

Hard and Soft Tissue Surgical Complications in Dental Implantology



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KEYWORDS

• Hard tissue • Soft tissue • Implant • Complications • Nerve injury • Peri-implantitis

KEY POINTS

- Complications can be avoided with proper surgical technique and treatment planning.
- Soft tissue complications include nerve injury, flapless surgical complications, and sinus complications.
- Hard tissue complications include complications from bone grafting and peri-implantitis.

No matter what measures are taken, doctors will sometimes falter, and it isn't reasonable to ask that we achieve perfection. What is reasonable is to ask (is) that we never cease to aim for it.

—Atul Gawande, *Complications: A Surgeon's Notes on an Imperfect Science*

INTRODUCTION

As with all surgical procedures, complications will occur. One can expect that the longer one is in surgical practice, the more procedures performed, there will be complications. Dental implantology is no different. The purpose of this article is to discuss surgical complications associated with the placement of dental implants, specifically focusing on how they occur (etiology), as well as their management and prevention. Dental implant surgical complications can be classified into those of hard and soft tissues.

Soft Tissue Complications

Mandibular nerve injury

The third branch of the trigeminal nerve (mandibular nerve or inferior alveolar nerve, IAN) is at constant risk of injury secondary to any mandibular

oral and maxillofacial surgical procedure. This nerve provides sensation to the lower lip and chin, as well as innervating the associated dentition. It also provides motor innervation for the muscles of mastication and sensation to the tongue. Injury to the IAN can result in partial or complete paresthesia, analgesia, anesthesia, or in rare cases dysesthesia, to the structures it innervates.¹ The incidence of IAN injury secondary to dental implant surgery is variable, with a range of 0% to 44% in the literature.² The etiology of IAN injury is usually associated with inadequate planning or overzealous implant placement, with injury occurring as a result of either miscalculation of nerve position from the preoperative radiographic assessment or injury via placing implant drills or fixture too apical into the nerve canal. In rare cases, the IAN can be injured from local anesthetic injection (injection injury) or retraction of the gingival flap causing stretching of the mental nerve (terminal branch of the IAN). In the edentulous/atrophic mandible, the mental foramen may be located at the crest of the alveolar ridge, and it can be at a higher risk of being traumatized from incision and flap elevation. Prevention of IAN injury is directly related to proper and thorough preoperative implant planning.

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Ideally Cone beam computerized tomograms (CBCTs) or conventional computed tomography (CT) scans can be utilized as part of the treatment planning phase to not only plan for implant size, location, and vector of placement, but also to identify and avoid the mandibular canal. Proper measurements and the use of implant planning software are all excellent tools in planning ideal implant placement that avoids injury to the IAN. If a panoramic radiograph is used, the surgeon must be able to adequately visualize the course of the IAN in the mandibular body and parasymphysis regions. When measuring the distance of the alveolar ridge to mandibular nerve canal, one must factor in up to a 25% magnification (magnification factor of 1.25) on the panoramic radiograph. As such, clinical bone height can be more adequately planned by dividing radiographic bone height by the magnification factor (usually 1.25) according to the formula:

$$\text{Clinical bone height} = \frac{\text{radiographic bone height}}{\text{magnification factor}}$$

For example, if the measured radiographic bone height is 13 mm, dividing by 1.25 gives a clinical measurement of 10.4 mm, then the use of an implant fixture less than 10.4 mm will ensure that the IAN will be protected.

Intraoperatively, utilizing CT-based surgical guides (presurgically fabricated based on CT evaluation during the treatment planning phase with precise CT-based placement of the dental implant with depth control away from IAN) can also protect the IAN. Other options include taking radiographs step by step during the procedure with either a drill or positioning locator in place to ensure that the drilling has not gone more apical than planned. If radiographically the IAN canal is violated or it appears that a drill has gone too apical, options include using shorter drills for a shorter implant, aborting the procedure with or without a bone graft, or

redirecting fixture placement. If the radiograph indicates that the canal is violated, clinical assessment can give clues to extent of injury (if any). Violation or injury to the IAN will cause electric shock like pain in even those with good nerve block; the appearance of significant (though transient) bleeding may occur out of osteotomy. Use of local infiltration as opposed to nerve block can also maintain patient feedback while drilling in the posterior mandible. Topical dexamethasone has been suggested to reduce inflammation in the site of injury. If there is witnessed gross injury to the mandibular canal or IAN, then immediate referral to a microsurgery specialist for treatment is indicated.

An immediate postoperative panoramic radiograph must be taken to assess the placement of the implant(s). If the IAN canal appears encroached, the implant must be backed out or removed. If the implant appears positioned clear of the canal, but the patient has a consistent paresthesia that has not improved within 2 to 3 days after surgery, it is reasonable to either observe or obtain a CBCT to assess if the canal was damaged during placement. If there appears to be damage to the canal (most likely from overzealous drilling) referral to a microsurgery specialist is indicated. If there is no injury to the canal, but the paresthesia persists and the implant appears close to the canal, backing out or removing the implant is indicated. If there does not appear to be encroachment of the implant on or injury to the mandibular canal, postoperative edema maybe the cause of the paresthesia, and a course of corticosteroids may be helpful. If there appears to be no improvement, then consideration of an injection injury must be considered and referral to a microsurgery specialist (Fig. 1).

Sinus/nasal floor perforation

Perforation of the maxillary sinus and nasal floor occur, usually secondary to poor planning or

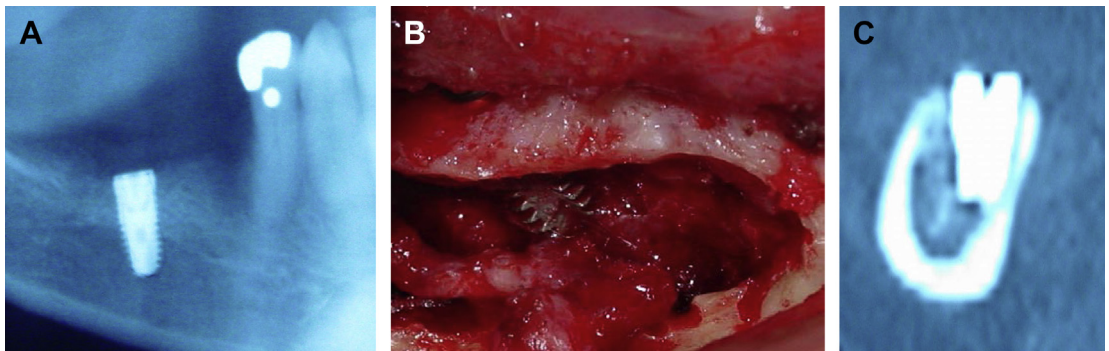


Fig. 1. (A) Panoramic radiograph of implant placed into right mandibular canal. (B) Buccal plate bone window created with implant into mandibular canal and neurovascular bundle. (C) Coronal CT scan with implant into canal. (Courtesy of Dr Vincent Ziccardi, Newark, NJ.)

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