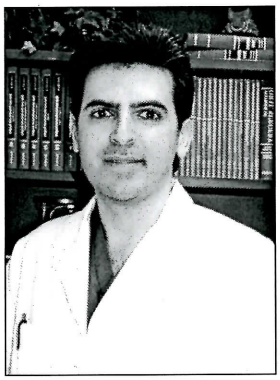
A Professional Courtesy of:

Ramin Shabtaie, D.D.S, Inc.

10921 Wilshire Boulevard, Suite 608
Los Angeles, California 90024
310-208-3471 • Fax: 310-208-2553
www.ImplantsinLa.com



Report on
ORAL SURGERY™
Focusing on Dental Implants

Forecasting Bisphosphonate-related Osteonecrosis Of the Jaws

Dentoalveolar surgery is the most frequently observed risk factor for the development of bisphosphonate-related osteonecrosis of the jaws (BRONJ). Some investigators have suggested that a reduction in the C-terminal telopeptide (CTX), a collagen degradation product used as a measure of bone resorption, can establish the degree of osteoclast suppression that may forecast the development of BRONJ following dentoalveolar surgery.

Fleisher et al from New York University College of Dentistry performed a retrospective study to investigate whether reduced serum CTX levels (≤150 pg/mL) were related to BRONJ following dentoalveolar surgery and whether certain radiographic alterations were associated with teeth that develop BRONJ after dental extraction. Variables that influence CTX levels include age, gender, alcohol consumption, smoking, ovulation, exercise, drugs (corticosteroids), disease (diabetes) and circadian rhythms. BRONJ is defined as the existence of exposed necrotic bone for >8 weeks in a patient without a history of radiation therapy to the jaws treated with a bisphosphonate. The clinical picture can be variable and asymptomatic, or exhibit mobility of teeth, soft-tissue inflammation, neurosensory alterations, sinus tracts and discharge.

The study design was a retrospective assessment of radiographic and/or serum CTX data from 68 patients who had a history of treatment with a bisphosphonate and who had received a dental extraction or had been diagnosed with BRONJ.

Postoperative healing was evaluated for 26 patients with diminished serum CTX levels (≤150 pg/mL) who had had a dental extraction or had been treated for BRONJ. Preoperative radiographs were assessed for 55 patients whose healing was within normal limits or who developed BRONJ following dental extraction.

Results of this study revealed that 100% of the patients (26 patients) who had serum CTX levels ≤150 pg/mL healed within normal limits subsequent to dentoalveolar surgery (20 patients) or following therapy for BRONJ (6 patients). Of the 55 patients who had radiographic assessment, 24 patients

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with BRONJ (83%) demonstrated periodontal ligament (PDL) widening affiliated with extracted teeth, but only 3 patients who healed normally (11%) illustrated PDL widening.

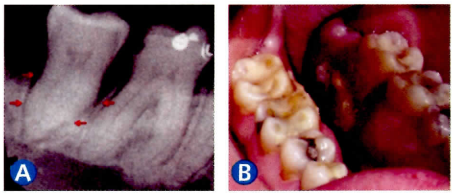

Figure 1. PDL widening along the root of the mandibular right second molar (A) with lingual bone exposure (B). (*Reprinted with permission from Fleisher KE, Welch G, Kottal S, et al. Predicting risk for bisphosphonate-related osteonecrosis of the jaws: CTX versus radiographic markers.* Oral Surg Oral Med Oral Pathol Oral Radiol Endod *2010;110:513.*)

Conclusion

Because BRONJ is usually not radiographically discernable in its early stages, there may be a delay in establishing a diagnosis. However, late radiographic manifestations may include osteolysis, osteosclerosis and persistence of the extraction socket outline. The data from this study suggest that PDL widening viewed on a radiograph may be a more sensitive and practical indicator than CTX testing when attempting to predict the risk of BRONJ (Figure 1). Healing of patients having dental extractions or treatment for BRONJ can occur with low-serum CTX levels, and periodontal alterations may predispose the patient to BRONJ.

Fleisher KE, Welch G, Kottal S, et al. Predicting risk for bisphosphonate-related osteonecrosis of the jaws: CTX versus radiographic markers. Oral Surg Oral Med Oral Pathol Oral Radiol Endod *2010;110:509-516.*

Survival Rate of Replaced Implants

Kim et al from Seoul National University Bundang Hospital, South Korea, evaluated the survival rate and condition of replaced implants following removal of failed implants. The researchers recruited 49 patients who had had a total of 60 implants (39 implants in men, 21 implants in women) placed and subsequently experienced failure of the implant, requiring the insertion of a replacement. The mean age of these patients was 53.2 ± 10.8 years. These implant failure cases were selected as a subset of a larger group of 573 patients.

Within this group of patients, the study revealed that the maxillary first molar region was the most frequent site of implant failure. When initial implant failure occurred, the failure rate subsequent to a functional prosthesis (late failure) was 31.7%; the failure rate during the healing phase after implant placement (early failure) was 68.3%. Complications after the first implant placement included osseointegration failure (86.7%), infection (5.0%), implantitis (5.0%), malposition (1.7%) and fracture of fixture (1.7%).

Immediate replacement of the failed implant occurred in 48.3% of the cases; delayed replacement occurred in 51.7% of the cases. When a delayed placement protocol was utilized, the average healing period was 2.40 ± 3.06 months. However, there was no significant difference in the failure rate of the replacement implant when either the immediate or delayed placement protocol was used.

Failure rate of the second implant was 11.7%. In all cases of second implant failures, the authors placed a third implant. The second and third implants in all patients survived until the final follow-up (22.00 ± 14.56 months following implant insertion). The marginal bone loss at the final follow-up was 0.33 ± 0.49 mm, the width of the attached gingiva was 1.68 ± 2.11 mm and the pocket depth was 3.33 ± 1.21 mm.

Conclusion

Implant failure is multifactorial, involving the dentist, the patient and the implant material used (Table 1). Implant survival in patients experiencing initial implant failure can be improved through the placement of an additional implant.

Kim Y-K, Park J-Y, Kim S-G, Lee H-J. Prognosis of the implants replaced after removal of failed dental implants. Oral Surg Oral Med Oral Pathol Oral Radiol Endod *2010;110:281-286.*

Table 1. Implant failure factors

Dentist	Patient	Implant material
• Bone necrosis due to overheating	• Bruxism	• Biocompatibility
• Contamination	• Parafunctional habits	• Surface treatment
• Inappropriate number, length and width of implants	• Poor dental hygiene	• Design
• Inappropriate site or orientation	• Smoking	
• Prosthesis design	• Drug therapy	
• Occlusal interference	• Radiation therapy	
• Preparation and adjustment of prosthesis	• Uncontrolled diabetes	

Management of Impacted Maxillary Canines

The role of the practitioner is critical in the identification of impacted maxillary canines and the appropriate and timely referral from the orthodontist to the oral and maxillofacial surgeon. If the identification and suitable referrals of the impacted canines are properly initiated without delay, and the proper uncovering techniques are selected, the eruption process can be simplified. This will result in predictable stability and esthetics. Kokich from the University of Washington delineated the approaches to treat labial and palatal maxillary canine impactions, orthodontic mechanics, and long-term stability, as well as the rationale for certain surgical approaches.

Third molars are the most frequently impacted permanent teeth, followed by impacted canines, of which one-third are situated labially or within the alveolus and two-thirds are located palatally. Proper timing and surgical approach to exposure of an impacted canine are dictated by certain criteria.

Labially impacted canine

Labial impaction of the maxillary canine is caused by ectopic migration of the canine over the lateral incisor root or a shift of the midline of the maxillary dentition, creating inadequate space for canine eruption. One study suggested that removal of the deciduous canine by age 8 to 9 years self-corrects the problem and improves the chance of canine eruption. The 3 techniques available for uncovering the labially impacted maxillary canine are the excisional uncovering (Figure 2), apically positioned flap and closed eruption approaches. The criteria utilized to select the most appropriate approach included determination of the labiolingual position of the crown of the impacted canine, the vertical position of the tooth relative to the mucogingival junction, the quantity of gingiva in the area of the impacted canine and the mesiodistal position of the canine crown.

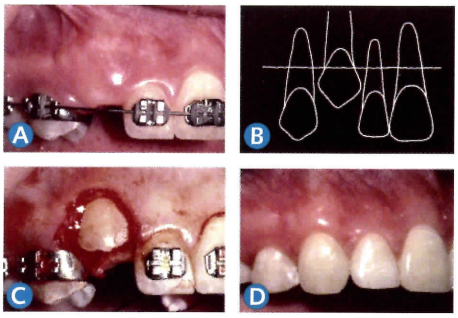

Figure 2. (A) Space created orthodontically. (B) Tooth labially positioned, coronal to mucogingival junction. (C) Excisional procedure to uncover impacted canine. (D) After orthodontic eruption, relationship of gingival margins relative to adjacent teeth was normal with adequate zone of gingiva. (*Reprinted with permission from Kokich VG. Surgical and orthodontic management of impacted maxillary canines.* Am J Orthod Dentofacial Orthop *2004;126:279.*)

Palatally impacted canine

If radiographs demonstrate that the crown of the permanent canine is positioned over the maxillary lateral incisor root but not past the mesial surface of the root, self-correction of the ectopic canine is evident with a high level of predictability. When the permanent canine is situated beyond the mesial surface of the root of the lateral incisor, self-correction will not occur, and the impacted canine must be exposed by the surgeon and properly positioned in the arch by the orthodontist (Figure 3).

Assessment of the position of the impacted canine crown

Radiographs are used to assess the correct position of the crown. When utilizing periapical radiographs, the buccal object rule is applied to determine the labiolingual position of the crown of the impacted canine. This rule posits that when screening 2 adjacent periapical radiographs of the impacted canine taken at slightly variable horizontal angles, the buccal object will appear to move in the opposite direction of the x-ray beam, and when the impacted tooth is on the palate, the crown of the tooth will move in the same direction as the x-ray beam.

This principle can be remembered by using the mnemonic S.L.O.B. rule (same lingual, opposite buccal). Three-dimensional cone-beam computed tomography can also interpret buccolingual information, define the extent of root resorption, allow the surgeon to view the surgical anatomy and permit the orthodontist to plan directional traction.

Conclusion

The general dentist's understanding of the principles of diagnosis and treatment of the maxillary impacted canine is essential for the overall successful outcome of these types of cases.

Kokich VG. Surgical and orthodontic management of impacted maxillary canines. Am J Orthod Dentofacial Orthop *2004;126: 278-283.*

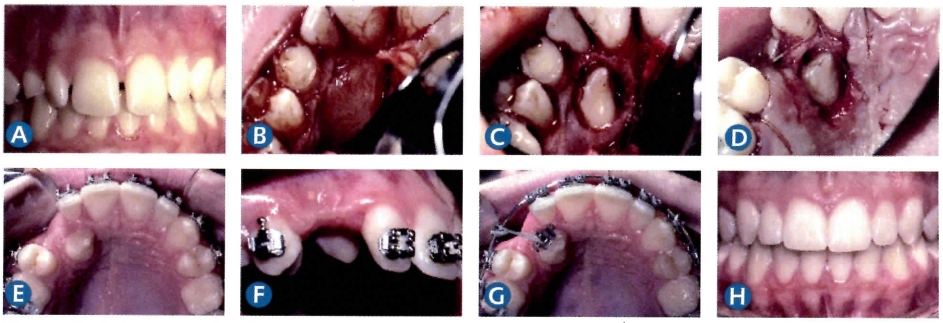

Figure 3. (A) Impacted right canine on palate. (B) Flap reflected. (C) Palatal bone removed down to cementoenamel junction. (D) Hole placed in flap. (E–F) Canine erupted without orthodontic forces. (G) Bracket placed on canine. (H) Symmetry of maxillary right and left canines. (*Reprinted with permission from Kokich VG. Surgical and orthodontic management of impacted maxillary canines.* Am J Orthod Dentofacial Orthop *2004;126:282.*)

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Survival Rate of Immediately vs Delayed Loaded Implants

The original surgical protocol for implants established by Brånemark consisted of submerging an implant following placement and maintaining a nonloaded implant environment for 4 to 6 months. The patient's desire to shorten the treatment period and to avoid an edentulous condition encouraged the introduction of an immediately loading protocol.

Romanos et al from the University of Rochester, New York, analyzed human and animal histologic and histomorphometric data, as well as clinical evidence from an immediate loading protocol for variable bone qualities. The authors wanted to determine the influence of bone quality on conventional delayed loading compared with immediate loading. They assessed the clinical outcomes and the peri-implant bone responses to the 2 different protocols (delayed and immediate). Analysis of the literature search revealed high levels of osseointegration and elevated survival rates of immediately loaded implants, along with high percentages of bone-to-implant contacts.

Immediately loaded implants were initially defined in 2002 at the World Congress Consensus Meeting in Barcelona, Spain, as implants that have been placed in the bone and have been restored with occlusal contacts within 3 to 4 days subsequent to surgery. The advantages of an immediate loading protocol include

1. an abbreviated treatment period
2. improved patient satisfaction and quality of life
3. the avoidance of an edentulous or partially edentulous state

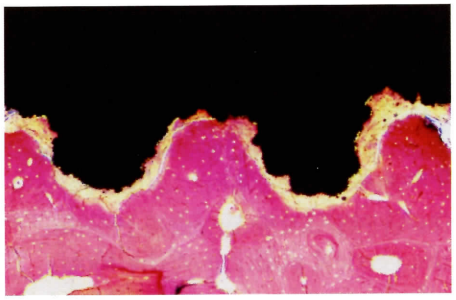

Figure 4. Implant-bone interface intimately related as seen in immediately loaded and delayed loaded implants.

The success of immediately loaded implants is clinically dependent on implant stability and histologically dependent on bone response. Other factors influencing implant stability include

1. geometry and length of implant
2. morphology of the surface
3. splinting of implants
4. control of occlusal load
5. quality of bone
6. lack of deleterious patient parafunctional habits

The results indicated that immediate implant loading may stimulate bone formation around the implants (Figure 4) as evidenced in animal and human studies. The authors suggested that there must be satisfactory biomechanical force transfer between the implant and peri-implant bone for implant osseointegration to occur. Therefore, when an immediate loading protocol is utilized, the design of the implant is essential for the bone formation to take place. The orthopedic literature has demonstrated new bone formation with active remodeling of the bone when the bone is mechanically stimulated.

Conclusion

Analysis of pertinent publications from 2003 to 2008 revealed that the overall survival rate of implants using the immediate loading protocol ranged between 90% and 95%, which is comparable with the traditional 2-stage delayed loading protocol implant survival rate of 92%. Thus, the immediate loading protocol for dental implants offers many patient benefits, including long-term outcomes, even in situations with less-than-ideal bone quality.

Romanos G, Froum S, Hery C, et al. Survival rate of immediately vs delayed loaded implants: analysis of the current literature. J Oral Implantol *2010;36:315-324.*

In the next issue:

- Treatment of avulsed teeth
- Outcomes of placing short dental implants in the posterior mandible
- Decompression of odontogenic cystic lesions
- Osseoperception: active tactile sensibility of osseointegrated implants

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