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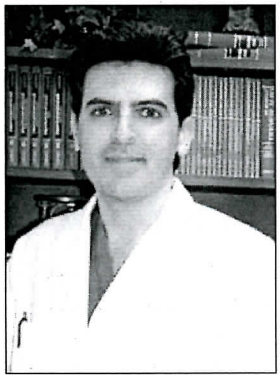

Report on ORAL SURGERY™

Focusing on Dental Implants

Implant Removal Influencing the Resolution of IAN Injury

Nerve injury during implant placement is a serious yet preventable complication with medicolegal implications. An implant preparation that disturbs the integrity of the inferior alveolar nerve (IAN) canal roof may produce hemorrhage into the canal or may deposit debris that compresses the nerve, producing ischemia. This pressure on the nerve may persist even if the implant is "backed out" or a shorter implant is placed. An electric shock during drilling or an inferior alveolar arterial or venous bleed may be indicative of damage to the IAN. Khawaja and Renton from King's College London Dental Institute, United Kingdom, assessed sensory disturbance and recovery in 4 patients with implant-related IAN injury and attempted to determine whether early removal of the implants promoted neural recovery.

In the first case, a 55-year-old woman received 2 implants in the lower right molar region. During the evening after surgery, the patient reported persistent numbness in her lower right chin and lip. The implants were removed approximately 17.5 hours after surgery. The patient's subjective function was reduced to 3–4 (on a scale of 0–10) in the dermal area of the neuropathic region and 6–7 in the vermillion region of the right IAN. Panoramic tomography showed that the implant sockets did not transect the IAN canal. Six weeks after surgery, the patient presented with markedly improved sensation.

The second case involved a 56-year-old woman who received 1 implant in the lower left first molar region. Overnight, the patient experienced numbness in the lower left lip, chin and lower anterior teeth. The implant was removed after 24 hours. After 2 months, the patient presented with markedly improved sensation and little residual effect.

The third patient, a 46-year-old woman, received 1 implant in the lower left second premolar region. She experienced persistent numbness of the lower lip and chin, and her implant was removed 2 days after placement. The patient suffered permanent neuropathy involving 100% of the IAN dermatome extra-orally, accompanied by a degree of thermal and mechanical allodynia with hyperalgesia.

Inside this issue: **Spring 2010**

Report on ORAL SURGERY™
Spring 2010

The fourth patient was a 39-year-old woman who received 1 implant in the lower right second premolar region. After persistent numbness of the right lower lip and chin, the implant was removed 4 days post-surgery. At examination 2 months following surgery, the patient showed neuropathy in 100% of the IAN dermatome, with a degree of mechanical allodynia with hyperalgesia. The patient accepted her permanent neuropathy.

No standardized guidelines exist regarding the management of implant-associated nerve injury. Although some authorities recommend referral of peripheral sensory nerve injuries before 4 months, this may be too late; within 3 months, permanent central and peripheral changes occur that are unlikely to respond to surgical intervention.

Many IAN injuries can be prevented with better patient selection, planning and performance of the procedures. A 2-mm zone of safety between an implant and the coronal portion of the mental foramen and IANs has been recommended. However, the clinician must recognize that certain preparation drills are ≤1.5 mm longer than the placed implant. Objective measures, such as assessment of light touch pressure, subjective function, sharp-blunt discrimination, 2-point discrimination and neuralgia, should be taken after suspected nerve damage.

Conclusion

IAN injury-associated neuropathy related to the placement of implants may be permanent, even if the implant is removed. If removal is required, the procedure must be done as quickly as possible. Some specialists no longer remove implants in patients presenting with IAN neuropathy, particularly after significant delay in referral.

Khawaja N, Renton T. Case studies on implant removal influencing the resolution of inferior alveolar nerve injury. Br Dent J *2009;206:365-370.*

Diplopia After Inferior Alveolar Nerve Block Anesthesia

Complications related to local anesthesia can be divided into 2 groups: local and systemic. Systemic complications may be the result of inadvertent intravascular injection, rapid absorption of the local anesthetic into the circulatory system, slow elimination or interactions with other medications.

Examples of systemic complications include

- toxic reactions to the local anesthetic (overdosage)
- toxic reactions to the vasoconstrictor
- allergic reactions to the local anesthetic or other components present in the cartridge
- cardiovascular effects

Examples of local complications include

- hematoma
- pain during injection
- burning sensation (hyperesthesia)
- paresthesia
- trismus
- infection
- edema
- separation of the needle
- sloughing of tissues
- self-inflicted soft-tissue trauma
- facial nerve paralysis
- impairment of ocular function including temporary blindness, diplopia (double vision) and ophthalmoplegia

Ocular complications resulting from the administration of an inferior alveolar nerve (IAN) block are extremely rare. However, at least 12 cases of diplopia have been reported in the dental literature.

Choi et al from Yonsei University, South Korea, published a report of 2 cases of diplopia subsequent to IAN block. Case 1 involved a 34-year-old woman undergoing extraction of the left lower third molar; case 2 involved a 15-year-old male being treated for a dentigerous cyst on the right lower second molar. Each patient reported altered ocular function following the administration of 1 cartridge of 2% lidocaine with 1:100,000 epinephrine using a 30-mm, 27-gauge needle with negative aspiration.

Case 1: Signs and symptoms

- Discomfort on the ipsilateral side of the face
- Diplopia
- Burning sensation on the occipital area
- Normal visual acuity on ocular function test
- Normal function of the facial nerve and its associated musculature
- No blanching on the burning sensation site or the oral mucosa
- Resolution of all symptoms 15 minutes after the initial observation

The original injection achieved satisfactory anesthesia, and the procedure was completed; none of the symptoms recurred.

Case 2: Signs and symptoms

- Pain and discomfort
- Diplopia in the right eye, whether the left eye was closed or opened
- Normal vision and movement in the left eye
- No alteration in the vital signs
- No alteration in mental status
- Normally functioning ocular muscles
- Intact facial nerve
- Resolution of all symptoms 1 hour after the initial observation

The original injection achieved satisfactory anesthesia, and the procedure was completed; none of the symptoms recurred.

The authors posed 2 hypotheses to explain the mechanism of diplopia caused by the IAN block. The middle meningeal artery is one of the major branches of the maxillary artery, which carries the anesthetic into the maxillary artery. However, in an anatomic variation that occurs in 1% of cases, the ophthalmic artery branches from the middle meningeal artery. In this situation, an IAN block may flow from the maxillary artery into the middle meningeal artery and then to the ophthalmic artery, thus producing ocular complications.

The second hypothesis for diplopia is malfunction of the extraocular muscles after diffusion of the anesthetic solution to the infratemporal fossa, pterygomaxillary fossa, inferior orbital fissure or orbital cavity, resulting in the anesthesia of the abductor muscle. The use of articaine may present a higher risk of complications because it has higher diffusion properties. The Gow-Gates method may also present a higher risk of complications related to the eye.

Conclusion

Most reported cases of diplopia related to IAN block resolved within 5 hours; the remaining case resolved within 2 weeks. When ocular complications are identified, vital signs, eye movement, visual acuity, facial muscle movement and blanching must be evaluated so that a diagnosis can be made.

Choi E-H, Seo J-Y, Jung B-Y, Park W. Diplopia after inferior alveolar nerve block anesthesia: report of 2 cases and literature review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod *2009;107:e21-e24.*

Dental Implants And Infection

Pye et al from Glasgow University, United Kingdom, reviewed the literature on dental implants with a focus on factors leading to infection and potential implant failure. Despite the fact that implants are often placed in a contaminated field, their clinical success has been reported to be as high as 90–95%. Achieving osseointegration of the implant and the bone is the main prerequisite for a stable implant. Peri-implantitis, an inflammation of the tissues around a functioning, osseointegrated implant, is a frequent cause of failure.

Classification of failures

The classification of implant failure includes both failing and failed implants; a failing implant shows a progressive loss of supporting bone yet remains clinically immobile, whereas a failed implant has become clinically mobile. Removal of a failed implant is recommended, while a failing implant may be retained if the problem is recognized early and treated appropriately.

Implant failures may also be considered as early or late failures, with early failures occurring before osseointegration and prosthetic rehabilitation, and late failures occurring afterward. Factors affecting early failure of dental implants are summarized in Table 1. The etiology of late failures is poorly understood but may be related to changes in the quality and volume of bone as well as to peri-implantitis.

Table 1. Factors affecting early failure of dental implants

Factor	Comment
Implant	Previous failure Surface roughness Surface purity and sterility Fit discrepancies Intra-oral exposure time Premature loading
Mechanical overloading	Traumatic occlusion
Patient (local factors)	Oral hygiene Bone quality/quantity Periodontal status of natural teeth Soft-tissue viability Vascular integrity Adjacent infection
Patient (systemic factors)	Smoking Alcoholism Predisposition to infection Systemic illness Chemotherapy/radiation therapy
Surgical technique/environment	Surgical trauma Overheating (use of handpiece)

Report on
ORAL
SURGERY™
Spring 2010

Microbiology of failures

While no single microorganism has been closely associated with implant failure, the microflora associated with peri-implantitis is similar to that observed in chronic periodontitis. Anaerobic gram-negative bacilli such as *Porphyromonas gingivalis* and *Prevotella intermedia*, and spirochetes including *Treponema denticola*, often predominate. Other microorganisms not usually associated with periodontitis, such as staphylococci, coliforms and *Candida* spp., have been isolated from peri-implant lesions. Both *Staphylococcus aureus* and coagulase-negative staphylococci have been linked with infections associated with metallic biomaterials. No standardized antibiotic regimens for dental implant placement or peri-implantitis have been established.

Failing dental implants are determined both clinically and radiographically using a mechanism similar to that used for periodontitis. The diagnosis is established by measuring the clinical parameters, including

- peri-implant loss of attachment
- bleeding upon probing
- plaque/gingivitis indices
- suppuration
- mobility

Conclusion

Few published guidelines exist on infection control during the placement of dental implants. However, several strategies have been suggested to reduce the oral flora during surgery. One strategy involves having the patient rinse preoperatively with chlorhexidine to reduce postoperative infection. An in vivo study indicated that chlorhexidine was more effective than was the use of antibiotics in inhibiting *P gingivalis*. Another study indicated that 2 g of amoxicillin given orally 1 hour before surgery significantly reduced early failure of dental implants. At surgery, the implant should be stored in the manufacturer's sterile packaging and used only with the recommended instruments. Concerns have been expressed over the efficacy of dental instrument decontamination; some manufacturers produce single-use drills for their implant systems.

Pye AD, Lockhart DEA, Dawson MP, et al. A review of dental implants and infection. J Hosp Infect *2009;72:104-110.*

Implants in Fresh Extraction Sockets

Botticelli et al, on behalf of the ARDEC Dental Clinic, Italy, conducted a prospective study that evaluated the 5-year clinical outcome of implants placed in fresh extraction sockets. The researchers extracted teeth from 18 consecutive patients. Cylindrical implants with a 4.1-mm diameter were installed in the extraction sockets, with the coronal margin of the endosseous portion of the implant placed apical to the marginal level of the buccal wall of the extraction socket.

After 4 months of healing, the sites were reentered, the closure screws were removed and the healing abutments were attached. After an additional 1–3 months (mean, 1.4 months), 10 cemented fixed partial dentures and 11 single-tooth restorations were placed, completing the prosthetic treatment. One week following the cementation of the prosthesis, a clinical baseline examination measured plaque, mucositis, probing pocket depth, the soft-tissue position with respect to the restorative crown margin and the marginal bone height. All measurements were repeated at 3 and 6 months, then annually.

At the time of the 5-year follow-up, no implants were lost. At 5 years, 13% of the sites measured harbored plaque and 15% of the sites had mucositis. The marginal level of peri-implant mucosa was above the margin of the restoration by

- 0.4 ± 1.3 mm at the buccal surface
- 1.0 ± 1.1 mm at the lingual surface
- 2.0 ± 0.6 mm at the proximal surface

Mean bone level showed a significant gain from baseline of 0.23 ± 0.43 mm ($p < .05$); 15 implants (71%) showed a mean gain of 0.41 ± 0.35 mm.

Conclusion

This study demonstrated that over a 5-year follow-up, immediate implants loaded 5–7 months after placement had a high success rate. All patients in this study were enrolled in a carefully supervised oral hygiene program, which was reflected in the plaque and mucositis scores; this supportive therapy showed decisive importance to the success rate achieved in this cohort.

Botticelli D, Renzi A, Lindhe J, Berglundh T. Implants in fresh extraction sockets: a prospective 5-year follow-up clinical study. Clin Oral Impl Res *2008;19:1226-1232.*

In the next issue:

- Periodontal disease and atherosclerotic disease
- Oral implications of cancer chemotherapy
- Biofilm on dental implants
- Evaluation of peri-implant tissue response according to the presence of keratinized mucosa

Do you or your staff have any questions or comments about **Report on Oral Surgery***?*
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