedure and care must be taken when using this technique. Some academicians are against the flapless implant concept as well as the immediate loading procedures as literature still lacks sufficient documentation for their credibility to be implemented in routine clinical practice.[33]

It was reported that immediately loaded implants may be at a greater risk of failure than conventionally loaded ones.[15] The authors of the present study decreased the risk of failure with immediately loaded implants, by using various "clinical tricks", such as under-sized osteotomy preparation of the implant site to achieve high primary stability, with the use of non-occluding provisional crowns during the healing period.

The tapered design of the new implant with its tapered-end conforms to the shape of the socket and the extracted root that allowed for filling of most of the socket space leaving from 0-1.5mm of a jumping gap (circumferential defect) that increased the initial stability of the implants and rendered the need for bone augmentation materials unnecessary.[38,39]

In this study, the flapless immediate post-extraction implant placement cannot be considered as a "blind" surgical technique as the integrity of the socket and the buccal plate of bone could be checked easily by probing and could even be visualized through the socket opening. Thorough knowledge of clinical anatomical structures around the implant site and sound surgical skills are needed for the validation of the flapless technique in order to become more popular for single-stage implant procedures.

Primary implant stability and lack of micro-movement are considered two of the main factors necessary for the achievement of predictably high success rates for osseointegrated oral implants.[20] The authors of the present study reported a strong correlation between implant successes and the initial stability of the implants ($>$ 30 Ncm) which was achieved by under-sized osteotomy preparation followed by placement of the new implant with tapered macro-design and buttress threads. In this study, the initial stability of the implants was not tested only by the torque wrench but the Periotest M was used as well. All the implants had Periotest M values below zero at the time of immediate placement and all the implants were successfully osseointegrated and gave better significant Periotest M values over the follow-up period.

The first thread of the implants used in this study was placed 3mm below the crestal bone level of the extraction sockets and this could be the reason for the minimal crestal bone resorption that occurred during the 12 month follow-up period of this study. Other studies recommended placement of the implants with their platforms

below the level of the socket by 1-2mm.[11,40]

CONCLUSION

The flapless, free hand implant placement in fresh extraction socket in conjunction with immediate loading is a successful technique when proper case selection as well as proper choice of implant design is applied. This study showed a 100% clinical success of the new design one-piece implants when placed in well selected patients. A high degree of primary fixation seems to be one of the prerequisites for success of the procedure.

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Disclosure
The authors report no conflicts of interest with anything mentioned in this article.

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