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JIACD

The Journal of Implant & Advanced Clinical Dentistry

The MIMS Technique for Gingival Grafting

Xenograft Socket Preservation

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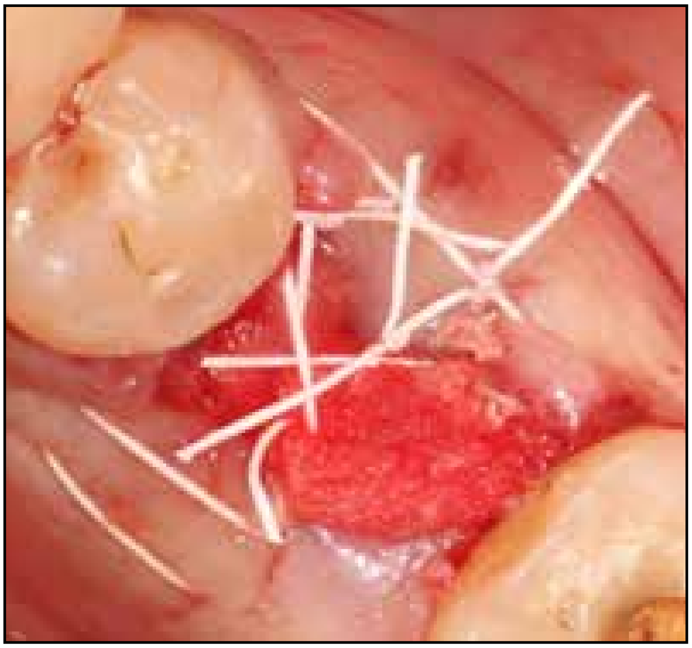
Table of Contents



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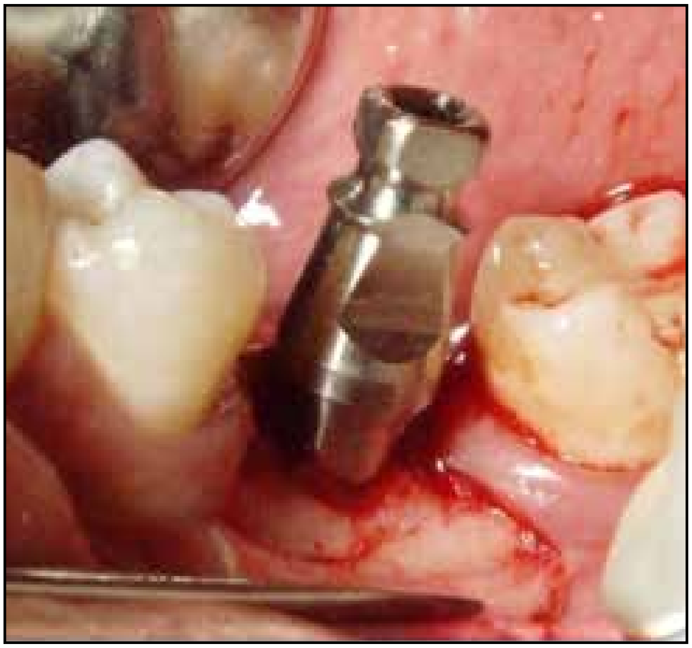
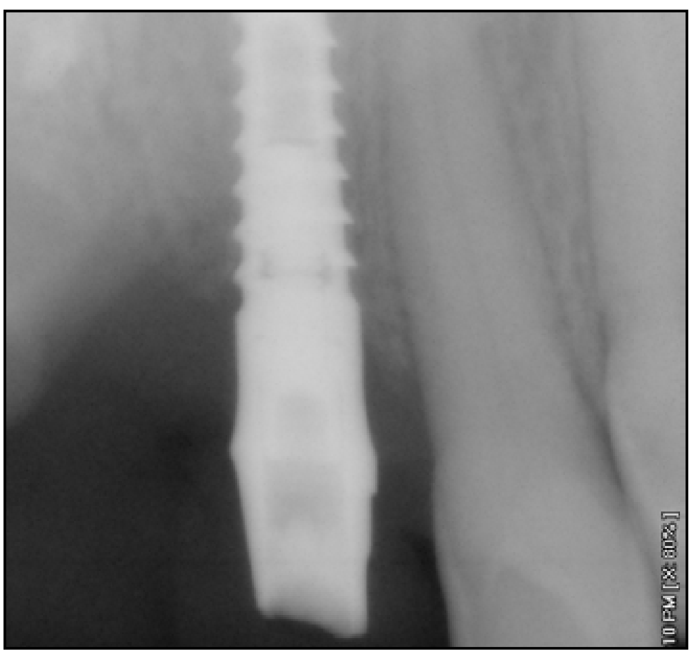
Volume 9, No. 4 • May/June 2017

Table of Contents





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JIACD
The Journal of Implant & Advanced Clinical Dentistry

The MIMS Technique – A Case Report: A First Look at a New Method for Optimizing Esthetic Gingival Grafting

Marcus J. Blue, DDS[1]

Abstract

Purpose: Suturing in the esthetic zone can be unsightly and difficult for patients post-operatively. Moreover, when clinically presented with a very thin tissue biotype needing soft tissue grafting to repair a mucogingival defect, approaches may be far and wide. Therefore, this article shows a new method of suturing that was created to address both lack of tissue resiliency and esthetics when working the smile zone.

Methods: A patient presented for soft tissue grafting in the anterior maxilla with a very thin tissue biotype and high smile line. A new non-conventional approach was utilized combining internal mattress and sling suture variations.

Results: The new method of utilizing a modified internal mattress sling technique (MIMS technique) secured the thin flap of tissue, provided well adaptation of gingival margins, and virtually eliminated any physical appearance of sutures present.

Conclusions: When presented with thin tissue biotypes and/or mucogingival defects in the esthetic zone, utilizing the Modified Internal Mattress Sling technique can greatly aid in securing and concealing soft tissue grafting for patients.

KEY WORDS: Mucogingival defect, gingival graft, suture, esthetics

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Figure 1: Pre-surgical intraoral view.

Figure 2: Immediate post-surgical intraoral view.

Figure 3: One week healing.

Figure 4: Two week healing.

INTRODUCTION

Suturing for gingival grafts can have many approaches with varying degrees of strength and stability. Performing maxillary anterior gingival grafts in the smile and esthetic zone can result in temporary, unsightly and embarrassing post-operative esthetics, especially in patients with a high smile line. More importantly, patients with thin tissue biotypes have very delicate gingiva before inflammation even begins during healing, so it is of utmost importance to prevent tearing and maintain collateral blood flow to ensure optimal results and graft stabilization. Some materials such as Monocryl (a clear, monofilament) may be used to help conceal suture appearance, but ultimately most techniques and materials result in visible suture lines and compression marks at the gingival margins, which can add time for collagen remodeling and healing. The proposed and outlined method presented in this Case Report not only helps to conceal sutures for an esthetic finish, but also reveals a way to add incredible strength for thin tissue biotypes greatly diminishing the risk of tearing, while adding compressive strength for the gingival graft.

CASE REPORT

The MIMS Technique (Modified Internal Mattress Sling)

The patient presented is a 44 year old white male with recession on teeth 7 and 8 (Figure 1). He presented with a very thin tissue biotype, minimal keratinized gingiva, and 5mm of clinical attachment loss. Additionally, composite restorations had been placed apically that had to be carefully removed without damaging the margins of the veneers. While additional teeth also will need soft tissue grafting, this proof of principle technique was confined to just 7 and 8. Surgical incisions were confined to the gingival sulcus and papillae. The tissue was then carefully reflected beyond the mucogingival junction with apical tissue release allowing tensionless advancement of the entire flap. The suture utilized was a black nylon 6-0 monofilament with a P-3 needle (Figure 2). Postoperative healing was uneventful (Figures 3, 4).

MIMS Technique: Step by Step Instructions (Figures 5-20)

1. In order to properly conceal and begin the technique, it is imperative to begin with the first pass of the needle at an apical placement (distal aspect of #6) much like an internal mattress would begin.
2. The needle is then passed interproximally (between 5 and 6) and slung around the tooth (6) passing it back through to the facial.
3. The needle is then passed internal to external in an apical fashion and immediately back through the flap just proximal.
4. The needle is then passed again interproximally (between 6 and 7), slung around 7 and through to the facial.
5. Once again, an apical pass from internal to external apically is performed with an immediate re-entrance just proximal.
6. In order to remove potential gingival margin “rippling” to due to advancement and aligning margins, the needle is passed internal to external just below the gingival margin.
7. The needle is then re-inserted just proximal below the gingival cuff on the facial and then passed through the interproximal space (this allows synching of the tissue around the neck of the tooth and elimination of a pulled appearance).
8. The needle then is passed interproximally and slung around the palatal of 7. At this point, the needle is to pass through the apical portion of the papilla (internal to external) and once again back internally just coronally. (The papilla pass and sling allows for tensionless closure and perfect adaptation of the tissues.)
9. The needle is then passed interproximally to sling around palatal of 6 and back facially passing internal to external just adjacent to the original insertion and tied. Suture slings may then be gently tucked into the palatal sulcus utilizing a periodontal probe or Woodson instrument.

Figure 5: MIMS suturing technique step 1.

Figure 6: MIMS suturing technique step 2.

Figure 7: MIMS suturing technique step 3.

Figure 8: MIMS suturing technique step 4.

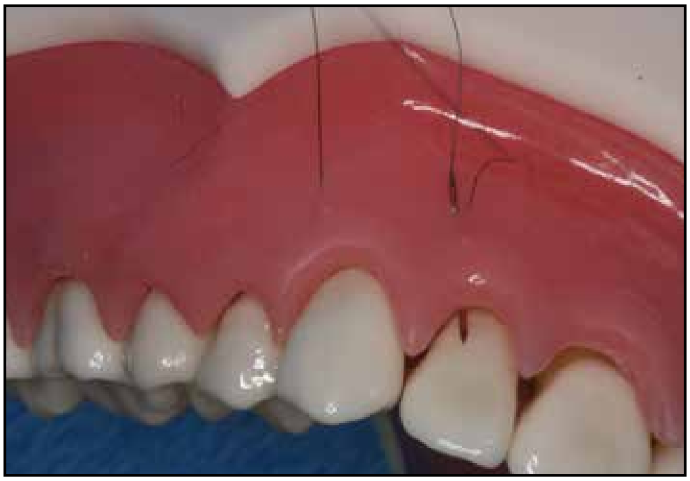

Figure 9: MIMS suturing technique step 5.

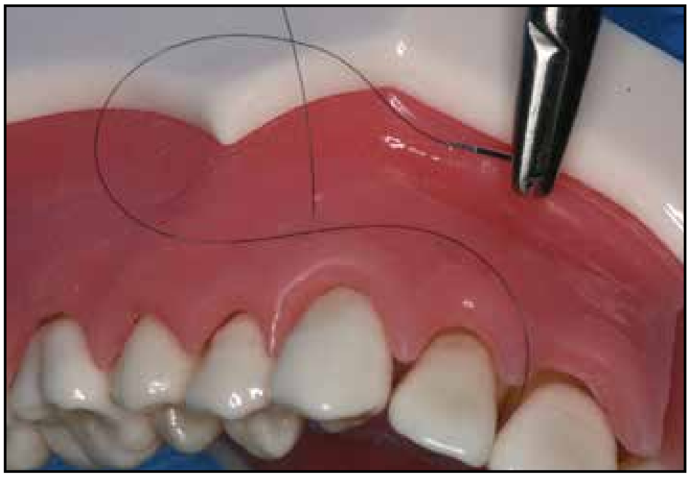

Figure 10: MIMS suturing technique step 6.

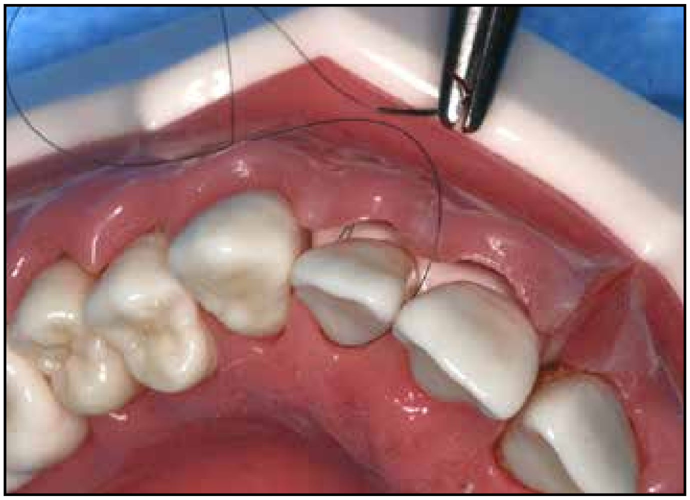

Figure 11: MIMS suturing technique step 7.

Figure 12: MIMS suturing technique step 8.

Figure 13: MIMS suturing technique step 9.

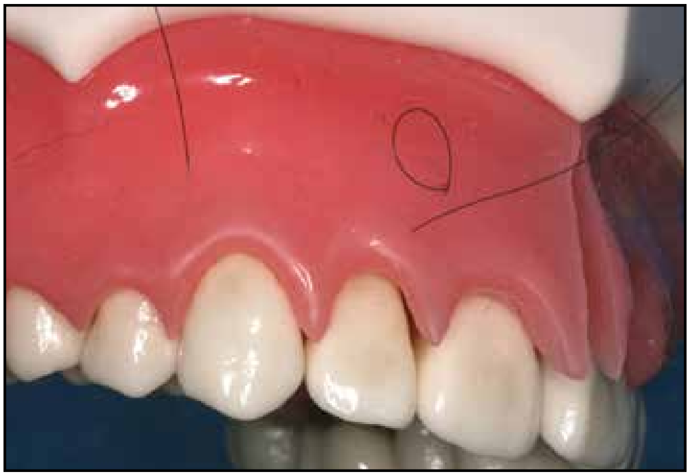

Figure 14: MIMS suturing technique step 10.

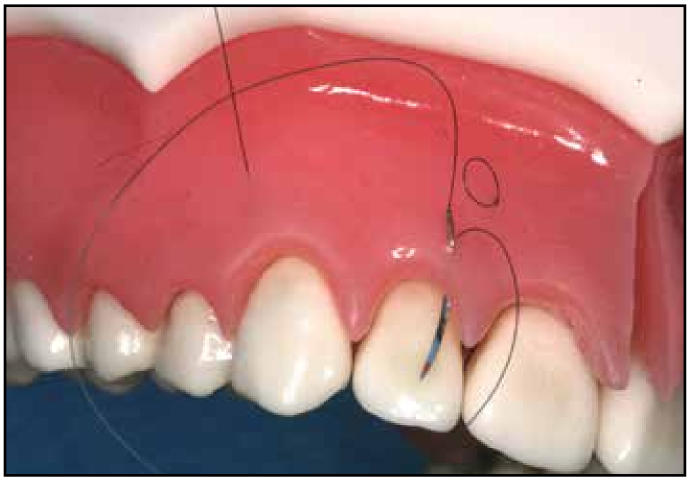

Figure 15: MIMS suturing technique step 11.

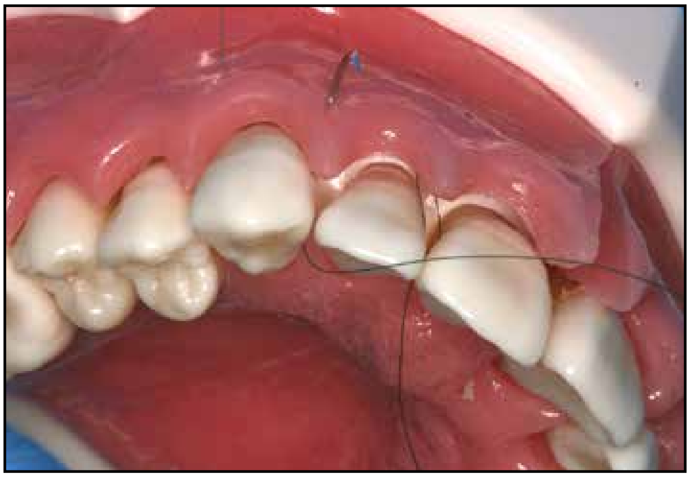

Figure 16: MIMS suturing technique step 12.

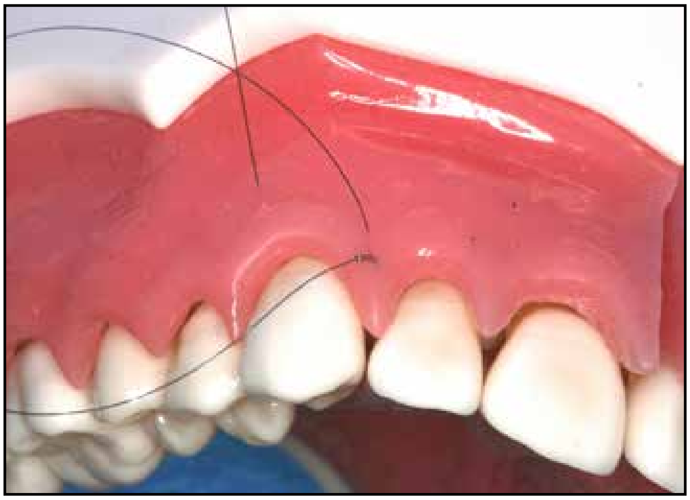

Figure 17: MIMS suturing technique step 13.

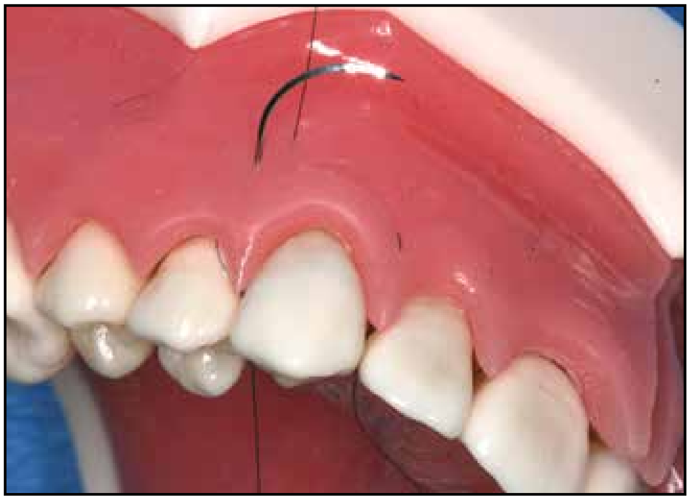

Figure 18: MIMS suturing technique step 14.

Figure 19: MIMS suturing technique step 15.

Figure 20 MIMS suturing technique step 16.

CONCLUSION

The end result is a very esthetic finish with exceptional strength due to the apical passes as well as excellent papillary adaptation without sacrificing blood flow or revealing gingival margin compression due to external suture passing. Removal is simple by cutting the palatal slings and pulling on the one knot from the facial.

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Materiala
Materials used in this Case Report include: 6-0 Nylon Premium+ P3 needle (AD Surgical 1296 Kifer Road, Ste 608, Sunnyvale, CA 94086) and Puros Dermis Allograft Tissue Matrix (ZIMMER Dental 1900 Aston Ave. Carlsbad, CA 92008).

Disclosure
The author reports no conflicts of interest with anything mentioned in this article.

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Socket Preservation Using a Small Particulate Xenograft: A Case Report

Dr. Lanka Mahesh[1] • Dr. Devich Aran Shetty[2] • Dr. Sagrika Shukla[3]

Abstract

Soon after tooth extraction a cascade of bone remodeling starts which result in bone resorption. Procedures such Socket Seal Surgery can be employed to preserve future implant site. There are various grafts which can used for the same purpose. The best method to observe a graft's healing is surgical re-entry and or histopathology. The aim of this Case Report is to document the use of Smartbone® xenograft for socket preservation. After 5 months of healing, histopathological core sampling revealed good osteoconduction of the graft.

KEY WORDS: Socket preservation, bone graft, xenograft

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3. Private practice, New Delhi, India

Figure 1: Intra oral view of non-restorable lower molar.

INTRODUCTION

Implant treatment has become the prime requisite for missing tooth replacement, however good bone quality is paramount for its placement.[1] Soon after tooth extraction, bone resorption takes place and the bone loses bucco-palatal and mesio-distal dimensions required for implant placement.[2,3] If the tooth extraction is done in the posterior maxilla, the sinus may expand, leaving a thin bone height for implants where placement is only possible after sinus augmentation procedures. In such cases either immediate implant placement or socket seal surgery (SSS) can be done to protect bone's integrity for implant placement. SSS can be successfully employed for the preservation of the alveolar process after tooth extraction. The literature also confirms that early bone loss can be significantly reduced with socket grafting.[4,5] The advantage is that any graft material can be used for SSS, however only few of the materials have shown superior regeneration capability as compared to the others. Smartbone® bone substitute is one such graft material. It is a xenograft, which is based on technology which uses regenerative medicine to replace the damaged bone and then heal it.

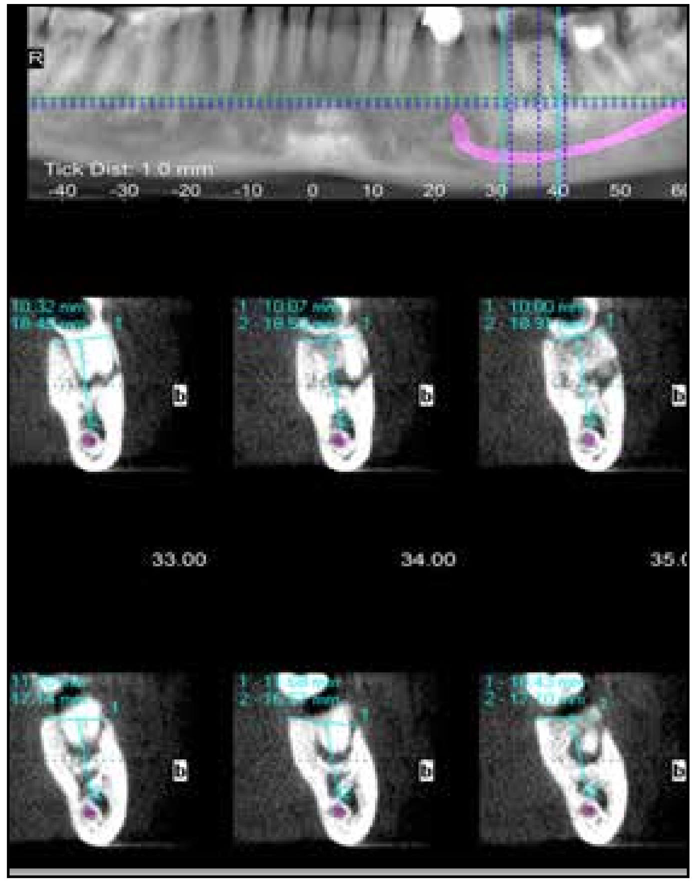

Figure 2: Denta scan of the grossly destructed lower molar.

METHOD AND MATERIALS

A 50 year old female reported to the dental office with non-restorable lower first molar. The patient was healthy and had no significant medical history. After a thorough check-up she

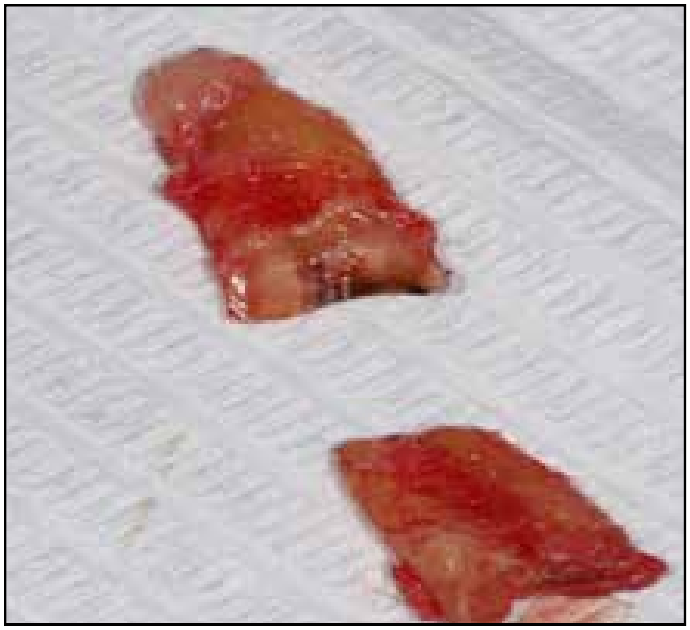

Figure 3: Extracted tooth.

Figure 4: SSS with DBBM Smartbone.

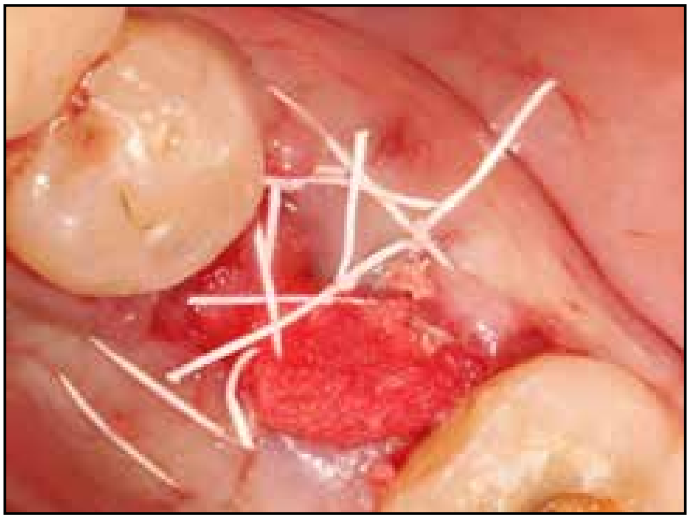

Figure 5: Socket closed with collagen plug and sutures.

was advised a socket bone graft with delayed implant placement as the tooth was very wide and the periapical infection too deferred immediate implant placement (Figures 1and 2). Under the patient's consent, tooth was extracted as atraumatically as possible (Figure 3) and the socket was curettaged with a

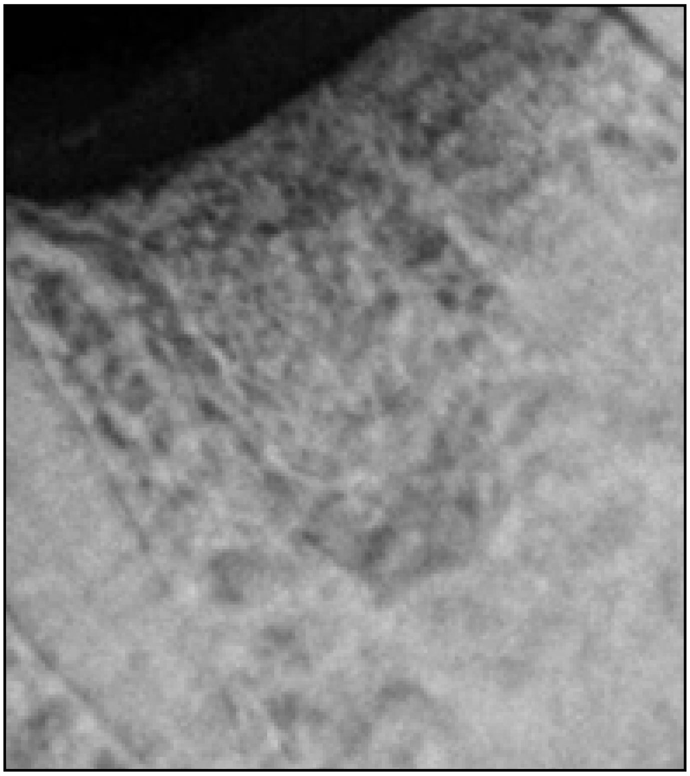

Figure 6: IOPA immediate post-op.

Figure 7: Well vascularised graft after 5 months.

Figure 8: IOPA at 5 months.

Figure 9: Bone sample taken with a Trephine for Histopathology.

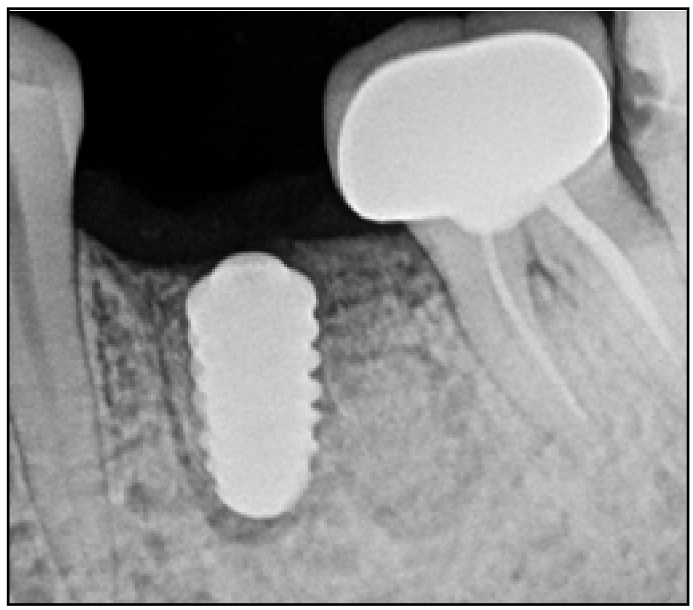

Figure 10: Four months post op implant IOPA.

Buck file (Hu Friedy, USA). Once the site was clean of infection, socket seal surgery was performed with small bone DBBM (Smartbone, Switzerland) (Figure 4). After complete fill of the socket was achieved, the grafted socket was closed with a resorbable Collagen Plug (RCP, Ace Surgicals, USA) and 3-0 cytoplast sutures (Ostegenics, USA) (Figures 5 and 6).

After 5 months of SSS, the site was re-entered to observe healing clinically and histologically. Clinically the graft was seen well vascularised and IOPA revealed a well inte-

Figure 11: Final prosthesis.

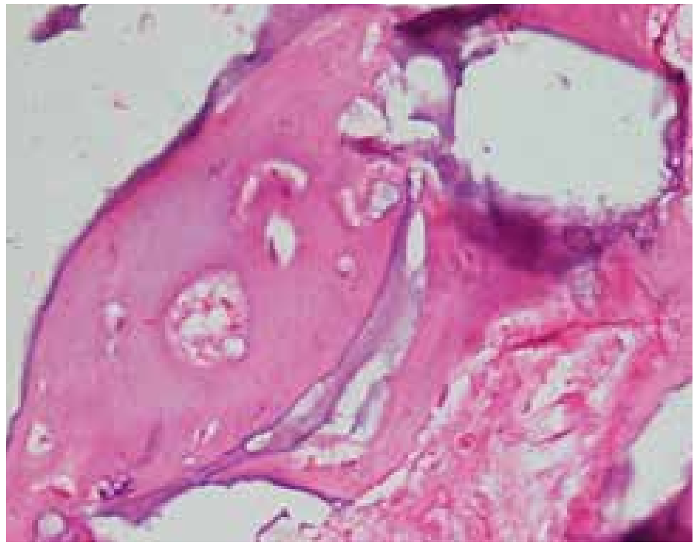

Figure 12: Histopathology of the site after 5 months.

grated graft with surrounding host bone (Figures 7 and 8). Bone sample for histopathology was taken with the help of a trephine of inner diameter 2.8 mm outer diameter 3mm (Koine, Italy) (Figure 9). The core was harvested from the centre of the site where the implant placement and future restoration was planned. At the same time after taking the bone sample, an implant 5/11.5 Top Dm (Bioner, Barcelona) was inserted at 50 Ncm (Figure 10). 4 month post-op implant placement healing has been uneventful (Figure 11).

RESULTS

The biopsied cores were studied histopathologically after decalcifying in mild decalcifying agent and processing it using routine procedures. 4 micron thick sections were taken and stained with Hematoxylin and eosin stain and observed under the research microscope for histopathological examination. The histopathological examination revealed areas of graft material progressively resulting in formation of new vital bone (Figure 12). There is coexistence of the graft material and newly formed bone. Growth lines were also seen indicating good osteoconduction. Osteoblasts are seen to be lining the bone along with presence of osteocytes within the bony lacunae indicating viable bone. The bone is seen to be in various stages of osteogenesis and presence mature surrounding connective tissue with good vascularity indicates good osteoconduction.

DISCUSSION

Socket preservation is a favorable treatment modality which enables the socket to heal without loss of bone and change in the ridge dimension. This helps in preserving the ridge, bony contours and soft tissues for implant placement.[1] Autogenous bone graft material is the material of choice when it come to bone grafting and still, in spite of various bone grafts, remains the gold standard. However, there are complications and disadvantages, out of which giving patient a second surgical site becomes cumbersome. Also for small purposes such as socket seal surgery, giving patient a second surgical site is not the right choice of treatment. Thus, authors used Smartbone® which is a xenograft and is based on technology which uses regenerative medicine to replace the damaged bone and then heal it. Combination of a bovine bone matrix (basically cancellous bones), a biodegradable polymer and specific cell nutrients. Cell nutrients being used are immobilized biomolecules possessing the RGD-sequence (Arg-Gly-Asp), which promotes cell adhesion and hence formation of a new bone. To further prove these aforementioned results, surgical re entry was done. Out of all the methods available to evaluate regeneration, surgical re-entry into previously surgically treated site is the gold standard.[6] It provides the clinician with the advantage of directly viewing the healing. At the same time bone sample for histological examination was also obtained which is the most reliable method to evaluate the progress of regeneration[7]. These methods though remain gold standard have disadvantages also such as, time consuming, causes patient discomfort and have ethical issue. But for implant placement the site had to be reopened and implant bed had to be prepared, thus the bone core taken was from the portion where implant had to be placed. Histological examination showed growth lines indicating good osteoconduction. Osteoblasts were seen to be lining the bone along with presence of osteocytes within the bony lacunae indicating viable bone. The bone was observed to be in various stages of osteogenesis and presence mature surrounding connective tissue with good vascularity indicates good osteoconduction.

CONCLUSION

This case report demonstrates proof of principle that the Smartbone® bone graft is a viable choice for bone grafting purposes. Histologically, this graft appears to heal in a manner that facilitates the placement of dental implants.

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

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Crestal Bone Loss: A Comparative Study Among Men And Women In One Stage Dental Implants

Dr. Doraiswamy Roopavathy[1] • Dr Bhaskaran Sathyapriya[2]
Dr. Purushothaman Lakshmanan[3]

Abstract

Background: Dental implantology is the state of the art technique to replace missing teeth. Crestal bone loss along implant surface jeopardizes its longevity and success of treatment. The present study was performed to evaluate and compare the crestal bone loss along the implant surface between men and women six months after the implant placement.

Methods: Fourteen one stage implants were placed in 14 patients. Digital IOPA using RVG was taken on the day of implant placement. The crestal bone loss on the mesial and distal sides of the implants was evaluated six months after placement.

Results: Six months after the implant placement, radiographic evaluation on digital IOPA showed a mean crestal bone loss of 0.66 mm on the mesial side of implant and 0.46 mm on distal side of implant. Gender had significant difference in bone loss. Men (0.78 mm) exhibiting more bone loss than women (0.34 mm). Conclusion: Even before functionally loading the one-stage implant, crestal bone loss of 0.66 to 0.46mm occurred around the implant and men exhibited more crestal bone loss than women. The smooth polished collar design of the implant, open flap surgical intervention and implant osteotomy procedure by itself could have contributed to crestal bone loss. More over men elicited clinically significant more plaque accumulation compared to women, thus exhibiting significant crestal bone resorption.

KEY WORDS: Dental implants, crestal bone loss, radiographs

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3. Consultant Orthodontist, Apollo Hospitals Chennai

INTRODUCTION

In the past two decades, there has been a paradigm shift in the philosophy of saving teeth at all costs to extracting compromised teeth and replacing them with dental implants for a better and more predictable long term outcome. A dental implant is an alloplastic material implanted into oral tissues beneath the mucosal and periosteal tissues, and on/or within the bone to provide retention and support for fixed or removal prosthesis. During the last decade, a great deal of information has been generated concerning the effectiveness and predictability of endosseous implants. Implant therapy has become a viable option in the rehabilitation of partial and complete edentulism.

In the late 1950's Per-Ingvar Branemark, a Swedish professor in anatomy developed through a serendipitous finding a historical breakthrough in medicine: he predictably achieved an intimate bone-to-implant apposition that offered sufficient strength to cope with load transfer, the phenomenon called "Osseointegration". It is defined as a direct structural connection at the light microscopic level between bone and the surface of a load carrying implant. [Branemark PI, 1995]

The design of an implant has a great influence on initial stability and subsequent function. The main design parameters being: implant length, diameter, shape and surface characteristics.

A typical implant consists of a titanium screw, with a roughened surface. Various implant surface treatment has been commercially applied with good success. Acid etching, large grit sandblasting, additive procedures like plasma spraying, hydroxyl apatite coating, fluoridated surfaces were done as surface treatments to increase the integration potential of the implant. The surface of an implant determines its ultimate ability to integrate into the surrounding tissue. The composite effect of surface energy, composition, roughness, and topography plays a major role during the initial phases of the biological response to the implant.

Over the years, clinical guidelines were established for the predictable achievement of Osseo integration in patients: the implant (i) should be inserted with a low trauma surgical technique, avoiding overheating of the bone during preparation of a precise implant recipient site; (ii) should be placed with minimal primary stability; and (iii) should not be functionally loaded during the healing period. Provided that these guidelines are followed, successful osseointegration is observed predictably for submerged implants requiring a two-stage procedure as well as for non- submerged implants characterized by a one-stage surgical procedure.

The stability of implant at the time of placement is very important and is dependent upon bone quality and quantity as well as implant design. A direct correlation exists between implant stability and crestal bone loss. Greater the crestal bone loss, lesser the implant stability. Differences in bone mass between males and females would explain the lower number of implant failures in males and more failures are likely to be found in females. [Mesa, Francisco et al; 2008]

Crestal bone loss along implant surface jeopardizes its longevity and success of treatment. Crestal bone loss has been attributed to implant design, local bacterial colonization, biological width and mechanical stresses acting on the crestal bone around the implant. Various implant crest modules or neck collar designs are being studied and proposed to reduce crestal bone loss. Many of the implant systems have a polished collar design to aid in reducing plaque accumulation

Figure 1: Edentulous implant site.

Figure 2: Crestal incision.

Figure 3: Full thickness flap reflected.

Figure 4: Dental implant osteotomy.

and to promote biologic seal around the implant collar. Such collar design may itself be contributory to crestal bone loss. Early implant exposure is a harmful factor resulting in early crestal bone loss around implants. Prosthetic loading of implant may aggravate the crestal bone loss, subsequently. Scanty information is available in the literature regarding the comparative crestal bone level changes between men and women with one stage implants before functionally loading.

MATERIALS AND METHODS

An in vivo study was undertaken to evaluate the crestal bone loss between men and women, by using RVG (radiograph) at the end of six months after placing one stage implants, but before functionally loading.

Study Population

The study groups have been selected from among the patients attending the Periodontology and Oral

Figure 5: Implant placement using ratchet key.

Figure 6: Implant placed at the level of alveolar crest.

Figure 7: Healing abutment placed.

Figure 8: Suturing of surgical site.

Implantology clinic for management of their periodontal conditions including edentulous space.

Inclusion and Exclusion Criteria

All patients willing to comply with the study-related procedures, including good oral hygiene and written informed consent were eligible for study. Patients who had significant untreated periodontal disease, caries or infection, who smoked or chewed tobacco, or who were systemically compromised, who used tooth picks, patients with bruxism, pregnant women, and women who attained menopause were excluded.

Subject and Site Selection

Fourteen patients (7 men and 7 women of 20-45 years of age group) presenting with single unilateral edentulous posterior mandibles with adjacent teeth present were candidates for this study. The teeth being replaced had been missing for at least 1 year or more. The implants used were Swiss plus Zimmer implant system (California, USA) which are one-stage, root-form, MTX Titanium implant. MTX is a non-coated, micro textured surface created by grit-blasting the machined titanium implant surface with hydroxyl apatite (HA) particles, followed by washing in non-etching acid and distilled water baths to remove residual blasting material. Furthermore, implant threads are not rounded by the MTX process, and cutting grooves remain intact for efficient self-tapping. Diameters of implants used were 4.2 and 4.8 mm. The implant lengths were 10, 12 and 14 mm. The implant size was selected by using the manufacturer's X-ray indicator stencil on OPG and study casts. Bone mapping was done under local anaesthesia to determine bone width.

Periodontal Status Evaluation

Clinical parameters assessed for the study were:

- Simplified oral hygiene index
- Plaque index
- CPITN
- Probing pocket depth
- Clinical attachment loss

Clinical Procedure

Under 2% xylocaine with 1:80,000 adrenaline local anesthesia, crestal incision was given for full thickness flap reflection using No. 15 Bard Parker blade fixed to No.3 BP handle to expose the implant site (Figures 1-3). After marking the implant site by surgical stent, pilot drill was used, followed by twist drill, 2-caliber and final drill up to the decided depth (Figure 4). The implants were inserted first by using finger key, followed by implant ratchet key (Figures 5, 6).

Insertion Torque Measurements

During the implant insertion, the maximum insertion torque value was recorded by means of the torque wrench.. Starting from 20 Ncm, the placement torque was increased in steps of 5 Ncm, when the rotation stopped because of friction before the implant was fully inserted. The torque wrench was developed to provide a well-controlled insertion torque to avoid mechanical overload of the equipment or bone tissue. The final maximum insertion torque value of each implant was recorded in 25, 35, 40 and 45 Ncm. The implants were placed at the level of alveolar crest. Healing abutment was placed to close the implant and the implant was left exposed (Figure 7). The flap was closed with tight sutures to achieve primary closure around the implant (Figure 8).

Medical Management

- Anti - inflammatory, analgesics and antibiotics were prescribed.
- Supportive therapy has been adopted with vitamin supplements and protein rich food substitutes
- Oral hygiene instructions were given
- Patient advised not to use tooth brush in the area of surgery on the following two days after surgery.
- Patient has been advised to use mouth rinse with 0.12% chlorhexidine 8 hourly for 5 days.

A Digital IOPA and Bitewing were taken using RVG and an OPG was taken on the day of implant placement, one hour after the surgery (Figure 9). The patients were advised to report on the following day for assessing any post-operative bleeding, swelling and discomfort. Patients were placed on periodic review and follow up RVG were taken at 6 months (Figure 10).

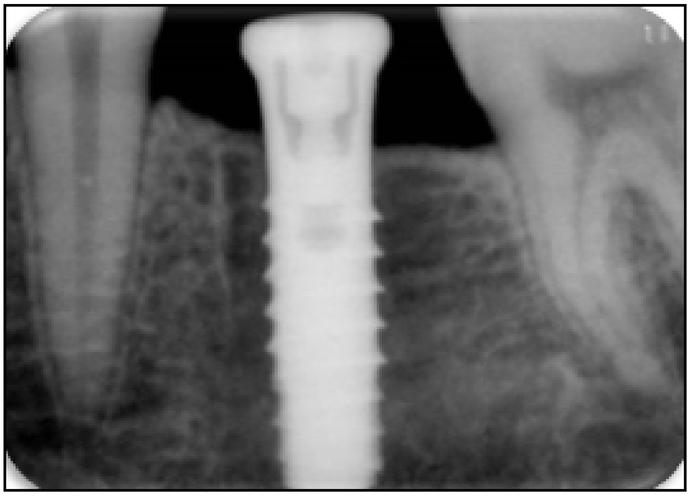


Figure 9: Baseline radiograph.

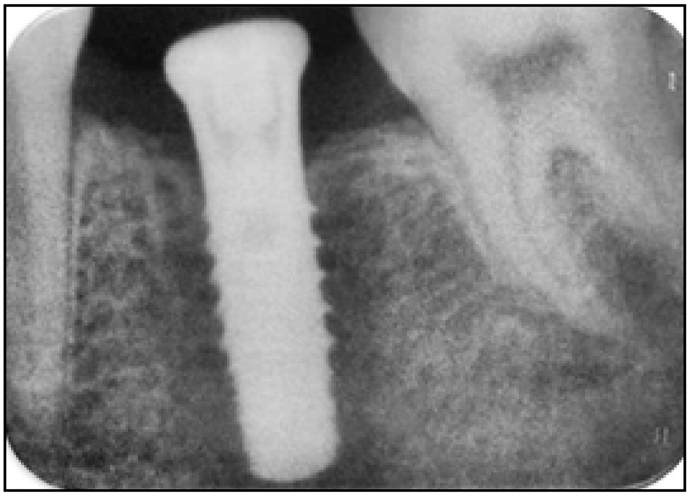


Figure 10: RVG at 6 months.

Radiographic Evaluation

Crestal bone loss was measured on digital IOPA taken on the same machine, which was used for digital IOPA at the time of implant placement using paralleling cone technique standardised by the EVA film holders. The distance between the top of the implant and the level of crestal bone (first bone to implant contact) along the implant surface on mesial and distal side was measured on the RVG machine monitor, using its software. The measured value was autocorrected by the in-built software for radiographic magnification factor. Values obtained were up to one unit after decimal. To find whether there is significant difference between the genders for mean bone level changes around the implants (Tables 1-3, Graph 1).

Inference

Thus there is statistically significant difference between the bone level changes between genders around the implants and men exhibit more bone loss than women.

DISCUSSION

Dental implant has been accepted as one of the major treatment concepts for restoring completely and partially edentulous patients over the last three decades. Despite the high success rates reported in literatures, time dependent marginal bone resorption around implants is still unavoidable and a major concern for Implantologists.

The level of bone crest surrounding the implant is of utmost significance to determine osseointegrated implant success, as preservation of marginal bone height is highly important for long-term dental implant survival. Successful osseointegration is observed predictably for submerged implants requiring a two-stage procedure as well as for non-submerged implants characterized by a one-stage surgical procedure. Discussing the various factors that affect bone resorption can give a clear vision of the known hidden reasons for crestal bone level changes occurring after implant placement. The implants used in this study [Swiss plus Zimmer implant system] were one-stage, root-

Table 1: Crestal Bone Level Changes in Men (mm)		
Men patients	**Mesial side**	**Distal side**
1	1	0.7
2	2.4	1.8
3	1.04	0.05
4	0.54	0.29
5	0.92	0.51
6	0.85	0.71
7	0.8	0.04
Mean	**0.98**	**0.59**

form and threaded implants. Implants were made of pure Titanium with Micro Textured Surface (MTX). Implants had a surface roughness of 1-2 microns. Non submerged/one stage implants have the following advantages over the submerged implants (Buser, 1999):

One-stage surgical procedure

- Less chair time, less pain, shorter healing period, reduction of related treatment cost
- No microgap at the alveolar bone crest level
- Less crestal bone resorption
- Implant shoulder at the soft-tissue level
- Implant easily accessible for prosthetic procedures

The Swiss plus implants used in this study had 2.5mm of smooth polished collar design. The junction of smooth collar and rough grit blasted threaded portion lies about 1 mm below the crest of bone at the time of implant placement, as the implants were placed at the level of crest. The crest module design can transmit different types of forces onto the bone, which depends upon its surface texture and shape. A polished collar and a straight crest module design transmit shear force, whereas a rough surface with an angled collar transmits beneficial compressive force to the bone. The crestal bone loss in the present study prior to the loading of the prosthetic component correlates with the studies done by Hanngi et al. and Herman et al. who showed that peri-implant crestal bone reaction is dependent on rough-smooth implant border. This may explain the average crestal bone loss of 0.66 mm on the mesial side of the implant and 0.46 mm on the distal side observed in this study.

Surgical Trauma due to heat generated during drilling, elevation of the periosteal flap and excessive pressure at the crestal region during implant placement may contribute to bone loss during the healing period.

Table 2: Crestal Bone Level Changes in Women (mm)		
Women patients	**Mesial side**	**Distal side**
1	0.58	0.37
2	0.1	0.1
3	0.98	0.81
4	0.07	0.42
5	0.04	0.16
6	0.34	0.21
7	0.3	0.3
Mean	**0.34**	**0.33**

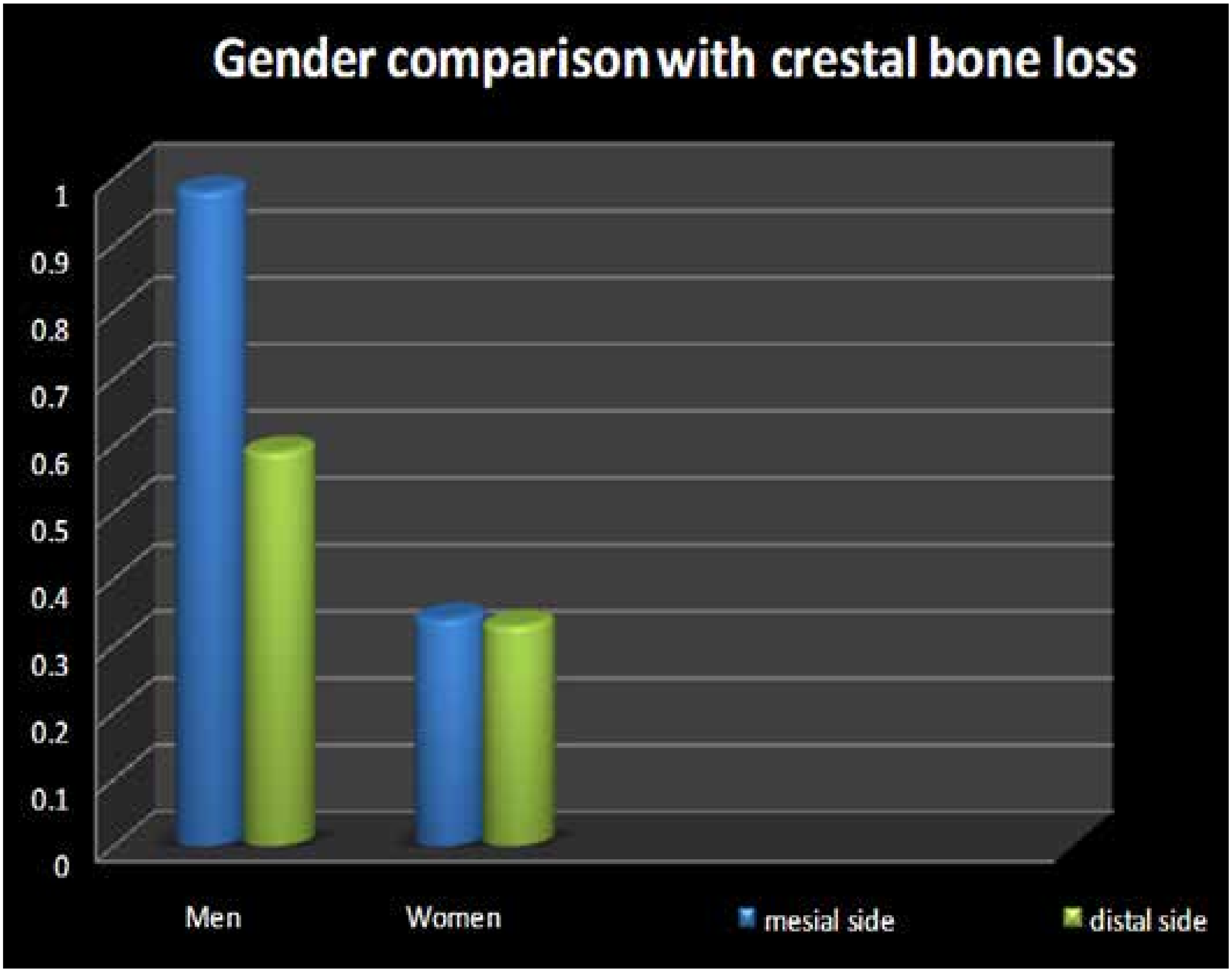
Table 3: Gender Comparison Between the Bone Level Changes Along the Mesial and Distal Side of the Implants (mm)		
Gender	**Mesial**	**Distal**
Male	0.98	0.59
Female	0.34	0.33

Implants were placed using flap elevation procedure in this study which correlates with the study of Wildermann et al. 2008 who reported that bone loss occurred due to flap elevation was restricted to the area just adjacent to the implant. Thus, surgical trauma is likely to cause early crestal bone loss.

Grit-blasted, acid-etched (SLA) surfaced implants used in the present study exhibited crestal bone loss which correlates with the study of Hanngi et al. 2005 who reported SLA surfaced implants tend to have slightly less bone loss compared to titanium plasma spray (TPS) surfaced implants.

In the present study implants were not functionally loaded during the six months of the study period. The results of this study correlates with the study of Hanngi et al. who showed that crestal bone remodeling was not dependent on implant loading, as it is a physiological change which starts as soon as the implant is placed in the bone.

All the subjects in the present study exhibited a significant plaque score at the end of six



Graph 1: Gender comparison between the bone level changes along the mesial and distal side of the implants (mm). Mean crestal bone loss in men (0.78mm). Mean crestal bone loss in women (0.34mm). P value =0.003<0.05.

months after implant placement which could contribute to crestal bone loss which correlates with the report given by Moon et al. 2008 who described Plaque accumulation during osseointegration period has a role in crestal bone loss.

This study was undertaken to observe the amount of crestal bone loss between men and women, occurring at the end of six months after placing the implants and before loading it functionally.

This study included fourteen patients out of which 7 were men and 7 were women. There was significant difference in bone loss occurring in men and women. Bone loss was found to be predominantly more in men (0.78 mm) than in women (0.34 mm), which is similar to another study Kim et al. 2008 in which gender revealed a statistically significant association with mean crestal bone loss at all years in the study, with women subjects losing less bone than male subjects.

The causes of crestal bone loss around implants are not fully understood. Since the present study had a relatively small sample size, the implants studied had a smooth collar design of 2.5mm, the implants were placed with an open flap surgical intervention, men exhibited significantly more amount of plaque accumulation than women, thus all these factors may have influenced the results. So, future longitudinal studies with larger sample size are needed to confirm the results of the present study.

CONCLUSION

The present study envisaged to evaluate the amount of crestal bone loss between men and women occurring after six months of implant placement and before loading it functionally. Fourteen patients participated in the study out of which 7 were men and 7 were women. The age of the participants ranged between 20-40 years of both sexes. Periodontal parameters comprising of OHI-S, plaque index, Probing pocket depth, and radiographic evaluation of implant at the time of placement and 6 months after implant placement were assessed for all subjects. Crestal bone loss was found to be more in men comparative to women and plaque accumulation was found to be slightly more in men compared to women with no statistical significant difference.

In conclusion, given the more prevalence of crestal bone loss in men after implant placement, in order to limit the bone resorption, these data would caution the clinicians to take interim care at patient selection, handling the patients during surgical intervention and in the maintenance phase.

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

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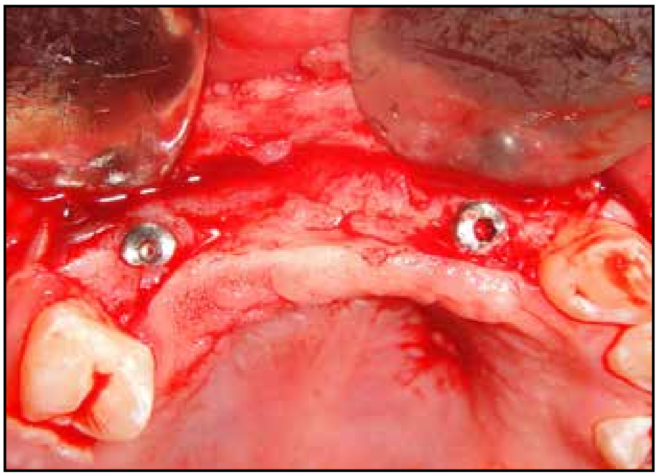
Maxillary Split-Crest Technique with Immediate Implant Placement in a 13-year old Patient with Two Years Follow up: A Case Report

Amr Zahran, BDS, MDS, PhD[1] • Basma Mostafa, BDS, MDS, PhD[2]

Abstract



This case report presented a divergent approach in which a modified split-crest technique using the piezoelectric tip, one drill and tapered implants was applied. The split-crest surgery was performed with immediate placement of two tapered self-tapping dental implants in the anterior maxilla of a young 13-year old female patient. The patient lost four of her maxillary anterior teeth as a result of an accident at the age of 9 years with subsequent severe alveolar ridge resorption. The average bucco-palatal ridge width was less than 4 mm. The average gain of alveolar ridge width was evaluated using the cone beam volumetric tomography (CBVT) and it was 1.92 ± 0.04 mm at 6 months postoperatively. The implant stability attested using the Periotest M showed PTM values -2.3 and -2.8 for the 2 implants at 6 months postoperatively. After two years the PTM values were -2.4 and -2.8 with 100 % survival rate of the osseointegrated implants. The implants were restored by using Peek (polyetheretherketone) bridge. Satisfying function and esthetics to the patient were also achieved.

KEY WORDS: Dental implants, bone augmentation, maxillary deficiency, split-crest

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INTRODUCTION

Tooth loss as a result of trauma or congenital absence presents a major problem in young individuals. It causes functional impairment in addition to psychological disturbances.[1] Missing teeth in youth has been reported to have a negative impact on individuals' own emotional condition, social relations, and speech, smiling and overall performance.[2] Oral rehabilitation is mandatory in such cases even before reaching complete skeletal and dental maturation. Removable partial denture has been considered as the first treatment option in such conditions due to the ease of construction and relatively lower cost. Certain drawbacks such as high caries incidence, periodontal problems, and increased residual alveolar bone resorption were accompanied with such treatment modality, in addition to its removable nature which is not favorable by many patients. Another recommendation to replace the missing teeth is the resin-bonded bridge. It was reported that this type of bridge has satisfying survival rates with debonding as a major concern. These led many authors to discuss the use of implants in young patients.[3] The success and predictability of dental implants placement in adults requires optimum quality and quantity of alveolar bone. Proper treatment planning as well as correctly performed surgical techniques is essential. In addition appropriate prosthetic restoration with good oral hygiene maintenance is also needed. The same factors are also applicable to reach high success of dental implants when placed in children, adolescents, or young adults in certain cases. The distinctive and significant difference between treating pediatric and adult patients is that the outcome and success of treatment is highly influenced by the craniofacial growth and dento-

Figure 1: Pre-operative intraoral photograph showing the four missing upper anterior teeth with the maxillary ridge deficiency.

alveolar development. The implants present for several years during facial growth can be embedded, relocated, or displaced during the growth of the jaws. The growth changes occurring should be compensated by continuous design adjustment.[4,5] The most important target for using dental implants in growing patients is the preservation of bone. In case of partially missing teeth, the insertion of dental implants can change the load mechanism to which bone is subjected and hence retards its resorption. Tooth loss as a result of trauma can affect the availability of sufficient bone volume for placing dental implants in many young healthy individuals due to the subsequent alveolar bone resorption following tooth extraction.[6,7] Various procedures may be necessary to provide adequate bone for implant placement. Bone augmentation with autogenous bone or any other grafting materials can be implemented. Guided bone regeneration (GBR) procedures using barriers and bone expansion or splitting techniques have been adopted for management of such vol-

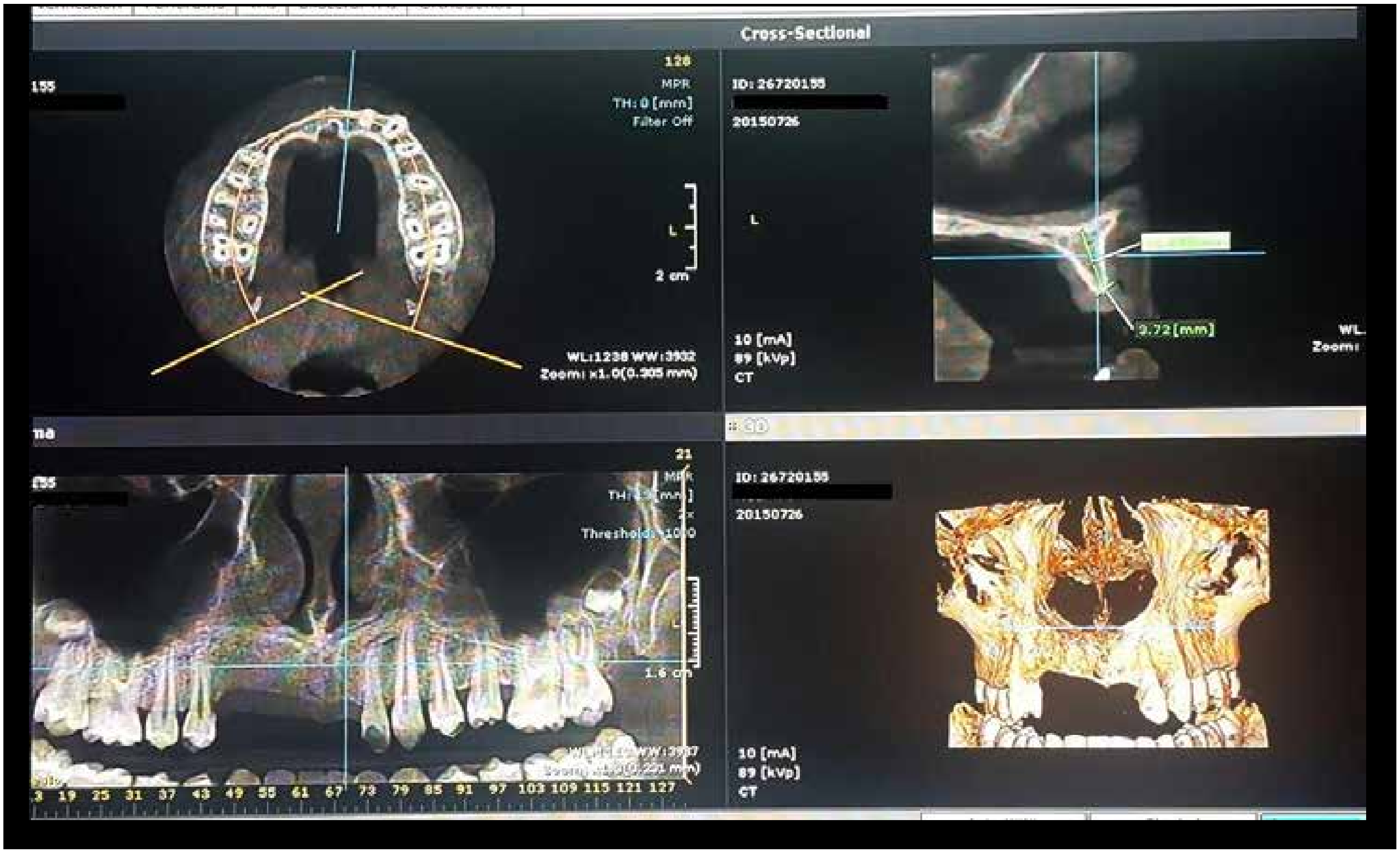

Figure 2: **Preoperative CBCT showing the deficient maxillary alveolar ridge width measurements.**

ume deficiencies. Many drawbacks was reported using GBR including invasiveness, supplementary donor site, resorption of grafting materials, membrane collapse, exposure to infection and delaying of implant installation for grafting maturation have also been associated and recorded with using of autogenous grafts and membranes.[7-11] Hence, employing some noninvasive techniques of ridge splitting and expansion can be carried out and has been discussed, without subjecting the patient to much trauma. Several ridge split techniques have been reported in the past years including split crest osteotomy, ridge expansion osteotomy, and frequent modifications of those techniques.[12] The unusualness presented in this case report is performing the split-crest technique with its modification followed by immediate implant placement in such young patients in management of the atrophic maxillary ridge. The first author has previously described a modified approach of this technique within which expansion of the alveolar ridge and immediate implant placement are combined in a single process. Few instruments were essential including a piezoelectric tip and one tapered osteotomy drill. The tapered implants were positioned into the determined osteotomy sites within the split channel. This placement was used to expand the bone during seating of the implants.[13] To our knowledge this is the first case reporting the application of these approaches at such a young age.

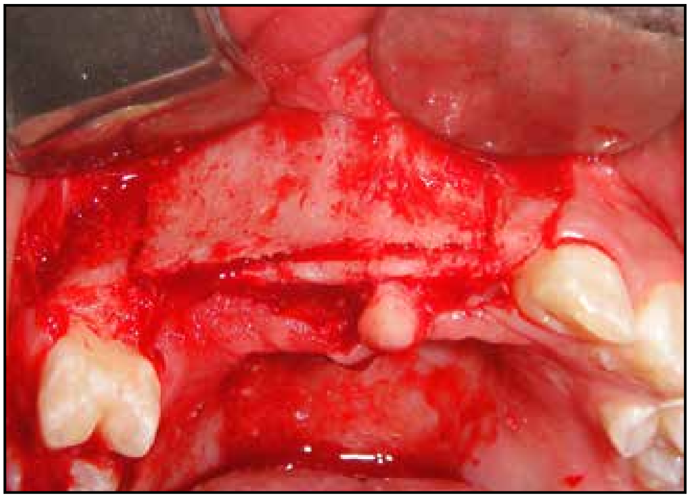

Figure 3: Bone channel created by Piezoelectric surgery.

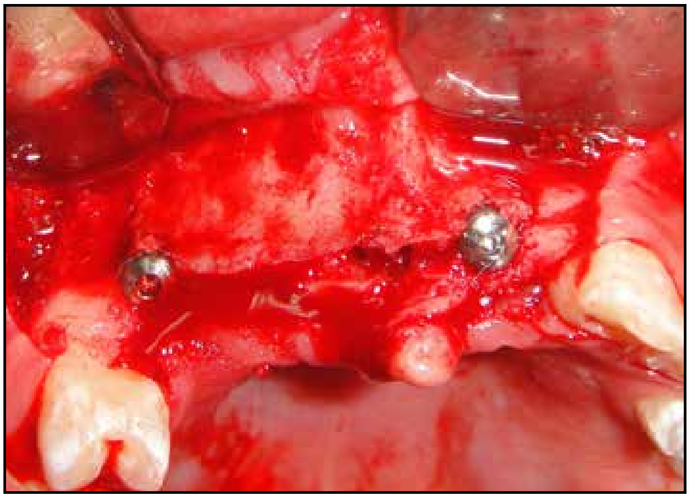

Figure 4: Immediate postoperative photograph showing placed implants with expansion of bone.

CASE REPORT

The present case report is about a 13-year-old girl who was referred to the first author's private clinic. It was noticeable from the first visit that the patient was in the same height and body form as her mother. She was healthy with ordinary normal medical history documented by the Cornell Medical Index Questionnaire.[14] It was reported that she was subjected to a bicycle accident at the age of 9 years and subsequently lost four of her upper anterior teeth as a result. She had been wearing a partial denture since the accident and she was not satisfied with having a removable prosthesis. She suffered from the inconvenient use of her partial denture and inability to correctly pronounce certain words. Her removable prosthesis required frequent removal for cleaning purposes following eating and she was often teased for this. She was afraid to participate in various sporting activities for fear of denture dislodgement. This led to a negative impact on her social life. Clinical intraoral examinations revealed the absence of the maxillary anterior teeth with presence of severely atrophic ridge (Figure 1). Radiographic examination showed severe loss of the bone width at the edentulous area (Figure 2). Wrist carpal radiographs and multiple cephalometric radiographs were taken and performed with superimposed orthodontic tracings to assess the degree of skeletal maturity of the jaw bones. No changes occurred over a period of 6 months, leading to the assumption that bone growth was nearly complete. The study protocol was reviewed and approved by the Ethical Committee at the Faculty of Oral and Dental Medicine, Cairo University. Clinically the edentulous site demonstrated insufficient bucco-palatal ridge width (less than 4 mm) with more than 10 mm of residual bone height and sufficient vertical inter-maxillary arch space, upon centric occlusion. No local or systemic conditions that may contraindicate minor oral surgeries were detected. Oral habits that might endanger the osseointegration process, such as smoking or parafunctional habits were not recorded. The patient and her mother were fully informed about

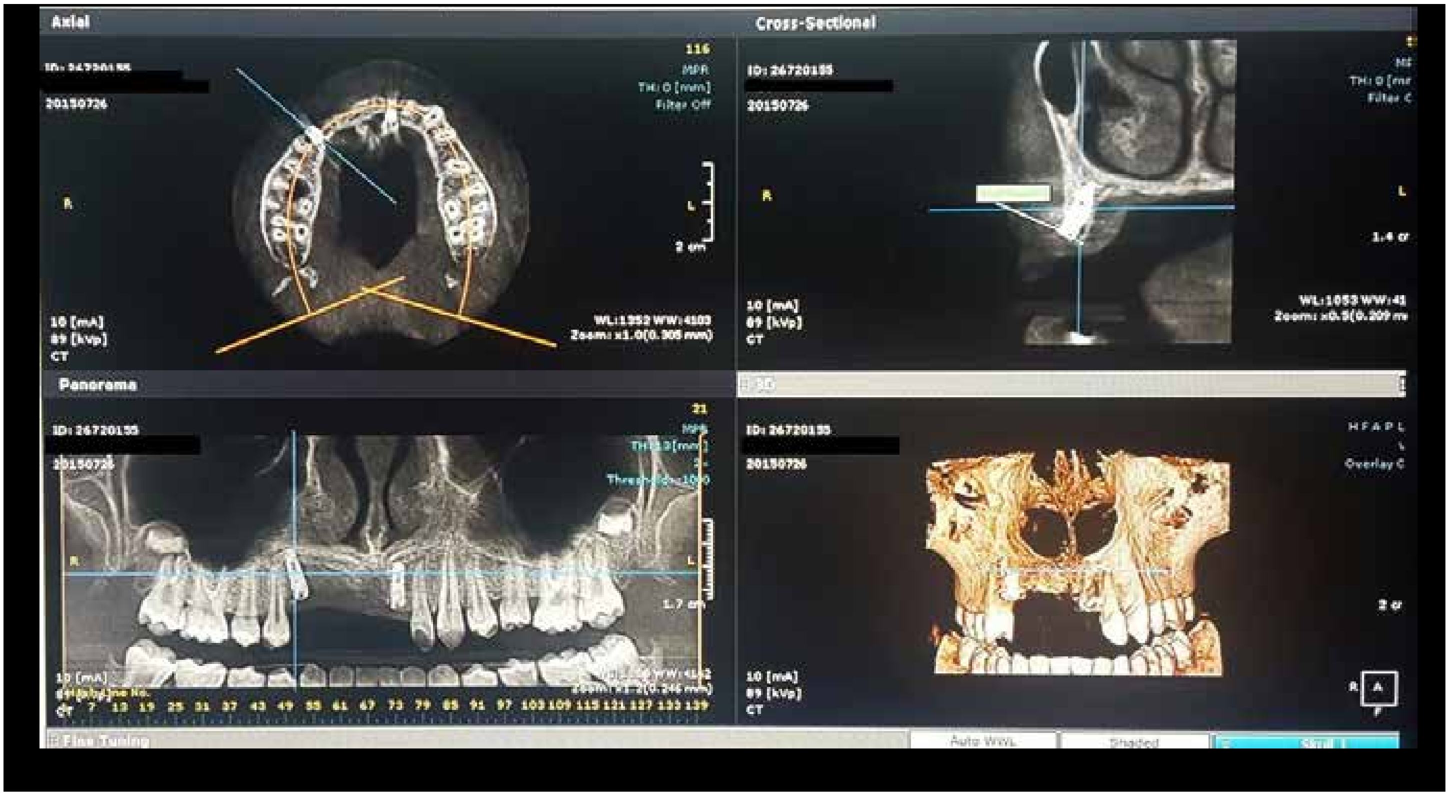

Figure 5: Six months postoperative CBCT showing the increase in ridge width measurements and the implant in place.

the associated risks of the procedures. The mother as the responsible guardian signed an informed consent form to document her approval.

METHODS

Pre-surgical evaluation was performed including visual examination and palpation of the entire oral and para-oral tissues. Study casts were prepared to evaluate the inter-maxillary space and type of occlusion. The bucco-palatal alveolar ridge width at the implant site was measured using a bone caliper. Periapical and panoramic radiographs for the recipient sites were taken. CBVT was performed on the assigned sites for the study in order to determine the bucco-palatal alveolar ridge width at the implant sites preoperatively.

SURGICAL PROCEDURES

The patient was anesthetized locally by infiltration anesthesia. A palatal sub-crestal incision was created for the surgical site. Two oblique releasing incisions were then made on the buccal aspect. Dissection of the full thickness mucoperiosteal flap was performed to provide complete exposure of the alveolar bone. Using piezoelectric surgery unit (tip model: SG1, NSK Variosurg ultrasonic surgical system, Japan) a horizontal crestal cut was created along the crest of the bone (Figure 3). The cut depth extended through the cortical bone to reach the spongy bone. The depth of the horizontal cut was approximately the same length of the implant to be inserted. Two vertical cuts were then created and these were connected to the horizontal crestal cut. After ridge

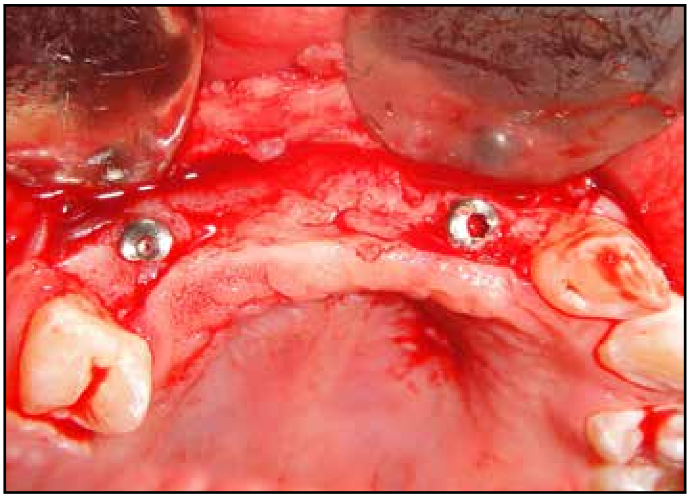

Figure 6: Re-entry after 6 months showing complete bone fill.

Figure 7: Six months postoperative photograph showing the fixed healing collars to the implants with the use of the Periotest M to confirm the osseointegration.

Figure 8: Photograph showing the cemented Peek bridge.

splitting, the osteotomy site was prepared using the new OsteoCare™ 3.25 mm Ultra drill and two OsteoCare™ Maxi Z Flat-end 3.75 x10 mm dental implants were placed (OsteoCare™ Implant System, London, United Kingdom) (Figure 4) and their positions were confirmed by immediate postoperative periapical radiographs. Careful seating of these tapered implants into the bone was performed until all exposed threads were submerged and the platform remained flush with the crestal bone then cover screws were inserted into the implants. This positioning of the implants created expansion through deformation between the split bony plates. Closure of the flap was performed using interrupted sutures with a 4-0 black silk suture material (Assut sutures®. Switzerland).

Post-surgery Patient Management

1. Augmentin® (Medical Union Pharmaceuticals Co. Egypt) 1g tablets were prescribed twice daily for 5 days.
2. Analgesics were prescribed as following: Brufen® (Khaira Pharmaceuticals and Chemical Industries Company, Cairo, Egypt) 200 mg t.d.s for 5 day.
3. Oral hygiene recommendations were provided including the use of a soft toothbrush.

Second Stage Surgery

After a healing period of 6 months postoperative periapical radiographs as well as CBVT

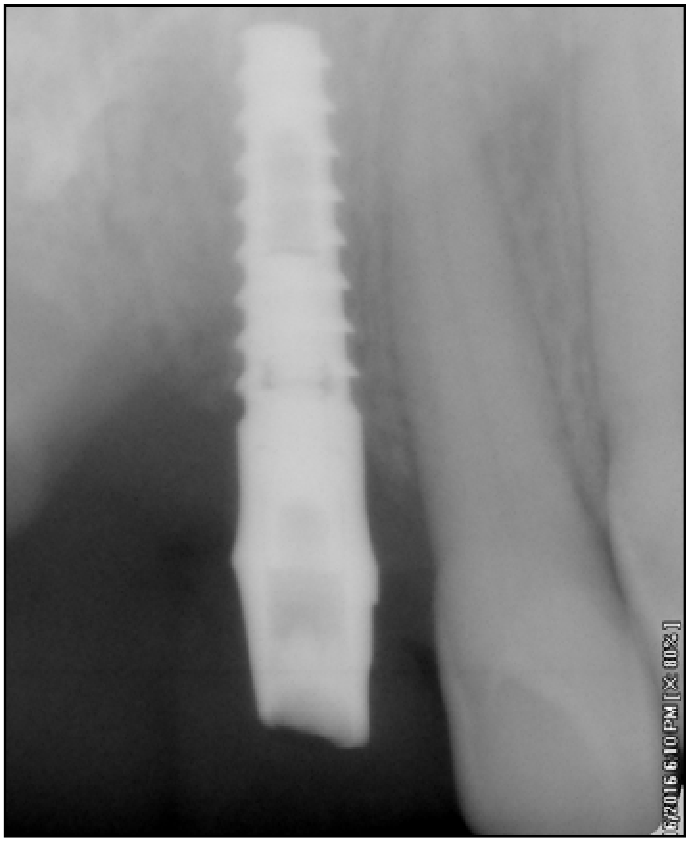

Figure 9a: 6 months postoperative periapical radiograph showing the implants in place.

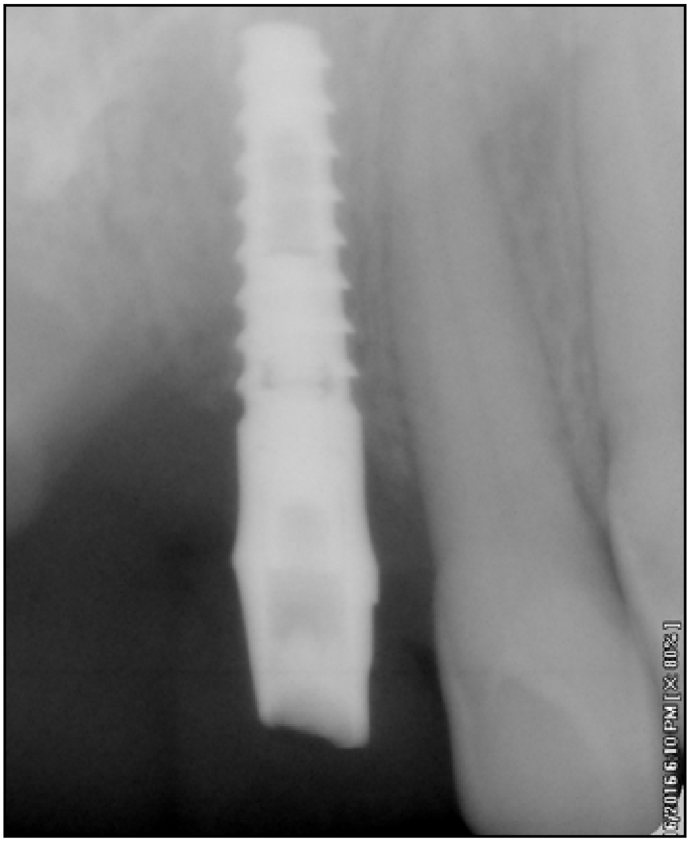

Figure 9b: Two years' postoperative periapical radiograph showing the implants in place.

were done (Figure 5) and the clinical and radiographic increase of the alveolar ridge width was recorded. Surgical re-entry after 6 months was undertaken in order to assess the success of the modified split-crest technique and to position the healing collars on the newly exposed implants (Figure 6). Periotest M (Periotest® M, Medizintechnik Gulden, Bensheim, Germany) was used to test implant stability at 6 months (Figure 7) before cementing the bridge and again after 2 years post-operatively.

Prosthetic Procedures

Two weeks after fixation of the healing collars, indirect impressions were taken using OsteoCareTM impression transfers for the open tray transfer technique. Impressions were given to the dental laboratory for construction of milled Peek bridge 15. After fixation of the abutments, the final bridge was cemented using zinc polycarboxylate cement (Figure 8).

Clinical Follow-up Evaluation and Success Criteria

The patient underwent immediate 'post surgery', 6 month, and 2 year post-operative examination and evaluation. The examination and evaluation criteria included review for: absence of peri-implant infection, no complaint of local pain at the site of implant insertion and no complaint of neuropathies

Figure 10: Two years' postoperative photograph showing no discrepancy of occlusion.

or paraesthesia. In addition the patient was evaluated for absence of clinically detectable mobility.

Radiographic Follow-up Evaluation

Standardized periapical radiographs (Figures 9a, 9b) using the parallel technique in addition to panoramic radiographs and CBVT were undertaken preoperatively, immediately postoperatively (within the first 24 hours), 6 months and after 2 years. CBVT scans were used to evaluate the total gain in alveolar ridge width, in the bucco-palatal dimension. They were also used to assess the stability of the marginal bone around the implant after the procedure and to record the post-operative ridge width. The raw data obtained from the CBVT scan was imported into bespoke third party software for secondary reconstruction and further clinical interpretation. The results recorded from each of the data sets were compared. The preoperative image was fused to the postoperative image by manual registration through landmarks in the cranium. Accurate registration (superimposition) was automatically performed by the software. Each image (primary and secondary) was color coded for identification. Firstly, key point measurements were recorded onto the primary image. The measurements on the primary image were held and the primary image was removed to leave the secondary image. New measurements were then recorded on the secondary image in the identical plane, direction and cut as that of the primary image to ensure standardization. The obtained data was then presented.

RESULTS

Two self-tapping titanium dental implants were placed in the 13-year old female patient during the split-crest procedure. The diameter of the 2 inserted implants was 3.75 mm with a length of 10 mm. Wound healing was normal around all the positioned implants without any signs of infection, suppuration or mucositis at the peri-implant area. Initial pain and minor swelling was noted. These conditions were completely resolved by the tenth day postoperatively. Osseointegration was clinically and radiographically checked and proven to be successful. Criteria of success were the lack of mobility as checked by Periotest M and the absence of radiographic radiolucency at the bone-implant interface. The 2 years follow up period showed the continued success of the treatment with no further bone loss as revealed radiographically. The preoperative bone width at the site of the first implant measured 3.72 mm. This changed after 6 months postoperatively to be 5.61 mm. The bone width gain was 1.89 mm. At the area where the second implant was inserted the bone width was 3.70 mm which changed after 6 months postoperatively to be 5.65 mm. The bone width gain was 1.95 mm. The average bone width preoperatively was 3.71 ± 0.014 mm which changed to 5.63 ± 0.028 mm 6 months postoperatively showing a significant ridge width bone gain of 1.92 ± 0.042 with a p-value 0.0001. The two implants were successfully osseointegrated when clinically assessed at 6 months postoperatively. The degrees of implant stability measured by Periotest M were -2.3 and -2.8 for the 2 implants after 6 months postoperatively. After 2 years the Periotest M values were -2.4 and -2.8. After the prosthesis was loaded, speech and pronunciation improved. Oral function was efficiently restored with high patient satisfaction within a limited time period. The follow-up period for two years reported no apparent vertical discrepancy between the implants and the adjacent natural teeth (Figure 10). The patient reported positive psychological consequence following the implant restoration and bridge fixation. 100% success and survival rates were recorded at the end of the two years follow up period.

DISCUSSION

The success and predictable long-term outcomes of dental implants in restoring partially edentulous cases in adults has been the base for many clinicians to broaden their application and use for younger patients who have lost their teeth as a result of agenesis and/ or trauma.[16] Implant-supported prostheses can provide the essential requirements for proper function and esthetics.[17] The use of implants in youth differs notably from adults. Special attention must be given to the growth pattern of the young, because a diversity of changes occurs in the dentition and jaws of these individuals.[18] In adult patients, the utilization of osseointegrated dental implants is frequently the treatment of choice as their performance is independent from adjacent teeth. Meanwhile implant placement in young individuals involves the risk of position relationship tribulations due to the "ankylosed" nature of the implant. The implants placed in young individuals might not follow the dento-alveolar development. This nature could lead to infra-occlusion of the ankylosed implant with possible periodontal, occlusal and esthetic consequences in the future. On the other hand, reviewing the concept that has been established by various studies that alveolar remodeling and growth does not end at puberty and that vertical discrepancy between a single dental implant and its neighboring natural teeth may possibly still occur in adulthood encouraged us to insert the dental implant in our young 13-year old patient.[18-20] It was documented that the delay of dental implant insertion in youth does not essentially exclude future complications. The placement of dental implant in young patients can provide both functional and psychological benefits. The ankylosed implant is fixed into the alveolar bone and therefore might provide the patient with more natural sensations. In addition to the security most importantly obtainable by a fixed prosthesis which has a tremendous psychological benefit for the patient[21] as occurred in this case report with our female patient who was happy and satisfied with her fixed restoration. Various contemplates were published reporting the use of dental implants in the anterior mandibular area at 5 years of age with affirmative successful treatment results.[1] Prachar and

Vaneek[22] also presented the results of using both cylindrical or screw implants in youth with age 15-19 years. With the various measures performed, the success rate was constantly higher than 96% over the 5 years study period. These studies are in line with our presented case report which showed 100% success and survival rates of the two inserted implants over the two years follow-up period. On the other hand Shaw[23] previously mentioned that the dramatic growth alterations occurring in infancy and early childhood were not conducive to the maintenance of dental implants. Other researchers suggested that treatment with implants must be postponed until the age of 13 years which is in line with our case, since an implant placed at the age of 7 or 8 may not be in a favorable location at the age of 16 years and concluded that the benefits of implant use in growing patients are as important as the concerns for their premature use.[24] The presence of maxilla with deficient bone is a challenging issue in the use of dental implants for replacing missing teeth. Following tooth extraction as a result of trauma a continuing alveolar bone resorption process is present leading to alveolar bone deficiency. In the non-existence of maxillary teeth, the alveolar ridge development will be defective and the maxilla will remain underdeveloped both in the sagittal and vertical planes causing inappropriate upper to lower jaw relationship[25] which was the condition in the present case report which presented an average deficient ridge width of 3.71 ± 0.014 mm. Many treatment modalities have been implemented for augmenting and correcting this defective alveolar bone.[9, 26] The modification of the split crest technique previously discussed by Zahran et al.[13] was applied and combined with immediate placement of tapered implants to expand the bone as alternative to the use of ridge expanders or osteotomes. The tapered implants in the present case are more controllable during the expansion procedures to ease the bone plates apart gradually minimizing the risk of fracturing the buccal plates. The two inserted dental implants were successfully osseointegrated as revealed by the Periotest M values and the supporting alveolar bone was also preserved. The unusualness of our work is that to our knowledge this is the first attempt in performing the split-crest technique at such a young age. The obtained results of the current report revealed an average bone gain of 1.92 ± 0.042 after 6 months postoperatively, without the use of any bone grafting materials or barrier membranes to block the defective space. These results were similar to many studies performed on adults which have reported satisfactory ridge bone gain without the use of grafting materials with a high success and survival rates. Chiapasco et al.[27] reported a final mean bone gain of 4 mm and Holtzclaw et al.[28] showed a mean bone gain of 4.03 mm. Meanwhile, Sohn et al.[29] reached a bone gain of 2.7 mm. Zahran et al. revealed a total mean bone gain of 2.93 mm also after 6 months[13] which are all in line with the present work done. The conquering implant placement in our 13-year old patient positively allowed us to track her growth, the prognosis, and the positions of the inserted implants in the two years follow-up period which reported no apparent vertical discrepancy between the implants and the natural teeth.

CONCLUSION

The present case report has provided a novel treatment option with 2 years follow-up in which a modified split-crest technique was applied with immediate implants successfully osseointegrated. Adequate alveolar bone width gain was achieved with proper restoration of function and esthetics. This applied treatment modality provides an encouraging therapeutic option in management of deficient maxillary ridges in young individuals. ●

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

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