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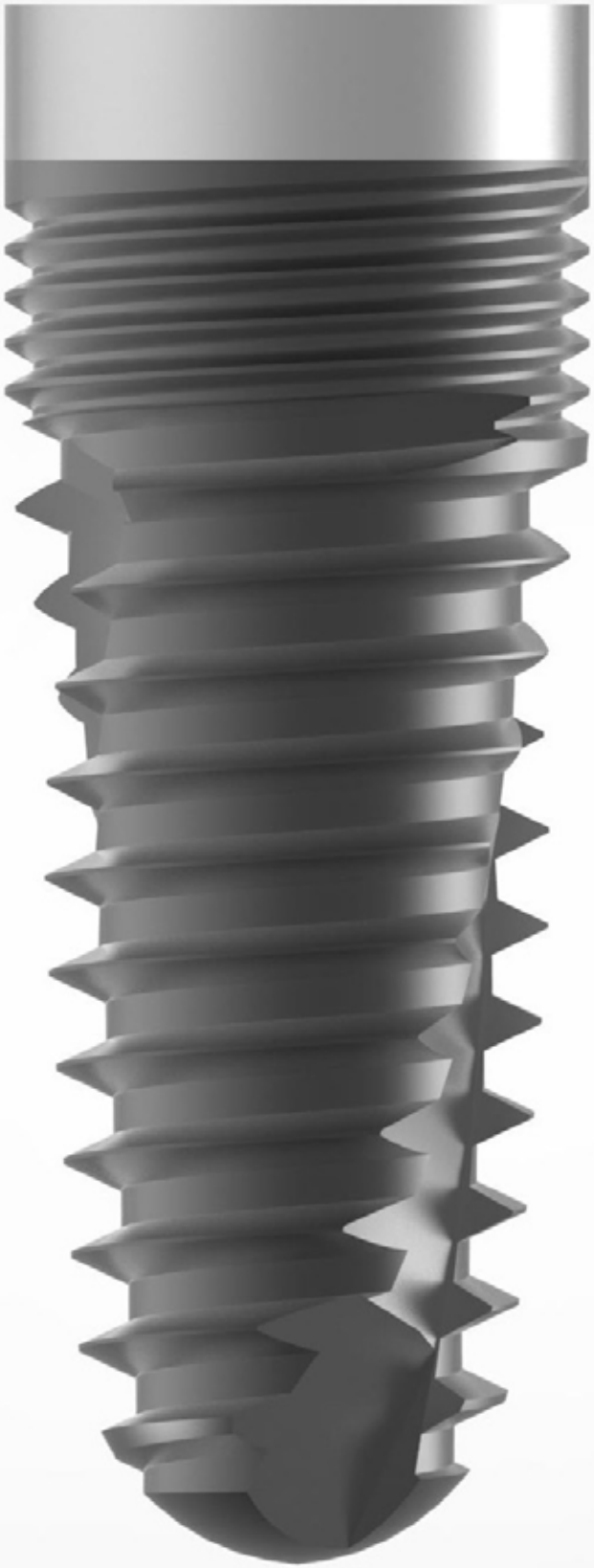
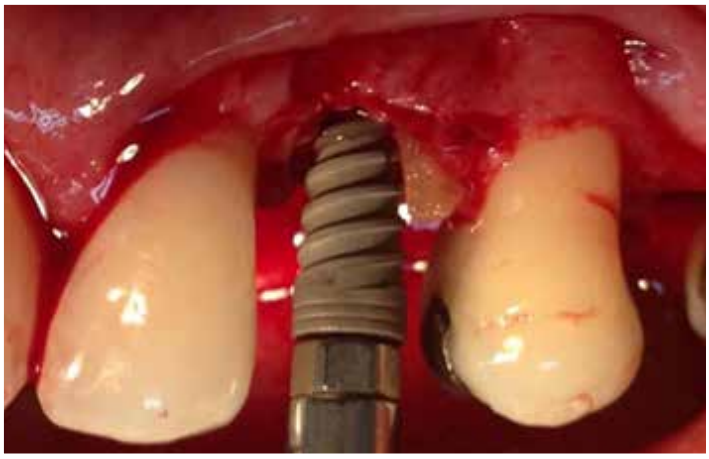


6 Year Multi-Center Study on Osseofuse Dental Implants



Impacted Canine Replacement

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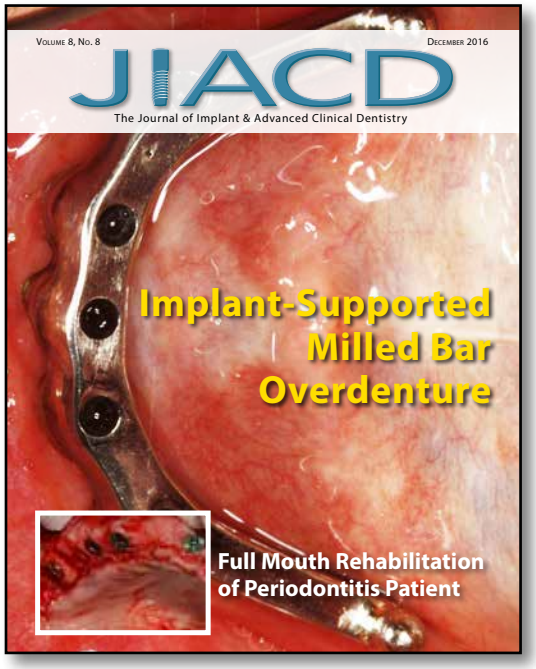

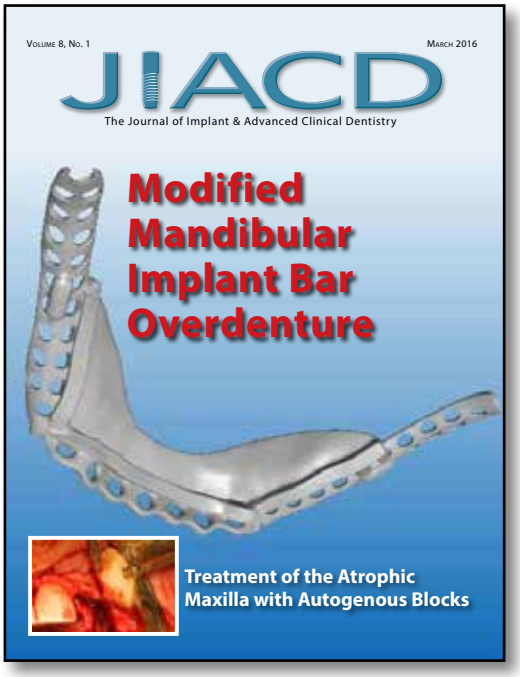

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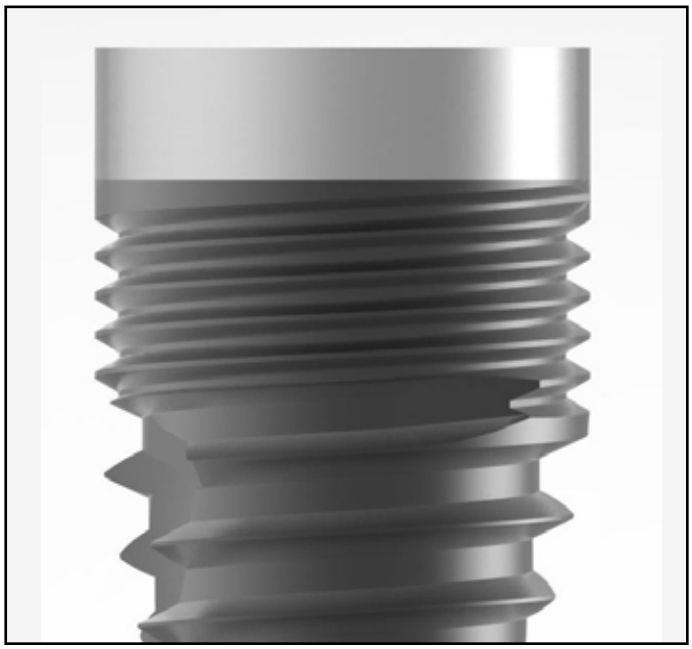

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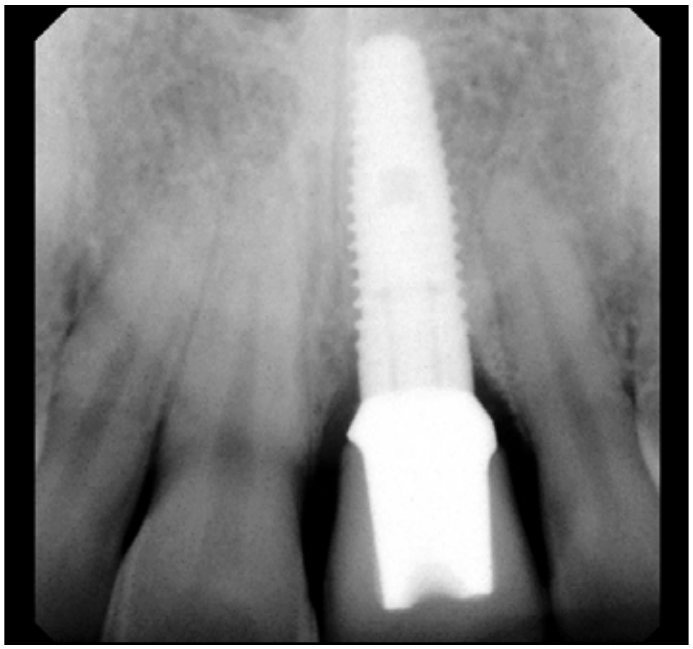

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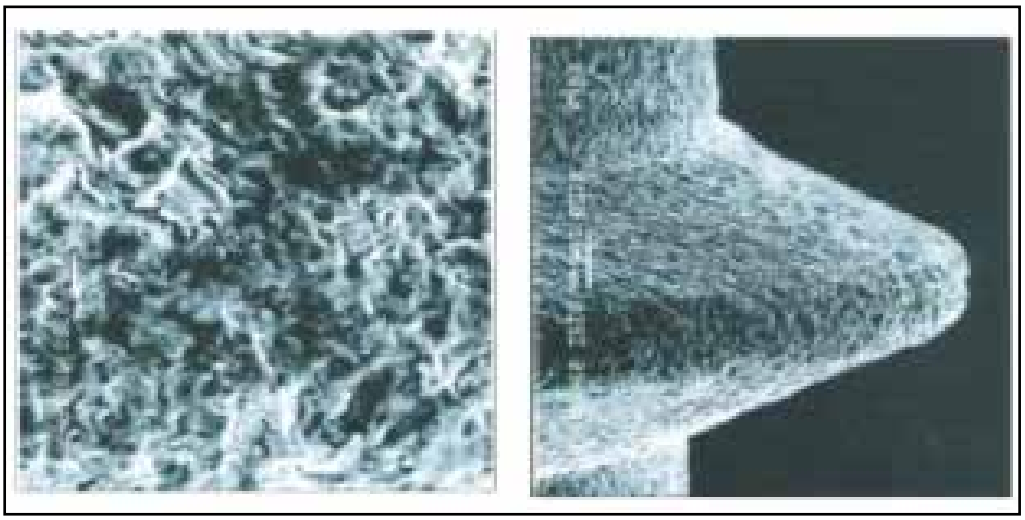
Osseofuse One Drill® System: A 6-Year Retrospective Follow-Up of Over 250 Implants

Dr. Leon Chen[1] • Dr. Jennifer Cha[1]

Abstract



Advances in technology have allowed contemporary dental implant systems to achieve success rates that routinely exceed 95% across all brands and models. With such predictable success, clinicians often base their choice for dental implants on certain unique features associated with different systems. While some clinicians focus on costs associated with dental implant systems, others seek ease of use and simplicity. The following retrospective report documents use of more than 250 Osseofuse® HexaPlus™ dental implants by multiple private practicing clinicians and provides a discussion regarding the unique attributes that compelled these clinicians to choose this system over others. Over a 6 year timeframe, a total of 95 patients were treated with 258 Osseofuse® HexaPlus™ dental implants. Seven dental implants were classified as failures during this timeframe resulting in a cumulative long term survival rate of 97.28%.

KEY WORDS: Dental implants, survival rate, maxilla, mandible, maxillary sinus

1. Private practice, Las Vegas, Nevada, USA

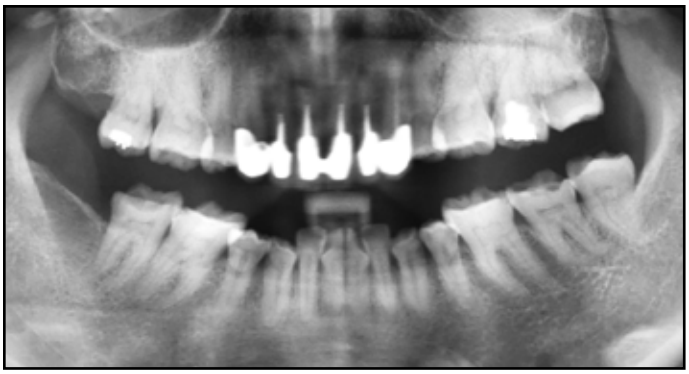


Figure 1: Case 1 pre-surgical radiograph.

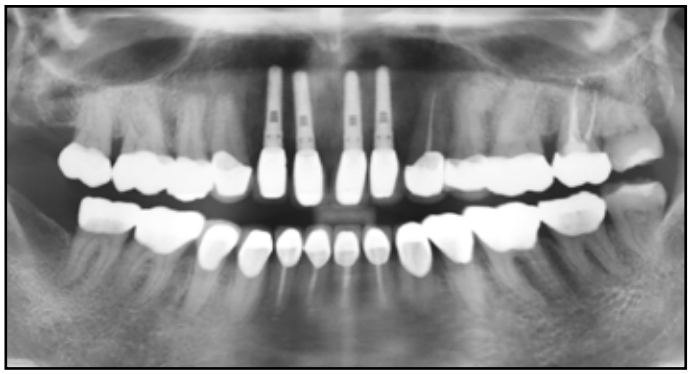


Figure 2: Case 1 post-surgical radiograph.

INTRODUCTION

Contemporary dental implants routinely achieve extremely high success rates across all brands and designs.[1-8] It is this predictability that has led to the massive growth of dental implant use over the past 25 years. With nearly all dental implant brands achieving survival rates that routinely exceed 95%,[1-8] what makes one particular brand more desirable than another? More often than not, it is specific design features of dental implant systems that compel clinicians to select one dental implant brand over another. Ease of use, speed, fiscal capacity, and reliability are just a few of the features that attract the attention of dental implant professionals. Accordingly, different dental implant brands have employed a variety of unique designs in attempt to satisfy the components of this equation. These design features occasionally provide a revolutionary step forward in implant technology, while other features come and go with the feel and function of nothing more than a marketing gimmick. Ultra-narrow implants,[9] extremely wide implants,[10] scalloped implant platforms,[11] colored implant platforms,[12] and trabeculated metal surfaces[13] are just a few of the different design features offered by dental implant companies over the past few years. The goal of this paper is to introduce the Osseofuse® HexaPlus™ dental implant system and highlight the authors' experiences with placement and follow-up of over 250 of these implants over a six year time span. This paper will also discuss the unique design features of this dental implant system that compelled the authors to initially select and continue using this product.

MATERIALS AND METHODS

A retrospective chart review was completed in the practices of multiple private practicing clinicians to examine all Osseofuse® HexaPlus™ dental implants placed from 2011 to 2017 (Figures 1-8). Locations of the practices included in this study were: a) Las Vegas, Nevada; b) Beverly Hills, California; c) San Francisco, California; d) Pasadena, California; e) Arcadia, California; f) Seattle, Washington. As this was a retrospective review, there were no exclusion criteria and Institutional Review Board approval was not required. Dental implants were placed with both immediate and delayed techniques, in all areas of the mouth, and in all types of bone. All dental implants were placed in a similar fashion by both practitioners according to

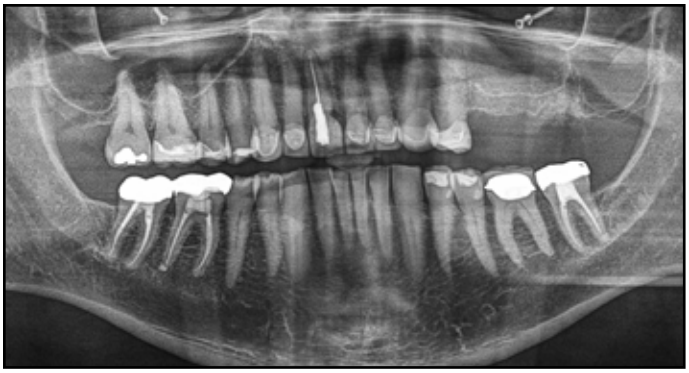


Figure 3: Case 2 pre-surgical radiograph.

Figure 4: Case 2 post-surgical radiograph.

Figure 5: Case 3 pre-surgical radiograph.

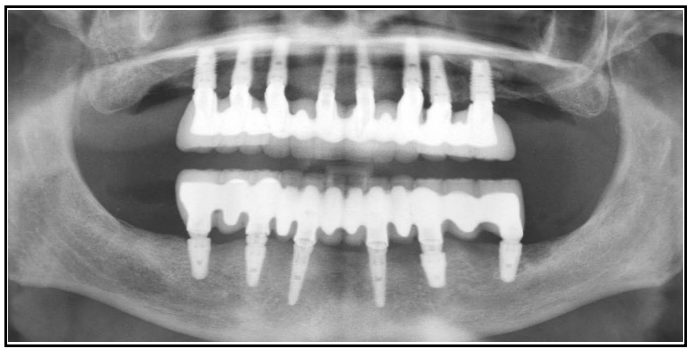


Figure 6: Case 3 post-surgical radiograph.

Figure 7: Case 3 pre-surgical clinical view.

Figure 8: Case 3 post-surgical clinical view.

manufacturer's directions. Following the administration of local anesthesia, dental implant osteotomies were achieved with a single Osseofuse® HexaPlus™ drill running at a speed of 800 RPM under copious external irrigation. In areas of particularly dense bone, a second drill was sometimes employed. All implants were placed with radiographic verification and torqued to a minimum of 32 Ncm. All dental implants were allowed to heal for an average of 4 months prior to loading and final restoration. Dental implant success and survival was determined by Albrektsson[14] success criteria (Table 1). For all patients in this study, rudimen-

tary demographic data including sex, age, and medical status were reviewed and recorded.

RESULTS

A total of 258 Osseofuse® HexaPlus™ dental implants were placed by the authors during the 6 year period evaluated in this paper. A total of 95 patients (52 males, 43 females) with an average age of 64.68 years (± 14.19 years, range 31-89 years) were treated. Medical conditions of these patients were highly varied from completely healthy patients to patients with a multitude of medical issues including smoking, high blood pressure, diabetes, asthma, chronic obstructive pulmonary disease, and more. A total of seven dental implants were classified as failures as determined by Albrektsson success criteria. All of these dental implants were replaced and healed uneventfully. With up to six years of follow-up, the success rate for Osseofuse® HexaPlus™ evaluated in this study was 97.28%. Restored dental implant fixtures were functioning as expected with bone loss levels within Albrektsson guidelines. Analysis of Osseofuse® HexaPlus™ failures revealed no particular pattern or discernible cause.

Table 1: Albrektsson Success Criteria[14]

● **Dental implant is immobile when tested clinically**
● **Radiograph does not demonstrate evidence of periapical radiolucency.**
● **Vertical bone loss should be less than 0.2mm following implant's first year of service**
● **Implant performance must be absence of signs and symptoms of pain, infection, neuropathies, parathesias, or violations of nerve structures**

DISCUSSION

The survival rate for the Osseofuse® HexaPlus™ dental implants evaluated in this paper compare very favorably to the survival rates of dental implants in multiple contemporary published studies.[1-13] As this was a retrospective study, there were no exclusion criteria and implants were placed in all "real world" situations including fresh extraction sites and in patients with active periodontal disease. When evaluating studies on dental implants, these are important points to consider as some studies selectively exclude periodontal patients while others only place implants into fully healed extraction sockets. Such actions have the ability to skew data and the undiscerning reader may inadvertently overlook these exclusions. Furthermore, some studies do not utilize the stringent Albrektsson success criteria when evaluating implant failures and only classify "lost" implants as failures. Classifying dental implant failures in this manner may create inflated survival rates as these studies do not count implants with significant bone loss as failures while other studies, such as the current paper, do count such situations as failures. One study,[16] for example, reports a 99.6% dental implant survival rate with only "one failed implant" while at the same time noting that multiple implants in their study presented with "significant crestal bone loss and recurrent peri-implant purulent infections." Studies using Albrektsson success criteria would classify these dental implants as failures,

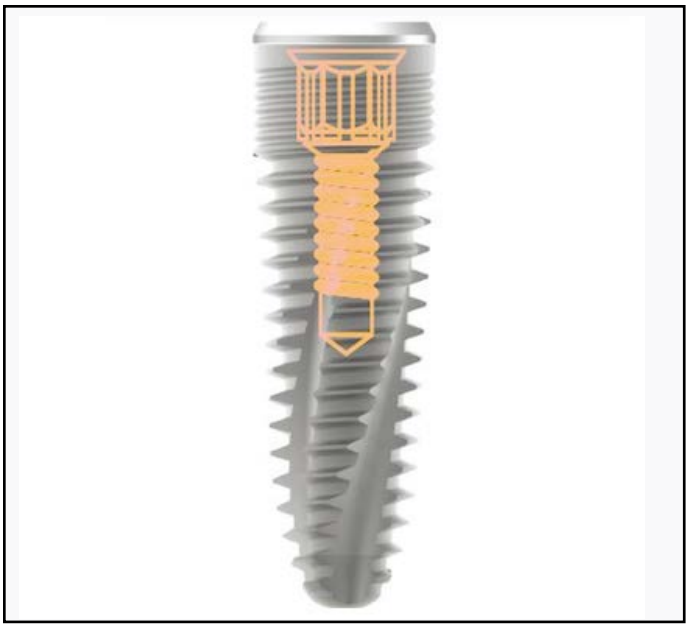


Figure 9: Tapered implant design.

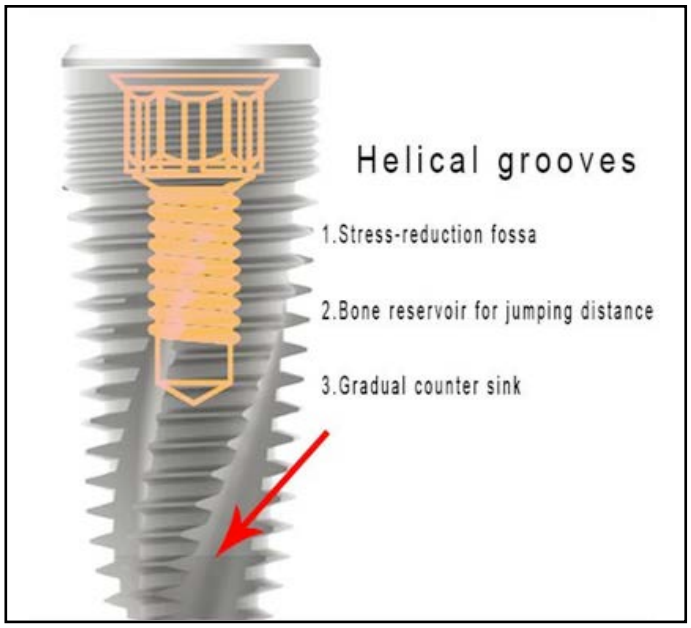


Figure 10: Helical grooves run full length of the dental implant.

thus resulting in a lower cumulative survival rate.

With all modern dental implants achieving comparable survival rates,[1-13] it is the unique attributes of each system that sets them apart from one another. Studies concerning specific dental implants are often written to highlight these unique attributes in addition to providing proof of principle regarding their success rate. For example, in 2009 Irinakis et al. published two studies[8, 17] highlighting the unique features of a newly introduced dental implant system and provided guidelines for its use. Like the Irinakis studies[8,17] regarding the Nobel Biocare® NobelActive™ dental implant system, the current study highlights the unique features of the Osseofuse® HexaPlus™ dental implant system. At their most basic level, the Osseofuse® HexaPlus™ dental implant system shares many attributes with other modern dental implants. Like most contemporary dental implants, the Osseofuse® HexaPlus™ dental implants are Titanium, specifically a grade 23 Titanium alloy. The implant has a mild tapered design (Figure 9) allowing versatility of placement in either anterior or posterior regions. Helical shaving grooves run the full length of the fixture (Figure 10), deep and wide to narrow and shallow, allowing the implant fixture to achieve multiple functions. The wide side of cuts provides the ability to optimize initial stability even in sites containing uneven distribution of bone densities. When placing the Osseofuse® HexaPlus™ implants, multiple, evenly distributed grooves make the implant self-centering and safeguards against the fixture wobbling during loading. Additionally, the engaging thread design allows for improved torque during placement making values of 30+ Ncm easily and routinely achievable. The apical portion of the implant is end-cutting, allowing advancement

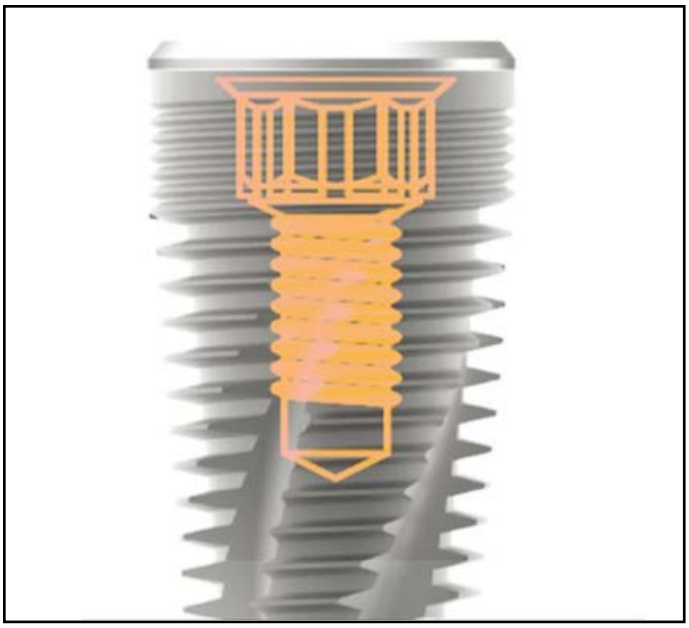


Figure 11: Polished 0.5mm collar.

of the implant, even in dense bone situations. These aggressive cutting grooves, threads, and edges enhance the ability for immediate implant placement in extraction sites and their high torque allows for immediate loading. Furthermore, these features make the "5-in-1" technique possible whereby extractions, immediate implantation, sinus lifting, bone grafting, and immediate loading are all accomplished in a single visit. At the coronal end of the implant, micro-threads on the coronal one-third of the fixture are designed to provide additional stability for the implant, even in soft bone situations. Furthermore, the coronal aspect of the implant has a 0.5mm polished collar (Figure 11) to reduce bacterial accumulation that may contribute to the causes of crestal bone loss and peri-implantitis. The remainder of the Osseofuse® HexaPlus™ implant surface is roughened with resorbable blast media (RBM). The RBM implant surface (Figure 12) uses bio-

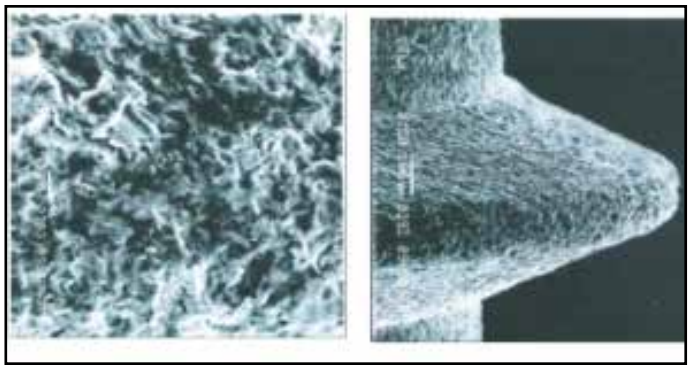


Figure 12: RBM implant surface.

compatible calcium phosphate ceramic media to roughen the Titanium which increases available surface area by up to 250% compared to smooth machined surfaces. Multiple studies have noted the superiority of roughened dental implant surfaces compared to smooth machined implant surfaces.[18-20] In Cochran's State of the Art Review of Dental Implants published in the Journal of Periodontology,[20] which was a meta-analysis study involving more than 150 publications, it was concluded that roughened dental implant surfaces had significantly higher success rates compared to smooth surface implants. The most predominant finding of studies evaluating roughened surface implants is that the rough surface results in greater bone-to-implant-contact (BIC) compared to smoother surface implants.[20] While the Osseofuse® HexaPlus™ dental implants used in this study enjoy the benefits offered by a roughened surface, this particular characteristic does not necessarily set this implant apart from other implants as nearly all contemporary dental implants now utilize roughened surfaces. Another design feature of the Osseofuse® HexaPlus™ dental implant is a built in "platform switch" (Figure 13). The concept of plat-

Figure 13: Built in platform switching, all in one platform

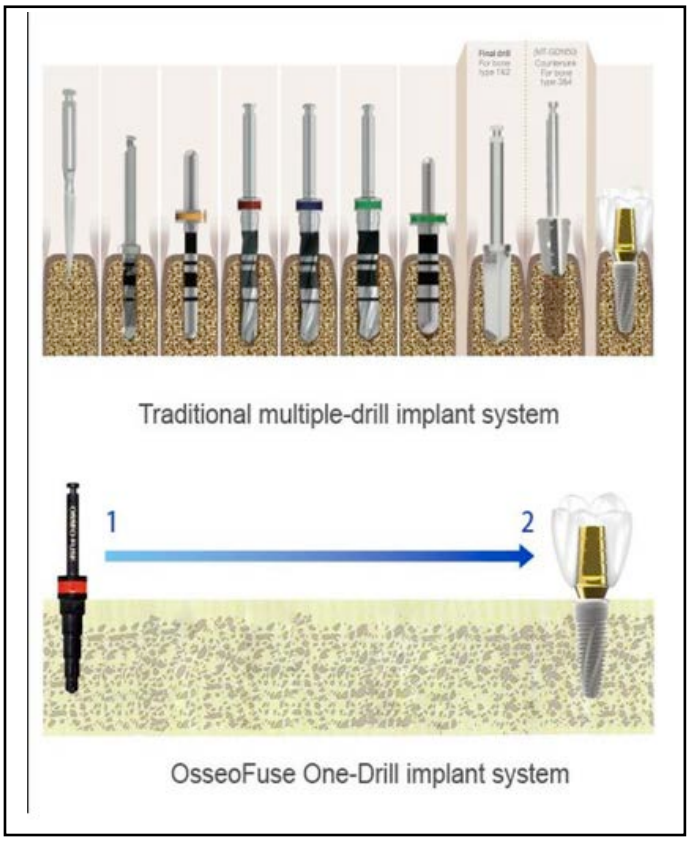


Figure 14: Osseofuse™ One-drill implant system.

form switching dates back to the early 1990's when small diameter abutments were placed onto larger diameter dental implants, oftentimes out of necessity rather than intended design.[21] Over time, dental implants restored in the manner of platform switching inexplicable demonstrated less than anticipated crestal bone loss compared to traditional non-platform-switched dental implants.[22-24] As more studies confirmed the crestal bone preservation benefit of platform switching, a number of dental implant companies began to incorporate this design feature into their product design. The modern concept of platform switching either utilizes abutments that are specifically designed to be smaller than their corresponding implant platform diameter. This type of connection shifts the perimeter of the implant-abutment junction towards the middle of the implant, reducing contact angle and improving force distribution.[25] As more implant companies incorporate the platform switching design concept into their product designs, multiple studies have now confirmed the benefits of this design.[25] In addition to the better preservation of crestal bone, platform switching has demonstrated improved aesthetic results in numerous studies.[26,27] While the dental implants used in the current study enjoy

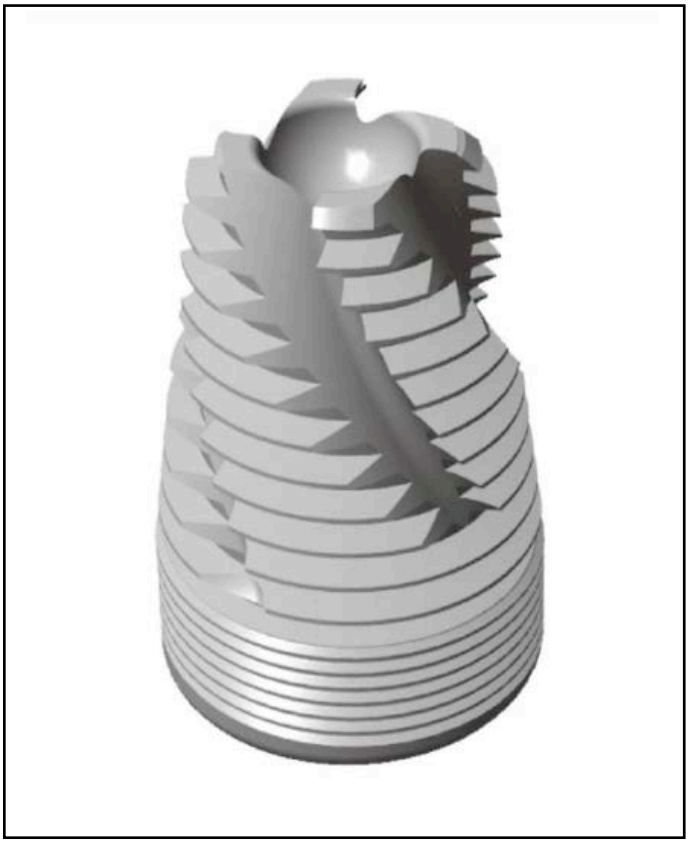


Figure 15: Osseofuse-Tome™ implant design for placement into maxillary sinuses.

Figure 16: Reverse Drill System kit to be used in conjunction with the Hydraulic Sinus Condensing technique.

the benefits of platform switching, this particular design feature does not necessarily set this implant apart from other implants as multiple systems now employ platform switching.

While the previously discussed design features of Osseofuse® HexaPlus™ dental implants demonstrate considerable benefits, they do not set this implant system apart from others. The first of many features that does, however, differentiate the Osseofuse® HexaPlus™ implant system from others is the fact that all Osseofuse® HexaPlus™ dental implants utilize the same abutment size. One uniform abutment size for all dental implants offers significant benefits over other systems in terms of reduced cost and improved ease of implant placement. Other dental implant systems use up to four different abutment diameter sizes for implants within the same product line. In terms of cost, such a system requires the purchase and stocking of four different implant abutments, four different implant drivers, four different impression copings, four different temporary esthetic copings, and four different sizes of screws. In addition to requiring increased investment to attain these supplies and wasting valuable storage space to store these supplies, surgical speed may be slowed as

practitioners must switch between multiple different parts when placing implants of different diameters. Furthermore, placing the wrong part into the wrong implant can lead to serious and costly complications such as fractured screws, loose abutments, or inaccurate impressions.

Another significant design benefit of the Osseofuse® HexaPlus™ dental implant system that sets it apart from other dental implant systems is a unique minimized drilling sequence. In most cases, Osseofuse® HexaPlus™ dental implants can be placed utilizing only one single drill (Figure 14). In cases of very dense bone, a total of two drills may sometimes be required. Osseofuse® dental implant drills have a proprietary blade design that eliminates the need for a multi-drill sequence as is used with other systems. Furthermore, these drills are also length specific with stops that eliminate the need for the practitioner to search for hard to see drill measurement lines. In addition to improving the ease of the surgical process, this also reduces surgical time for implant placement. With the Osseofuse® HexaPlus™ system it is one drill to the depth stop and the implant osteotomy is ready to receive the implant fixture. On the other hand, conventional dental implant systems often require using up to six different osteotomy drills, while looking for hard to see measurement lines that fade over time, prior to placing an implant.

A third unique feature of certain Osseofuse® HexaPlus™ dental implants that sets the system apart from other dental implant systems is the Osseofuse-Tome™ (Figure 15) design available for implants intended to be placed in conjunction with maxillary sinus lifts. The Osseofuse-Tome™ design utilizes a reverse bullnose design that cups natural/grafted bone in an osteotome-like manner providing assisted elevation of the Schneiderian membrane during implant placement with reduced risk of perforation. Furthermore, the deep threading and side cuts of the Osseofuse-Tome™ implants provide for improved stability with immediate placement in compromised sites such as posterior maxillae, replacement implant sites, and immediate extraction sites. In cases where additional lifting of the sinus membrane may be required, the Hydraulic Sinus Condensing (HSC)[28] technique can be employed with the Osseofuse® Reverse Drill System (Figure 16).

CONCLUSION

With modern implant systems achieving comparable levels of success, unique attributes that contribute to ease of use, speed, and reduced costs are factors that compel clinicians to select one implant system over another. The Osseofuse® HexaPlus™ dental implant system discussed in this paper achieved long term survival rates that are comparable to other dental implant systems in addition to reducing surgical time and costs.

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

References

1. Anitua E, Piñas L, Begoña L, Alkhraisat MH. Prognosis of Dental Implants Immediately Placed in Sockets Affected by Peri-implantitis: A Retrospective Pilot Study. Int J Periodontics Restorative Dent 2017;37(5):713-719.

2. Oztel M, Bilski WM, Bilski AJ. Risk Factors associated with Dental Implant Failure: A Study of 302 Implants placed in a Regional Center. Contemp Dent Pract 2017;18(8):705-709.

3. Simmons DE, Maney P, Teitelbaum AG, Billiot S, Popat LJ, Palaiologou AA. Comparative evaluation of the stability of two different dental implant designs and surgical protocols-a pilot study. Int J Implant Dent 2017;3(1):16.

4. Sato RK, Thomé G, Fontão FNGK, de Melo Filho A, Melo ACM. Morse Taper Implants Immediately Loaded in Fresh Extraction Sockets: A Prospective Cohort Study. Implant Dent 2017;26(3):345-350.

5. Malchiodi L, Caricasulo R, Cucchi A, Vinci R, Agliardi E, Gherlone E. Evaluation of Ultrashort and Longer Implants with Microrough Surfaces: Results of a 24- to 36-Month Prospective Study. Int J Oral Maxillofac Implants 2017;32(1):171-179.

6. Nagi SE, Khan FR, Ali R. A 6-year Evaluation of 223 Tapered Dental Implants and associated prosthesis in 92 patients at a University Hospital. J Pak Med Assoc 2016;Oct:66.

7. Lee PK, Siu AS. A Two-Year Evaluation of a Sloped Marginal Contour Implant System Placed in Healed Sites. Int J Oral Maxillofac Implants 2016;31(6):1423-1428.

8. Irinakis T, Wiebe C. Clinical evaluation of the NobelActive implant system: a case series of 107 consecutively placed implants and a review of the implant features. J Oral Implantol 2009;35(6):283-8.

9. Galindo-Moreno P, Nilsson P, King P, Worsaae N, Schramm A, Padial-Molina M, Maiorana C. Clinical and radiographic evaluation of early loaded narrow-diameter implants: 5-year follow-up of a multicenter prospective clinical study. Clin Oral Implants Res 2017; Jun 18. doi: 10.1111/clr.13029. [Epub ahead of print]

10. Ku JK, Yi YJ, Yun PY, Kim YK. Retrospective clinical study of ultrawide implants more than 6 mm in diameter. Maxillofac Plast Reconstr Surg 2016;38(1):30.

=11. Starch-Jensen T, Christensen AE, Lorenzen H. Scalloped Implant-Abutment Connection Compared to Conventional Flat Implant-Abutment Connection: a Systematic Review and Meta-Analysis. J Oral Maxillofac Res 2017;8(1):31.

12. Gil MS, Ishikawa-Nagai S, Elani HW, Da Silva JD, Kim DM, Tarnow D, Schulze-Späte U, Bittner N. A prospective clinical trial to assess the optical efficacy of pink neck implants and pink abutments on soft tissue esthetics. J Esthet Restor Dent 2017;Jun 5. doi: 10.1111/jerd.12309. [Epub ahead of print]

13. Romanos GE, Delgado-Ruiz RA, Sacks D, Calvo-Guirado JL. Influence of the implant diameter and bone quality on the primary stability of porous tantalum trabecular metal dental implants: an in vitro biomechanical study. Clin Oral Implants Res 2016; Feb 24. doi: 10.1111/clr.12792. [Epub ahead of print]

14. Albrektsson T, Dahl E, Enbom L, Engevall S, Engquist B, Eriksson AR, Feldmann G, Freiberg N, Glantz PO, Kjellman O, et al. Osseointegrated oral implants. A Swedish multicenter study of 8139 consecutively inserted Nobelpharma implants. J Periodontol 1988;59:287–296.

15. Tallarico M, Xhanari E, Pisano M, De Riu G, Tullio A, Meloni SM. Single post-extractive ultra-wide 7 mm-diameter implants versus implants placed in molar healed sites after socket preservation for molar replacement: 6-month post-loading results from a randomised controlled trial. Eur J Oral Implantol. 2016;9(3):263-275.

16. Pettersson P1, Sennerby L. A 5-year retrospective study on Replace Select Tapered dental implants. Clin Implant Dent Relat Res 2015;17(2):286-95.

17. Irinakis T, Wiebe C. Initial torque stability of a new bone condensing dental implant. A cohort study of 140 consecutively placed implants. J Oral Implantol. 2009;35(6):277-82.

18. Wagenberg B, Froum SJ. A retrospective study of 1925 consecutively placed immediate implants from 1988 to 2004. Int J Oral Maxillofac Implants 2006;21(1):71-80.

19. Li D, Ferguson SJ, Beutler T, Cochran DL, Sittig C, Hirt HP, Buser D. Biomechanical comparison of the sandblasted and acid-etched and the machined and acid-etched titanium surface for dental implants. J Biomed Mater Res 2002;60(2):325-32.

20. Cochran DL. A comparison of endosseous dental implant surfaces. J Periodontol 1999;70(12):1523-39.

21. Lazzara RJ, Porter SS. Platform switching: a new concept in implant dentistry for controlling postrestorative crestal bone levels. Int J Periodontics Restorative Dent 2006;26(1):9-17.

22. Cappiello M, Luongo R, Di Iorio D, Bugea C, Cocchetto R, Celletti R. Evaluation of peri-implant bone loss around platform-switched implants. Int J Periodontics Restorative Dent 2008;28(4):347-55.

23. Luongo R, Traini T, Guidone PC, Bianco G, Cocchetto R, Celletti R. Hard and soft tissue responses to the platform-switching technique. Int J Periodontics Restorative Dent 2008;28(6):551-7.

24. Hürzeler M, Fickl S, Zuhr O, Wachtel HC. Peri-implant bone level around implants with platform-switched abutments: preliminary data from a prospective study. J Oral Maxillofac Surg 2007;65(7 Suppl 1):33-9. Erratum in: J Oral Maxillofac Surg. 2008 Oct;66(10):2195-6.

25. López-Marí L, Calvo-Guirado JL, Martín-Castellote B, Gomez-Moreno G, López-Marí M. Implant platform switching concept: an updated review. Med Oral Patol Oral Cir Bucal 2009;14(9):e450-4.

26. Calvo Guirado JL, Saez Yuguero MR, Pardo Zamora G, Muñoz Barrio E. Immediate provisionalization on a new implant design for esthetic restoration and preserving crestal bone. Implant Dent 2007;16(2):155-64.

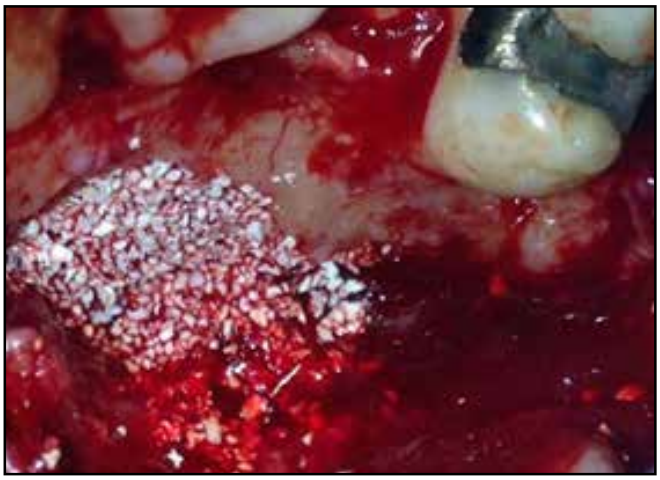
27. Degidi M, Iezzi G, Scarano A, Piattelli A. Immediately loaded titanium implant with a tissue-stabilizing/maintaining design ('beyond platform switch') retrieved from man after 4 weeks: a histological and histomorphometrical evaluation. A case report. Clin Oral Implants Res 2008;19(3):276-82.

28. Chen L, Cha J. An 8-year retrospective study: 1,100 patients receiving 1,557 implants using the minimally invasive hydraulic sinus condensing technique. J Periodontol 2005;76(3):482-491.

Immediate Implant Post-Extraction of Impacted Maxillary Canine: A Clinical Case Report

Britto Falcón-Guerrero MDS, DDS[1]

Abstract



Introduction: This clinical report outlines the surgical and restorative steps involved when a patient presented with an impacted maxillary canine. The patient was treated with extraction and immediate implant placement. This was a challenge due to the bone resorption frequently associated with complex tooth extraction that often necessitates bone regeneration in these cases.

Case report: A 37-year-old female with an impacted maxillary canine underwent implant therapy to restore function and esthetics. The surgical phase of treatment included extraction, immediate implant placement, placement of a bone substitute and platelet-rich fibrin (PRF) membrane. One year follow up is presented.

Conclusion: This report suggest that this treatment for maxillary impacted canines with dental implants is viable with a good outcome both functionally and aesthetically, although more work is needed to strengthen an adequate protocol of this treatment alternative.

KEY WORDS: Dental implants, impacted canine, maxilla, extraction, bone graft

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Figure 1: Reabsorption of deciduous canine and presence of impacted canine.

Figure 2: Pre-operatory view.

INTRODUCTION

Impaction of maxillary canine teeth can result in esthetic, functional, and phonetic problems, in addition to root resorption and chronic or acute infections.[1] The management of impacted canines is one of the most complicated aspects of dento-alveolar surgery.[2] There are many treatment alternatives for impacted maxillary canines, including interceptive approaches to guided forced eruption, extraction and orthodontic space closure, and auto transplantation.[1,3] However, if traction is not feasible or the patient refuses orthodontic treatment, an alternative solution is to remove the impacted tooth and immediately place an implant.[4] Chrcanovic et al.[5] in a systematic review and meta-analysis, reports that immediate implants are a common procedure and a very promising approach in selected cases. The main advantage of this treatment being the reduction in surgery and treatment time. Recently, Falcón[6] reported on a systematic review that In the case of an impacted maxillary canine, the possibility of immediate implant placement after extraction is viable and may produce a good outcome, provided there is adequate residual apical bone. Such cases have been noted with up to 8 years of follow up, however, there are a limited number of these cases. Therefore, the objective of this paper is to present a clinical case using this treatment to increase the scientific literature.

CASE REPORT

In 2010, a 31-year-old woman presented to the dental office complaining about the mobility of her maxillary primary left canine. There were no other complaints or health problems. The canine had been treated years ago with endodontic therapy and now hypermobility and poor esthetic condition required its extraction. Radiographic examination revealed the presence of root resorption of the deciduous canine and an impacted canine (Fig 1). However, the patient disappeared and then later returned again in 2016, saying that she had lost the deciduous canine about a year ago (Fig 2). The position of the impacted canine and the osseous volume were evaluated using

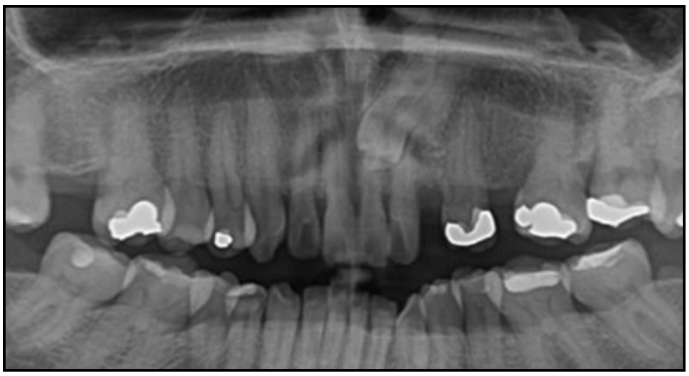

Figure 3a: **Panoramic radiograph of impacted canine.**

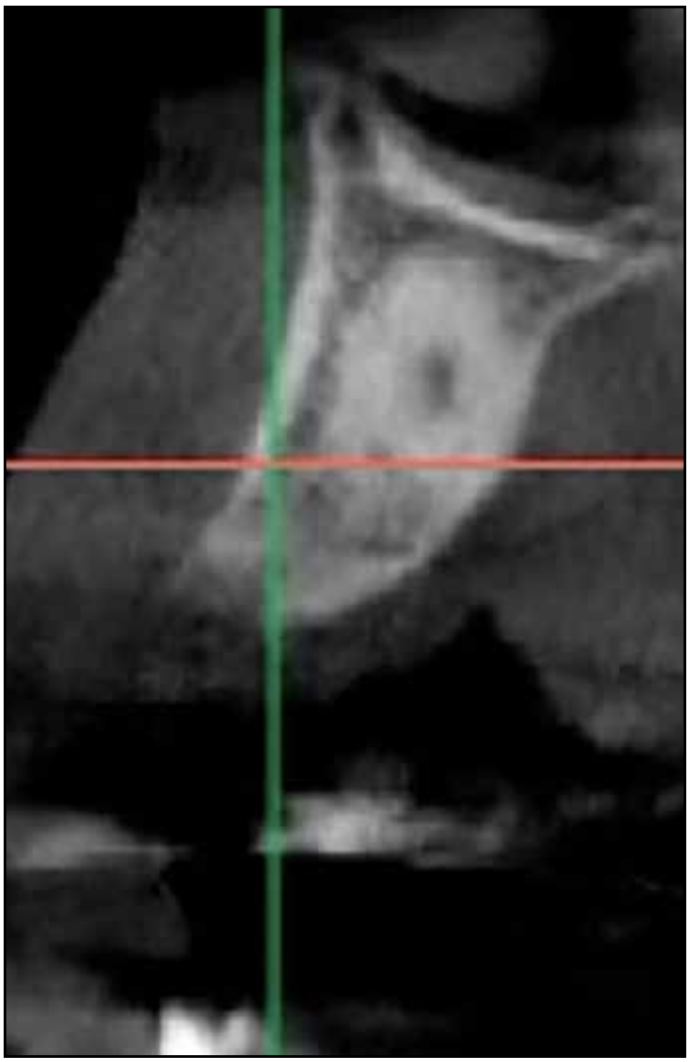

Figure 3b: Tomographic view of impacted canine.

Figure 4: Flap elevation to visualize the bone areas of impacted canine.

computed tomography. Extraction with bone regeneration was considered, along with installing an immediate implant, because there was enough bone to achieve primary stability (Figs 3a,b).

SURGICAL PROCEDURE

Before surgery, a full-mouth professional prophylaxis was scheduled. The patient was pre-medicated 1 hour before surgery with 2g penicillin and clavulanic acid to continue with 2g per day for 6 days and 0.12 % clorhexidine gluconate for 2 weeks. Under local anesthesia, surgical palatal exposure was achieved through a crestal intrasulcular incision and full-thickness flap elevation to visualize the bone area of impacted canine (Fig 4). The crown of the impacted canine tooth was exposed via an ostectomy from the palatal side performed with a round drill on a handpiece turbine. Odontotomy was achieved using a trunk-conic steel dental bur on a handpiece turbine, separating the crown from the root, to luxate and remove them separately, trying not to damage the remaining bone (Figs 5a,b). After

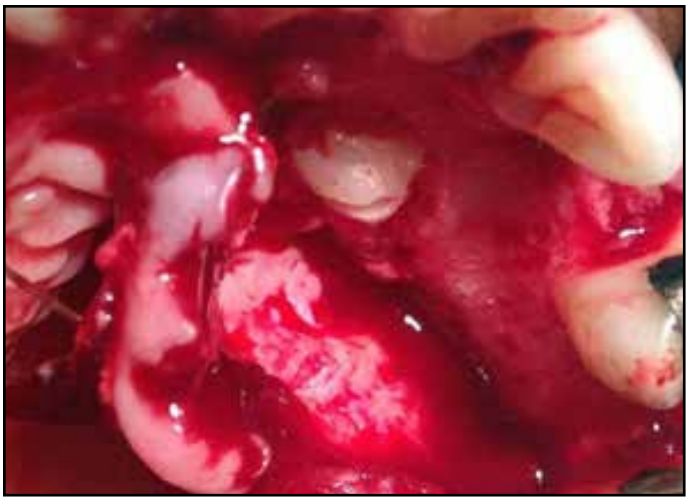

Figure 5a: Osteotomy, Odontotomy of impacted canine.

Figure 5b: Impacted canine extraction.

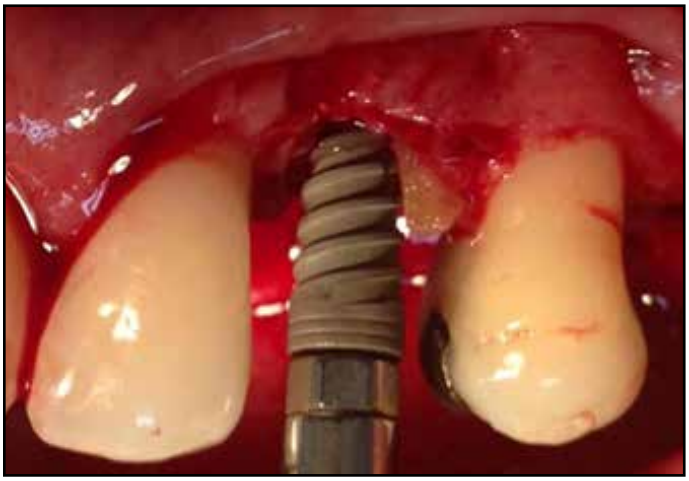

Figure 6a: Implant insertion.

Figure 6b: Implant insertion.

impacted canine tooth removal, the ridge crest bone was preserved to allow good primary stability upon implant placement. Surgical drills were used to prepare the implant site, and a long conical implant (4.2 × 15 mm) was immediately placed (Figs 6a,b). The implant achieved good primary stability, but the apical zone of the implant had no bone coverage. Alloplastic graft material was thus prepared and applied in the cavity left by the extraction of the impacted canine. Finally, membranes of autogenously prepared PRF were positioned (Figs 7a,b). The surgical closure technique comprised of flap repositioning and suturing with 4-0 chromic gut suture (Fig 8).

PROSTHETIC PROCEDURE

Second stage surgery occurred after a healing period of 4 months to create papillae and emergence profile with manipulation of the soft tissue. An impression was immediately taken thereaf-

Figure 7a: Alloplast graft placement.

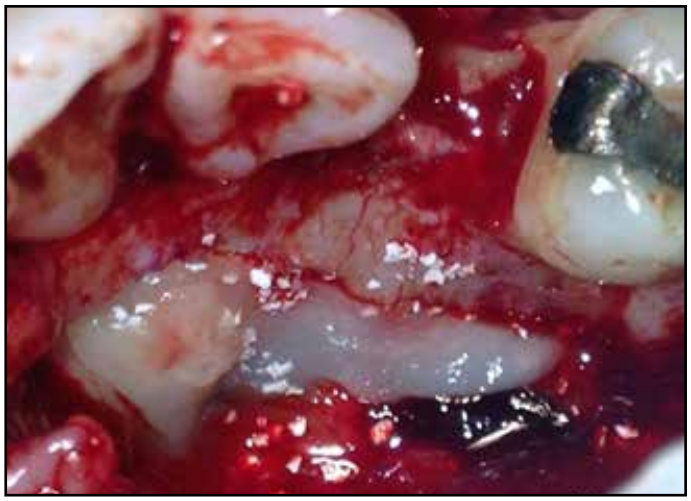

Figure 7b: PRF membrane placement.

Figure 8: Suturing with 4-0 chromic gut suture.

ter and a healing screw was placed. Within 24 hours, a porcelain crown was installed, obtaining a good emergence profile and function. The patient was very happy with the result. A one year follow up revealed that the function, stability and esthetics of the implant were stable (Figs 9a,b).

DISCUSSION

The clinical management of an impacted maxillary canine can be challenging and frustrating.[1] When patients do not accept orthodontic treatment and/or the impacted canines are in a high position precluding orthodontic traction, the treatment of choice is often extraction.[7,18] In this situation, Mazor, et al.[8,19] proposes the alternative of installing an implant immediately after the removal of the impacted maxillary canine. Falcon,[6] found that there is a 100% survival of the implants installed after the extraction of the impacted canine and that accompanied by guided bone regeneration, with a follow up of up to 8 years. In the present report, we performed the implant insertion immediately after extraction with bone regeneration (accompanied by PRF membranes). At one year of follow up, we have obtained good stability and function. Authors such as Demarosi et al.,[4] Zuiderveld et al.,[9] D'Amato et al.,[10] Mahesh et al.,[11] and Cardaropoli et al.[7] have all reported on immediate provisionalization, provided there was good primary stability of the implant. Although our case obtained suitable torque of 35 Ncm, we nonetheless decided to submerge the implant for 4 months.

Davarpahah et al.[12] interestingly described several cases of implants being placed through

Figure 9a: One week healing.

Figure 9b: One year healing.

impacted teeth to avoid invasive surgical removal. Of the seven implants placed into four impacted teeth, all healed uneventfully except a short 8.5mm implant that became mobile after 4 months. This article suggested that implant placement through an impacted tooth might not interfere with implant integration or harm occlusal function, at least in the short term.

CONCLUSION

A correct diagnosis and treatment plan are critical factors in a successful outcome. This report suggests that this treatment is viable and with a good outcome both functionally and aesthetically, although more works is needed to strengthen an adequate protocol of this treatment alternative.

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

References

1. Quirynen M, Op Heij DG, Adriansens A, Opdebeeck HM, van Steenberghe D. Periodontal health of orthodontically extruded impacted teeth. A split-mouth, long-term clinical evaluation. J Periodontol. 2000 Nov;71(11):1708-14.
2. Alberto PL. Management of the impacted canine and second molar. Oral Maxillofac Surg Clin North Am. 2007 Feb; 19(1):59-68.
3. Arikan F, Nizam N, Sonmez S. 5-year longitudinal study of survival rate and periodontal parameter changes at sites of maxillary canine autotransplantation. J Periodontol. 2008 Apr;79(4):595-602. doi: 10.1902/jop.2008.070409 .
4. Demarosi F, Varoni E, Rimondini L, Carrassi A, Leghissa GC. Immediate implant placement after removal of maxillary impacted canine teeth: A technical note. Int J Oral Maxillofac Implants. 2016 Jan-Feb;31(1):191-4. doi: 10.11607/jomi.2588.
5. Chrcanovic BR, Albrektsson T, Wennerberg A. Dental implants inserted in fresh extraction sockets versus healed sites: a systematic review and meta-analysis. J Dent. 2015 Jan;43(1):16-41.
6. Falcón GB. Immediate Implant Post-Extraction of Impacted Maxillary Canine: Systematic Review. J Dental Sci 2017, 2(2): 000130.
7. Cardaropoli D, Debernardi C, Cardaropoli G. Immediate placement of implant into impacted maxillary canine extraction socket. Int J Periodont Restorat Dent 2007; 27: 71-7.
8. Mazor Z, Peleg M, Redlich M. Immediate placement of implants in extraction sites of maxillary impacted canine teeth. J Am Dent Assoc 1999;130: 1767–1770.
9. Zuiderveld EG, Meijer HJA, Vissink A, Raghoebar GM. Immediate placement and provisionalization of an implant after removal of an impacted maxillary canine: two case reports. Int J Implant Dent. 2015 Dec; 1(1): 13. Published online 2015 May 30. doi: 10.1186/s40729-015-0013-3
10. D'Amato S, Redemagni M. Immediate Postextraction implantation with provisionalization of two primary canines and related impacted permanent canines: A case report. Int J Periodontics Restorative Dent. 2014 Mar-Apr; 34 (2):251-6. doi: 10.11607/prd.1612.
11. Mahesh L, Salama M, Kurtzman GM. Extraction of an impacted maxillary canine with immediate implant placement. Inside dentistry 8(3): 2-4.
12. Davarpahah M, Szmukler-Moncler S. Unconventional implant placement. 2: Placement of implants through impacted teeth. Three case reports. Int J Periodontics Restorative Dent. 2009 Aug;29(4):405-13.

An Economical Approach to the Establishment of Occlusal Guidances: A Case Report

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Abstract

Whenever treatment is performed on a patient that does not have a concrete foundation of evidence in the literature, one must always consider the ethical considerations before performing irreversible treatment. At all costs, respecting patient autonomy and practicing within a standard of care that is nonmaleficence must always occur. The topic of occlusal rehabilitation and the value of the literature available on the topic are of much discussion in dentistry. After an exhaustive literature search, the same conclusions can be drawn time after time, more research is needed however, many of the research articles analyzed gave recommendations to provide a functional and optimal standard of care when modifying or establishing occlusal scheme in a patient. Most practitioners understand occlusal guidance as a complete scheme, individual to each patient. Although, occlusal guidance may be a misnomer since it can consist of multiple guidances such as incisal guidance with canine protected occlusion, or group function, or an occlusal scheme void of any healthy relationship. Therefore, when referring to a specific occlusal scheme, it should be noted that multiple guidances could be present. In the case of article, many of these issues were not of concern because of the creative treatment that was performed.

KEY WORDS: Occlusal guidance, occlusal equilibration, dental prosthetics

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CASE REPORT

Patient KG, a 45 year old female, presented with moderate decay, temporal tension headaches, and polypharmacy. Her chief concern was that she "needed to replace crown #18 because food keeps getting stuck." Her medical history was positive for anxiety and depression, post-traumatic stress disorder, temporal tension headaches, facial muscle tension, and facial muscle spasms. All conditions were controlled with medications and/or therapy sessions. The patient's dental history consists of re-care twice a year, a bridge in the upper right, crowns in the lower left, and amalgam and composite restorations throughout. She also has a history of comprehensive orthodontics and orthognathic surgery. The patient neither smokes nor drinks.

After an evaluation and formation of a treatment plan, it was determined that KG did not in fact need a crown replaced, but she required two posterior restorations and in order to facilitate a stable and healthy dentition, a comprehensive occlusal evaluation should be completed. Patient KG presented us with a unique situation, one in which a valuable educational, AND beneficial treatment modalities arouse. After initial clinical evaluation of the patient, along with a full series of radiographs, a treatment plan was formed.

Upon evaluation, and interview with the patient, it was determined that the patient had a pathological parafunctional occlusion that was potentially causing difficulty eating, pain during mastication, and damaging occlusal contacts during lateral excursive movements. Treatment to Patient KG includes the restoration of occlusal guidance starting with occlusal equilibration, and restoration of a mutually protected occlusion via canine guided protection. With the upcoming analysis provided by the literature, evidence for the treatment recommended to Patient KG can be justified.

Clark et al. provides insight that there is not a single, universal criteria that denote an ideal functional occlusion. There is neither evidence for or against establishing canine protected occlusion in patients.[2]

In discussion of posterior relationships of teeth during lateral movements, Clark et al. provides some evidence in support of canine protected occlusion. The anatomy location and functionality of the canine are said to be the reason behind this theory.

(1) the canine has a good crown: root ratio, capable of tolerating high occlusal forces;
(2) the canine root has a greater surface area than adjacent teeth, providing greater proprioception
(3) the shape of the palatal surface of the upper canine is concave and is suitable for guiding lateral movements.[2]

A fourth reason is that the canine plays a pivotal role in the crossover movement (extreme lateral – protrusive) and protects the four incisors.

Additionally, in 1983, it was determined by Williamson and Lundquist, via electromyographic activity, that the muscles of mastication were shown to be at rest during canine guidance more than during group function, suggesting that canine protected occlusion reduces muscle strain.[4]

Also, in order to eliminate nonworking side interferences, Clark et al. argue that it is easier to accomplish this with canine protected occlusion. They go on to provide guidelines that treatment should include bilateral posterior contacts during centric occlusion, the difference (if any) between centric occlusion and maximum inter-

Figure 1a: Preoperative model in protrusive movement.

Figure 1b: Preoperative model in protrusive movement.

Figure 1c: Preoperative model in maximum intercuspation.

Figure 1d: Preoperative model in right laterotrusive movement.

Figure 1e: Preoperative model in left laterotrusive movement.

cuspation be no more than 1mm, posterior occlusal schemes can be either canine protected or group functions and that all nonworking contacts be eliminated during border movements of the mandible. Therefore, without further definitive evidence, the choice to restore a patient's dentition using canine protected occlusion should be determined by a case-by-case basis and by following the guidelines for a healthy functional occlusion.

While discussing potential occlusal schemes, Rinchuse et. al. state that those with a malocclusion, regardless of any change in occlusal scheme, the masticatory pattern remains the same. Therefore, those with a vertical chewing pattern would benefit from canine protected occlusion because it would allow for a sharp disocclusion while chewing. Whereas, those with a more flat or horizontal masticatory pattern could benefit from the stability offered by a group function pattern and the protection from the masticatory forces.[1] In the case of Patient KG, she would most benefit from the former.

Rinchuse et al. also goes on to state that no single overarching occlusal scheme has been shown to dominate or be more beneficial and therefore, each case should be considered independently. A dynamic analysis of occlusion is more useful than a static picture of a patient's occlusion.[1]

Wiens et al. provides a discussion on occlusal equilibration. The definition of occlusal equilibration is, "[The elimination] of prematurities or deflective occlusal contacts or [creating] harmonious gliding tooth contacts, which reduces off-axis loading or atypical wear patterns."[3] Specifically, on those patients who are symptomatic or those who will be undergoing restorative procedures affecting entire quadrants and/or restoration of anterior guidance.[3] Thus, providing evidence for the beginning treatment of Patient KG.

Wiens et al. argue for a mutually protected occlusion, regardless of either canine protected occlusion or group function providing the method of posterior protection during lateral movements and that the goal of occlusal therapy is to create stability and harmony by which ever means is appropriate for the patient in each specific case. There should not be any balancing interfering contacts during any movements in all cases in a natural and prosthetic dentition. Wiens et al. also included their support for a canine protected occlusion because of its effectiveness in eliminating occlusal interferences during laterotrusive, mediotrusive and protrusive excursions.[3]

With the support of the literature, the treatment plan was finalized and Patient KG was prepared to begin treatment.

Fully mounted and articulated casts were made and we were able to confirm that the patient had lost all anterior guidance and had bilateral occlusal interferences in all mandibular excursive movements. A new, individualized occlusal scheme was created in a diagnostic wax-up on the incisal edges of select anterior teeth. In wax, anterior guidance could be demonstrated in protrusive movement, along with canine protected occlusion in left and right working movements on the semi-adjustable articulator, as shown in Figures 1a-1e. A treatment plan was created to restore incisal guidance, with posterior disclusion and removal of all interferences during excursive movements. This included resin buildups of 6, 8, 9, 11 on the maxilla, and 22, 23, 24, 25, 26, and 27 on the mandible.

A significant amount of time was spent educating and demonstrating the benefits of therapy to the patient. Risks were addressed, and the projected treatment outcomes were discussed. The patient was aware of and accepted all benefits and understood the alternatives to treatment. Specifically, the unknown prognosis of the resin buildups was understood by the patient and she was given complete autonomy and full control of her dental care.

Canine protected occlusion was the occlusal scheme of choice for restoring the detention. Following both Weins et al.[3] and Clark et al.,[2] canine protected occlusion provide the simplest and most efficient way to disclude the posterior dentition during lateral excursions. Providing the patient with a mutually protected occlusion will decrease masticatory muscle strain, protect the anterior teeth from damaging occlusal forces, and maintain the posterior dentition during lateral and excursive movements.[1,2,3]

In order to transfer the wax buildup to the patient, the waxed up casts were copied in stone and vacuum formed matri-

Figure 2a: Day of procedure; the patient does not demonstrate a healthy, stable occlusion.

Figure 2b: Day of procedure; the patient does not demonstrate a healthy, stable occlusion.

Figure 2c: Day of procedure; the patient does not demonstrate a healthy, stable occlusion.

Figure 2d: Day of procedure; the patient does not demonstrate a healthy, stable occlusion.

Figure 2e: Day of procedure; the patient does not demonstrate a healthy, stable occlusion.

ces were fabricated representing the new anterior guidance. Figure 1 shows the diagnostic waxup, demonstrating excursive movements.

On the day of the procedure, posterior balancing was achieved via selective grinding to remove centric, lateral, and protrusive interferences in the posterior. As shown in Figures 2a-2e, the patient does not demonstrate a healthy, stable occlusion. As was discussed earlier, Wiens et al. reiterated that before any restoration of occlusal guidance or quadrant restorations be completed, removal

Figure 3a: 3 week follow up centric occlusion.

Figure 3b: 3 week follow up protrusive movement.

Figure 3c: 3 week follow up left working movement.

Figure 3d: 3 week follow up left non-working movement.

of parafunctional interferences is indicated. This ensures harmonious posterior contacts without the additional stress added to the teeth.[3]

Next, minor preparation (beveling and roughening) of the upper and lower incisors was done to increase retentive surface area and to improve the esthetics of the composite restorations. After etching and bonding, composite was placed into the incisal edges of the vacuum formed matrices, adapted to the teeth, and cured through the matix. The restorations were contoured and polished. The patient was sent home with the matrices and was instructed to wear them while sleeping. Wearing the matrices at night offered additional protection to the restorations during nighttime bruxism.

Figure 3e: 3 week follow up right working movement.

Also, since the vacuum formed matrices were fabricated on the waxed up occlusal scheme, they provided additional support to the restored dentition, while stabilizing the patient's musculature.

At 1 week follow up, minor cosmetic repairs were made to the restorations. The patient reported that initially, she was nervous to use her teeth, but after some reassurance, she began to function normally. Her excursive movements were exhibited and the patient successfully demonstrated the desired occlusal scheme.

At the 3 week follow up appointment, additional support was added to protect the patient's dentition. Canine stops were placed on the lingual surface of teeth #6 and #11 in order to provide a solid, balanced rest position, and provide a greater protection to the anterior composites. Because of the anatomy of the canine, it is well suited to support these additional occlusal forces.[1,2,3] New matrices were delivered with openings for the canine rest stops. Figures 3a-3e show the patient moving through excursive movements.

At 7 weeks the patient continued to adapt to her stabilized occlusion and was very grateful and satisfied with the treatment. Minor polishing and small chip repair were completed.

At 4 months, the patient reports a "comfortable and healthy bite." There were no necessary repairs to the restorations needed at that time since the patient was stable and functional with her new occlusal scheme.

OUTCOME OF TREATMENT

The patient was very receptive to the treatment and also significantly increased her dental IQ throughout the process. Although hesitant to use her teeth at first, she became fully functioning as time went on. The patient does not report any muscle pain and reduced TMJ concerns. Although it has been studied profusely and has been shown that the effect of occlusal rehabilitation does not change the symptoms of TMD,[1,2,3] this was independently reported by the patient. No longer were her temporal tension headaches a nuisance or hindered her daily living. The patient reports less upper lip tension and a decrease in muscle spasms as well. Overall, she reports satisfaction with the esthetics.

In analyzing the success of the therapy on the patient, taking into account the patient's own reported experience is important. When a patient makes comments such as, "It feels like I am sliding on ice [while eating]." and "My enjoyment of eating has returned and food tastes better!" One can conclude that the patient is satisfied with the treatment. As observed during the literature analysis, the study of successful occlusal modification and the subjectiveness between each patient make an objective determination of success difficult to say.[1,2,3] Therefore, in the case of Patient KG, the treatment outcome was successful because the patient reported that it was successful.

The restorations, after 4 months, were functionally and cosmetically intact. This is one demonstration of the benefits of having a mutually protected occlusion. Restorations placed in the most fragile areas held up long after their expected demise. The patient is capable of demonstrating a mutually protected occlusion, free from laterotrusive and mediotrusive interferences.

It is apparent that she has accepted her new "normal" and has reprogrammed her muscles to the restored occlusal scheme. Every step of the procedure was implemented to ensure patient comfort and success of the restorations, in a controlled and educational environment.

CONCLUSION

Due to her high dental IQ, Patient KG was not willing to immediately move to a definitive treatment modality without the option of test driving it first. Through a creative form a treatment, the ability to test drive a new "occlusion" was made possible. Treating a patient following the protocol outlined previously allows for a student dentist to learn the nuances of restoring a patient's occlusal scheme, while providing a service to the patient. The most beneficial part of this method is the ability to remove the risk of harming the patient. When restoring and establishing a new occlusal scheme, it has been shown that patients may develop TMD like symptoms and an inability to adapt to a new situation[1]. However, when restoring the patient's occlusal scheme in resin buildup form, the patient and the student are both able to learn, and with minimal risk since the treatment is reversible.

Since the patient gets a "risk free" trial with a mutually protected occlusion, the high cost of definitive restorations to achieve the same occlusal scheme is nonexistent. So, when necessary to provide optimal and acceptable treatment, the resin buildup can give patients an example of the benefits of occlusal rehabilitation, while keeping the cost down.

Form and function go hand in hand. With this patient, her presenting condition resembled someone who does not have a stable occlusion or anterior guidance. By introducing the patient to a restored, guided occlusion, we were able to influence her function in a positive way by manipulating her form. With proper planning during the diagnosis stage, placement of composite became simple and easily managed during follow-up visits. The pre-treatment preparation by the student dentist was essential to a successful treatment modality because it allowed for a clear picture of the end goal of treatment. To gauge the future prognosis of the patient's composite restorations, we could look at their status so far. Since restoring the occlusal scheme in Patient KG, the mutual protection, along with the lingual canine stops, suggests that she will continue to function confidently and esthetically for the foreseeable future. Treatment performed to Patient KG achieved beauty, longevity, form, function, and most importantly, stability.

Often, manipulation of the occlusion can be tough to manage and acceptance is never guaranteed. Essentially, our method allows the patient to "test-drive" his or her established protected occlusion in resin composite. This results in a reversibly permanent solution, with low risk to the patient, while at a lower cost. With proper instructions, compliance, and patient understanding, the fragility of composite incisal restorations is outweighed by the economics and effectiveness of the treatment. Based on the literature review, the treatment of choice was determined to be best for this patient, backed up with the evidence available.

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

References

1. Rinchuse, D., Kandasamy, S., & Sciote, J. (n.d.). A contemporary and evidence-based view of canine protected occlusion. American Journal of Orthodontics and Dentofacial Orthopedics, 132(1), 90-102. Retrieved March 5, 2015.
2. Clark, J. (2001). Functional Occlusion: I. A Review. Journal of Orthodontics, 28(1), 76-81.
3. Wiens, J., & Priebe, J. (n.d.). Occlusal Stability. Dental Clinics of North America, 58, 19-43.
4. Williamson EH, Lundquist DO. Anterior guidance: its effect on electromyographic activity of the temporal and masseter muscles. J Prosthet Dent. 1983;49:816–823.

Prosthetic Implant Management of Extraction Site after the Removal of a Single Anterior Tooth

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Abstract

The EDS classification has its importance in helping the clinician in establishing appropriate plan for surgical implant treatment. This classification came short and no detailed recommendation of the provisional stage was described before and after surgical treatment for the esthetic zone. The purpose of this paper is to describe all possible provisional techniques available to restore a single tooth in the anterior esthetic zone and to give recommendations to the preferable techniques during site development and implant placement according to the EDS classification. It is strongly advisable to have a preplanning session for the preparation of a vacuum heat formed template and ovate pontic(s).

KEY WORDS: Dental implant, extraction, prosthetics, maxilla

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INTRODUCTION

When a compromised anterior tooth is removed and to be replaced by a dental implant, surgical and prosthetic evaluation must be done for a predictable result.

SURGICAL EVALUATION

The presentation of the alveolar socket varies from simple to more complex defect. The healing process initiates a cascade of biochemical and histological events that ends up in reduction of the alveolar bone and soft tissues.[1] The remaining tissues surrounding the extraction defect dictates the implant therapies.[2] Several alveolar defect classification systems have been reported.[3,4,5] All of these existing classifications however, describe the condition of an already-healed edentulous site. A classification of the extraction defect immediately following tooth removal and prior to healing and remodeling which provides guidelines for implant treatment was introduced by Caplanis et al. in 2009.[6] The Extraction Defect Sounding (EDS) classification, simplifies the decision making process when planning for dental implant therapy from a surgical point of view. The EDS classification has its importance in helping the clinician in establishing appropriate plan for surgical implant treatment.[6] This classification came short and no detailed recommendation of the provisional stage was described before and after surgical treatment for the esthetic zone. (Table 1)

PROSTHETIC EVALUATION

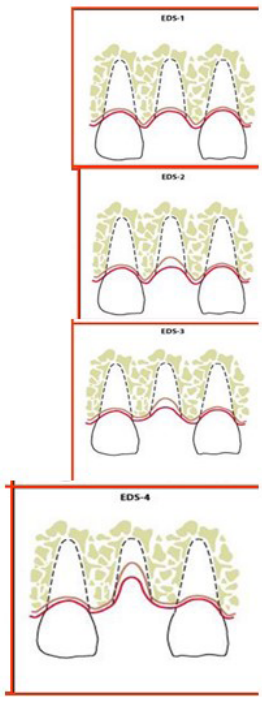
An ideal prosthesis design should fully enhance the esthetic features of the missing tooth or teeth. According to Cooper[7] there is a set of procedures that can ensure esthetic success for all anterior implants, the process begins with an esthetic diagnosis using objective criteria such as:

1) Determination of the adjacent connective tissue attachment;
2) Diagnostic wax-patterns with emphasis on peri-implant mucosal architecture;
3) Assessment of bone-to-prosthesis relationship (CBCT/bone sounding);
4) Possible bone and /or soft tissue augmentation to support objectively defined crown form;
5) Ideal placement of the implant relative to the planned gingival zenith;
6) Creating the ideal peri-implant mucosal using well-formed provisional crowns and abutments;
7) Selection of abutment and crown materials to support peri-implant mucosal health;
8) Removal of cement from the sulcus in case of cement-retained restorations.

According to Tarnow,[8] when the contact point to the bone crest on standardized periapical radiographs using paralleling technique was 5mm or less, the papillae were almost 100% present. When the distance was 6mm, 51% of the papillae were present, and when the distance was 7mm or greater only 23% of the papillae were present.[8] There are other factors determining the existence of the interdental papilla including the morphology and alignment of teeth, the mesio-distal distance between adjacent teeth and the volume of the embrasure space.[9]

Following anterior tooth removal and the recommended surgical treatment is done, the development and the maintenance of esthetic soft tissue architecture is to follow using interim restorations such as custom healing abutments, fixed interim prostheses, fixed bonded

Table 1: Surgical & Prosthetic Management of the Extraction Sefect Site
(Modified from Dr. Caplanis et al., by adding the prosthetic management after implant surgery by Dr. Tony Daher.



Defect Type	General Assess-ment	Socket Walls affected	Biotype	Hard Tissue	Distance to reference	Ideal Soft Tissue	Surgical Treatment Recommen-dations	Prosthetic Treatment Recommenda-tions
EDS-1	Pristine	0	Thick	0mm	0-3mm	Predictable	Immediate Placement (one Stage)	Provisional Screw Retained Crown or Bonded Ovate Pontic
EDS-2	Pristine to Slight Damage	0-1	Thin or Thick	0-2mm	3-5mm	Achie-vable but not predict-table	Site Preservation or immediate implant (one or two stage)	Bonded Ovate Pontic then Screw Retained Provisional Crown
EDS-3	Moderate Damage	1-2	Thin or Thick	3-5mm	6-8mm	Slight Compro-mised	Site preservation then implant placement (two stage)	Bonded Ovate Pontic then Screw Retained Provisional Crown
EDS-4	Severe Damage	2-3	Thin or Thick	>5	>8	Compro-mised	Site preservation then site development then implant placement (three stages)	Bonded Ovate Pontic then Screw Retained Provisional Crown

ovate pontics, and removable interim prostheses. Clinically we can make use of a provisional prosthesis as a template for the final prosthesis to induce the interdental papilla to undergo creeping papilla formation.[10]

The purpose of this paper is to describe and evaluate all possible provisional techniques available to restore a single tooth in the anterior esthetic zone and to give recommendations to the preferable techniques during site development and implant placement according to the EDS classification.

Interim Removable Partial Prosthesis

Interim removable partial prostheses are seldom used by the authors in the esthetic zone. It is hard to include positive rests and adequate retention in these interim restorations to prevent excessive compression of the extraction defect during the augmentation of soft and hard tissues. Because of its removable quality, interdental papillae could recede and get lost. (Figs 1a,b).

Custom Made Healing Abutments

Custom made healing abutments are used when

Figure 1a: Showing an anterior maxillary tooth and its interdental papillae missing.

Figure 1b: The missing interdental papillae are due to the wear "on and off" of maxillary interim acrylic removable partial denture also used as an orthodontic retainer.

a cement retained interim prosthesis is made. The authors do not like this procedure because it is time consuming, difficult to achieve optimum gingival contour, and hard to hide the cement margin.

Ovate Pontics

Ovate pontics (Figs 2a-g) preserve and establish esthetic soft-tissue emergence profiles following site preservation or development procedures. These provisional restorations with an ovate pontic design can be fabricated directly in the mouth or in the laboratory with the use of the study casts. It is tedious to fabricate a provisional restoration in the patient's mouth. A preplanning session could be done to prepare a smooth and easy fabrication of a fixed interim restoration. The objective of the preplanning session is to prepare the pontic(s) and a vacuum heat formed template. The vacuum heat formed template is made from study casts before the removal of the teeth in question or from a duplicate cast of a cast with a wax pattern replacing the missing tooth.

Ovate pontic(s) fabrication is done in the laboratory as follow (Figs 3a-i): cast surgery is performed to remove the tooth in question, creating a concavity with 2-3mm depth, partially simulating the extraction defect. A denture tooth, or the existing crown on the tooth to be extracted, or the clinical crown of the extracted tooth, all can be used to form ovate pontics. This ovate pontic will be bonded to the adjacent teeth after the removal of the tooth in question using a braided stainless steel wire. If the bonded ovate pontic is used without a retentive wire, the risk of debonding is possible. It is imperative to inform the patient when the pontic is loose, to come to the office as soon as possible to minimize the collapse of the surrounding soft tissues.

This pontic will fill in the missed contour and apply no pressure on the gingival margin and interproximal papillae, holding the tissue from collapsing following tooth extraction. They can be incorporated within fixed as well as removable transitional restorations either chairside or in the laboratory using conventional acrylic or composite. In case of ridge preservation procedures, the ovate portion of the pontic should make a less of 1mm depression on the membrane covering the bone graft. If the implant is placed and when the immediate loading is not indicated, the bonded ovate

Figure 2a: Immediate implant placement replacing a failing left maxillary central incisor.

Figure 2b: The modified existing metallo-ceramic crown of the extracted failing tooth is used as bonded interim fixed prosthesis.

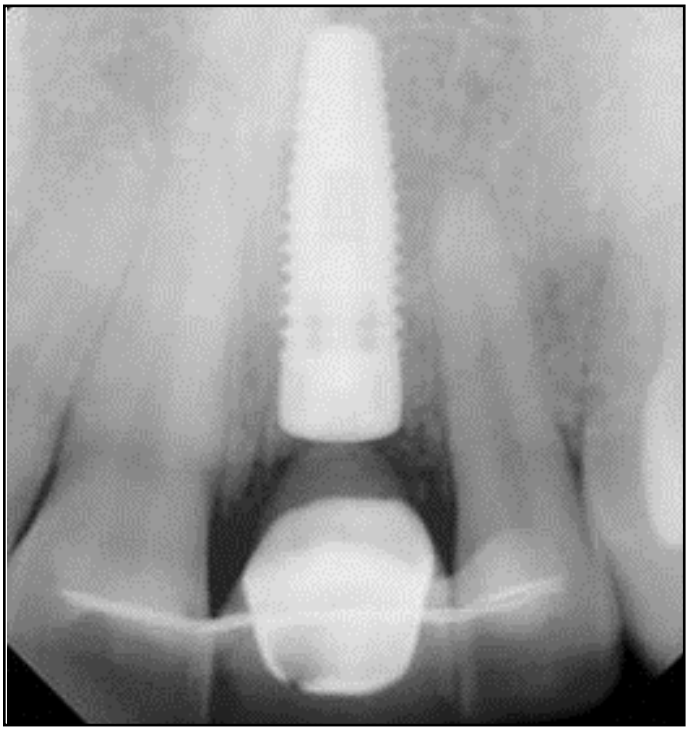


Figure 2c: The cover screw is placed over the implant, then the crown is relined with composite. The gingival area of the pontic is filled with composite material to support the gingival tissue and contoured to form an ovate shape. The top of the ovate shape touches the cover screw.

Figure 2d: The ovate pontic is bonded to the adjacent teeth.

Figure 2e: Any occlusal contacts must be removed in centric and lateral excursive movements.

Figure 2f: Final crown cemented over a custom made abutment.

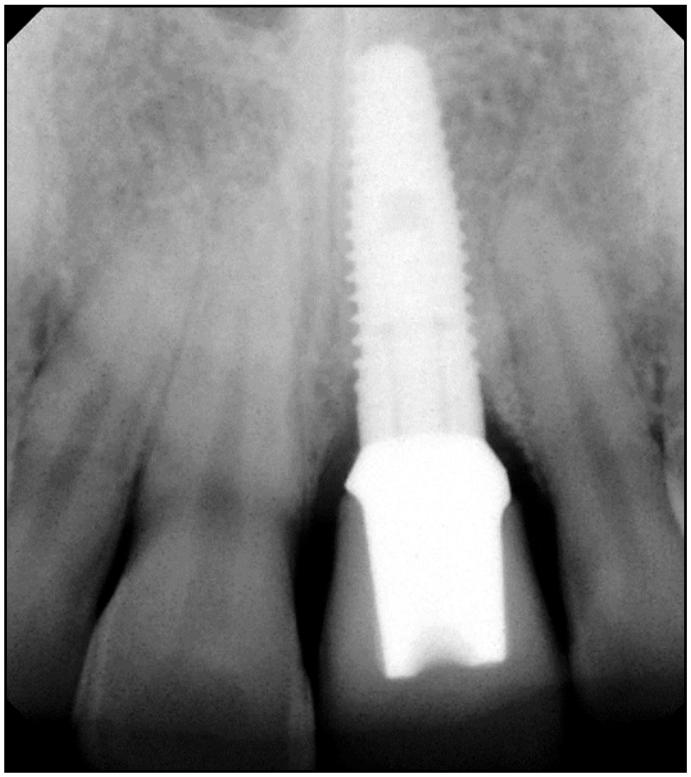


Figure 2g: Radiograph of final prosthesis.

portion of the pontic should be in intimate contact with the implant cover screw. This will facilitate the maintenance of the gingival contour and later on facilitate the formation of adequate contour of the interim implant fixed restoration.

Screw retained Provisional Crown

When the implant is placed with a torque >35Ncm and stable, a screw retained provisional crown can be made. Care is made to leave the interim crown off the occlusion in centric and excursive movements. We feel that in these situations, the screw-retained provisional restorations have many advantages over the cement-retained provisional restorations from a practical and biological point of view. If the access hole is on a labial or buccal surface, flowable composite will close it and make it undetectable.

Extraction Deficit is either EDS1 or EDS2

When the general assessment of the extraction deficit is pristine (EDS1) or slightly damaged (EDS2); (Figs 4a-g) the clinician has the option to place immediately the implant into the fresh extraction socket2. Clinical situations could arise either 1) the implant can be restored immediately with a provisional prosthesis in case adequate stability and a torque of > 35Ncm or; 2) the implant cannot be restored immediately. In the situation (2), a bonded ovate pontic can be placed to maintain the tissue architecture. The apical portion of the ovate pontic should be in contact with the implant cover screw.

Extraction Deficit is EDS3

When the general assessment of the extraction deficit is moderately damaged (EDS3) the clinician must do site preservation and then later place the implant. When the site preservation is done, a bonded ovate pontic can be placed to

Figure 3a: Vacuumed and heat formed template made on the cast before the removal of the questionable tooth.

maintain the tissue architecture and should not extend more than 1mm in the tooth socket. At a later date when the ridge preservation procedure is successful, the implant can be placed, thus bringing us to the situation of EDS1 or EDS2.

Extraction Deficit is EDS4

When the general assessment of the extraction deficit is severely damaged (EDS4) (Figs 5a-l) the clinician must do site preservation, then site development and then implant placement (3 stages). When the site preservation and site development are done, a bonded ovate pontic can be placed to maintain the tissue architecture. During site development the pontic could be made short to allow the bone graft to have enough space for healing purposes. At a later date when the ridge preservation procedure and the site development procedures are successful, the implant can be placed, thus bringing us to the situation of EDS1 or EDS2.

Figure 3b: The study cast.

Figure 3c: Removal of the right maxillary incisor and ridge contoured with an acrylic bur.

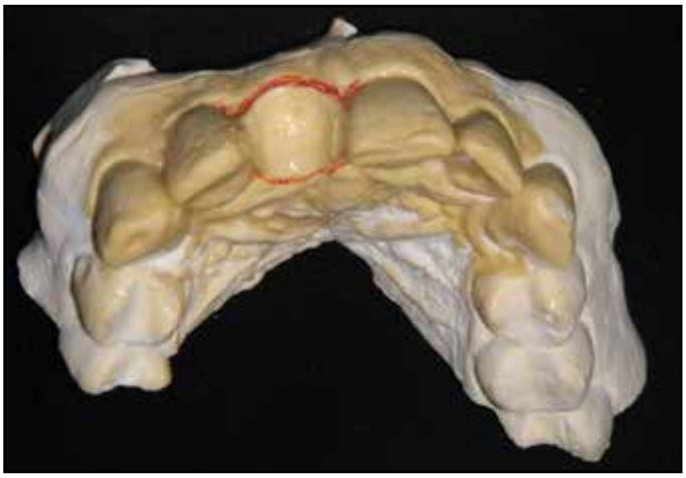


Figure 3d: Vaseline is painted in the area for isolation purposes.

Figure 3e: Provisional ovate pontic is made from the formed template and cervically contoured according the cervical contour of the extracted tooth.

Figure 3g: Provisional ovate pontic in place on study model (facial view).

Figure 3f: Provisional ovate pontic is made from the formed template and cervically contoured according the cervical contour of the extracted tooth.

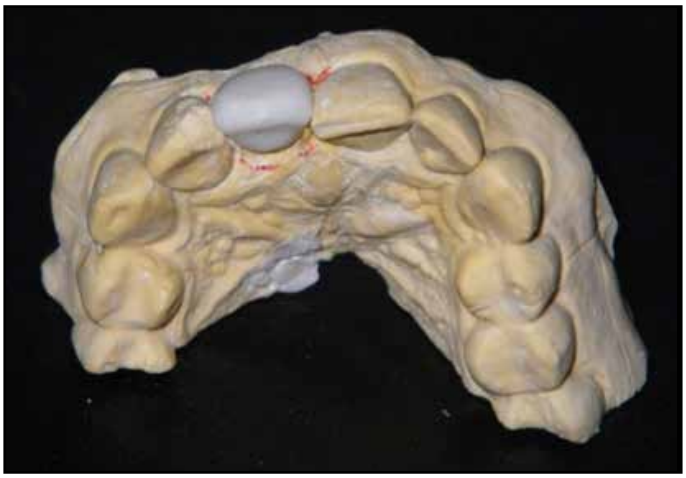


Figure 3h: Provisional ovate pontic in place on study model (incisal view).

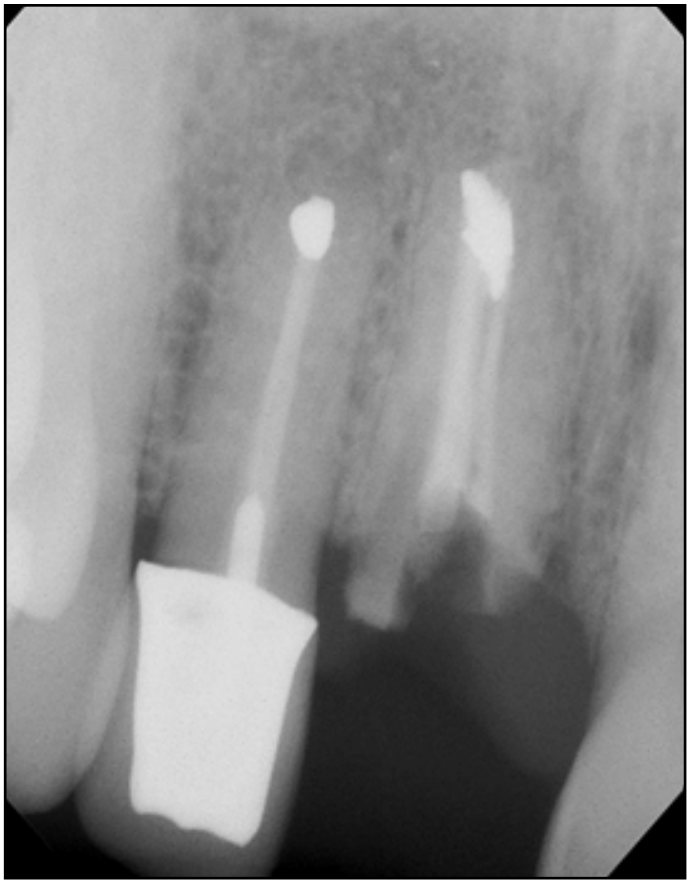


Figure 4a: Radiograph of left central incisor to be removed.

Figure 4c: The implant mount is removed and replaced with temporary abutment and the final provisional crown is made with the heat and premade vacuumed formed clear template from the study cast. BIS-GNA acrylic material is used for the screw retained provisional crown.

Figure 4b: Immediately placed dental implant after central incisor extraction.

Figure 4d: The screw retained provisional crown is finessed by adding flowable composite to the gingival shoulder of the temporary abutment.

Figure 4e: Provisional well contoured crown placed and left for 3 months for complete gingival healing and maturation. Caution is to be taken that no occlusal contacts are present on the provisional crown.

Figure 4f: Provisional crown left for 3 months for complete gingival healing and maturation. Caution is to be taken that no occlusal contacts are present on the provisional crown.

Figure 4g: Final implant crown in patient's mouth.

Figure 5a: Advanced periodontal lesion on the right lateral incisor.

Figure 5b: Ridge preservation using bone graft and resorbable membrane done right after tooth removal.

Figure 5c: An ovate-shaped denture tooth bonded in place using a rubber dam to optimize the bonding effect.

Figure 5d: An ovate-shaped denture tooth bonded in place using a rubber dam to optimize the bonding effect.

Figure 5e: An ovate-shaped denture tooth bonded in place using a rubber dam to optimize the bonding effect.

Figure 5f: Site healing after 4 months.

Figure 5g: Site healing after 4 months when ovate pontic is removed.

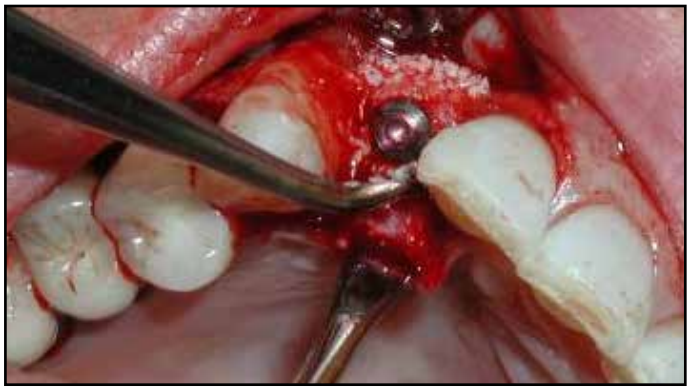


Figure 5h: Implant placement and simultaneous placement of bone graft.

Figure 5i: Implant placement and simultaneous placement of bone graft.

Figure 5j: Same bonded ovate pontic in place.

Figure 5k: Final cement retained implant crown over a custom abutment in place.

Figure 5l: Final cement retained implant crown over a custom abutment in place.

SUMMARY

Extraction sockets are often damaged so extensively multiple soft and hard tissues augmentation procedures are necessary to adequately develop the site with optimum hard and soft-tissue esthetics, and adequately manage the prosthetic situations. For that purpose it is strongly advisable to have a preplanning session for the preparation of a vacuum heat formed template and ovate pontic(s). The EDS classification attempts to categorize the most common extraction defect presentations and simplify the surgical and prosthetic treatment decision-making process.

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

References
1. Araujo MG, Lindhe J. Dimensional ridge alterations following tooth extractions. An experimental study in the dog. J ClinPeriodontol 2005;32:212-8.
2. Becker W. Immediate implant placement: diagnosis, treatment planning and treatment steps for successful outcomes. J Calif Dent Assoc 2005;33(4):303-10.
3. Seibert JS. Reconstruction of deformed partially edentulous ridges, using full thickness onlay grafts. Part Technique and wound healing. Compend ContinEduc Dent 1983;4:437-53.
4. Allen EP, Gainza CS, et al. Improved technique for localized ridge augmentation. A report of 21 cases. J Periodontol 1985; 56:195-9.
5. Wang HL, Al-Shammari K. HVC Ridge deficiency classification: a therapeutically oriented classification. Int J Period Rest Dent 2002;22:335- 43.
6. Caplanis N, Lozada JL, Kan JYK:Extraction Defect: Assessment, Classification and Management. Intern J of ClinImplDent, January-April 2009;1(1):1-11
7. Cooper L. Master of Esthetic Dentistry Objective Criteria: Guiding and Evaluating Dental Implant Esthetics. Journal of Esthetic and Restorative Dentistry 2008; 20(3):195–205.
8. Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. J Periodontol 1992;63:995-6.
9. Yu-Jen Wu, Yu-Kang Tu, Shay-Min Huang.The Influence of the Distance from the Contact Point to the Crest of Bone on the Presence of the Interproximal Dental Papilla. Chang Gung Med J 2003;26:822-8.
10. Hurzeler MB, Weng D. Functional and esthetic outcome enhancement of periodontal surgery by application of plastic surgery principles. Int J Periodontics Restorative Dent1995;15:298-310.

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