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CASE STUDY

COMPLICATIONS IN IMPLANT DENTISTRY

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ABSTRACT

Dental implants have become a mainstay for restoring teeth that have been lost over the last few decades. Eventhough success rates in implant dentistry are well above 90 percent, complications do occur. Most complications are preventable with proper diagnosis, treatment planning and execution. Other complications are inherent to the risks of surgery and may require intervention. The purpose of this paper is to classify the possible complications that may occur and to discuss their prevention and management.

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INTRODUCTION

Dental implants are a viable alternative for many patients in need of dental prosthesis and are widely accepted because they provide the tripartite objective of function, esthetics, and comfort. Although dental implants have improved the quality of life of many patients, a wide body of literature has reported their associated morbidity. A complication is defined in the Glossary of Oral and Maxillofacial Implants as an "Unexpected deviation from the normal treatment outcome." In 1981, Adell and co-workers (Adell *et al*., 1981) classified complications into three categories: 1) loss of osseointegration, 2) gingival complications, and 3) mechanical complications. This classification was later expanded by Balshi (1989), who included esthetic, phonetic, functional, and ergonomic complications. The purpose of this review article is to provide a systematic method of assessing the complications associated with implant placement or restoration, to offer guidelines for selecting the most appropriate management method for dealing with specific complications, and present suggestions for preventing surgical or restorative complications.

Presurgical complications

The list of risk or potential risk factors for implant failure is extensive. A thorough review of the medical questionnaire, medications, and social habits may shed some light on the prognosis of implant therapy in a patient. Patients with uncontrolled metabolic (diabetes, hyperlipidemia) or systemic (hypertension, osteoporosis) disorders may be at a higher risk of suffering from complications. Heavy smoking or drinking and drug habits may interfere with wound healing and therefore increase the risk of post-operative infections and complications. A few conditions should be considered as contraindications for elective implant therapy: IV bisphosphonate therapy, ongoing chemotherapy with immunosuppression, and history of radiation therapy adjacent or directly to the planned surgical area.A thorough intra-oral examination can help the clinician determine whether a particularpatient is a good candidate for dental implants. Poor oral hygiene and active periodontal disease should be addressed prior to commencing dental implant therapy. Recurrent decay and a high caries risk should be a warning sign of a non-compliant patient.

Surgical complications

Complications that occur during surgery have the potential to become the most serious. These events may be a result of inadequate planning, mishandling of surgical instruments, anatomical variations, inexperience of the operator, or simply the risks of the procedure itself.

Bleeding

Major bleeding during the placement of dental implants is uncommon and can be life threatening. The causes of major

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bleeding may be related to systemic issues or regional anatomy. Patients taking anticoagulants are at a higher risk of postoperative bleeding after simultaneous extraction and implant placement are combined if coagulation levels are not adjusted before the procedure. When such adjustments are not possible, the extraction and implant placement can be performed as a staged procedure.Intra-operative hemorrhagic accidents may occur both in the maxilla and mandible. In the maxilla, they most commonly arise during sinus augmentation by injury to the endosseous branch of the posterior superior alveolar artery in the lateral sinus wall. In the mandible, injury can occur to the inferior alveolar, facial and lingual arteries and their branches. Most of the serious injuries occur in the inter-foraminal region following perforation of the lingual cortical plate. The resultant elevation of the floor of mouth may lead to respiratory compromise and even be a threat to the patient's life. Dubois and colleagues (Dubois *et al*., 2010) reviewed 18 reported cases of life-threateninghemorrhagee after implant surgery, most of which occurred when implants were placed in the region between the canines. Eight patients required intubation and needed tracheostomies to ensure patency of the airway.

Nerve injury

Injuries to the inferior alveolar nerve and, less frequently, the lingual nerve have been reported and are of concern when posterior mandibular implants are placed. Management of these injuries is predicated on the degree of nerve injury. Prevention can be simplified to careful preoperative planning. Nerve damage can occur during soft tissue manipulation or implant osteotomy preparation. Post-operative sensory disturbances are usually caused by edema and compression of the nerve in the days following surgery and do not require any intervention. These disturbances can lead to paresthesia, dysesthesia, hypoesthesia and anesthesia. Injuries to nerves can lead to drooling, pain, changes in mastication and biting of the tongue, lip, or cheek. It has been suggested that anesthesia by local infiltration without block should be performed in order to be able to obtain sensory feedback from the patient during the preparation of the implant osteotomy.

Injury to adjacent teeth

When partially edentulous patients are treated, there is a risk of direct or indirect (thermal) injury to the roots of the adjacent teeth. Depending on the severity of the injury, the tooth may be sensitive to cold and tender to percussion, and may cause mild discomfort when the patient is eating, although the injured tooth may respond normally to vitality tests. Treatment may involve extraction or endodontic treatment. When an implant is in direct contact with an adjacent tooth, immediate removal of the implant may avoid major complications to the tooth. In some instances, implant removal may be accomplished with counterclockwise movement. In other instances, an internal device (Implant Retrieval Tool, Nobel Biocare, Kloten, Switzerland) can be used to unscrew the implant.) (Fig.1)

Fracture of the mandible

To Rehabilitate a severely resorbed mandiblewith implants is a surgical and prosthetic challenge because of the minimal amount of residual bone (Bell *et al*., 2002). Fractures can occur in less dense or poorly mineralized bone whenstress or strain develops as implants are placed. Excess tightening of a screw-type implant can result in microfractures in the surrounding bone caused by the strain generated by placing the implant in unhealthy bone.

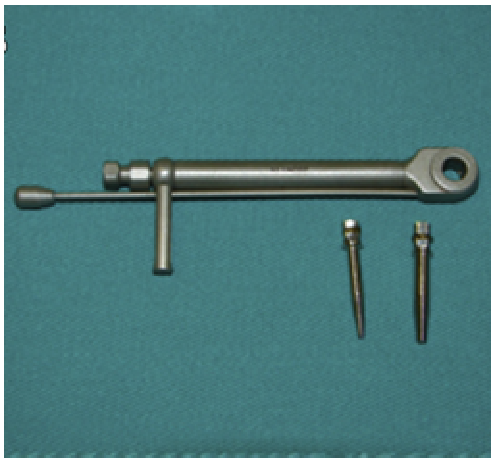

Fig.1. Implant retrieval tool

Before osseointegration occurs, the implant site acts as a region of tensile stress concentration and ultimately an area of weakness. Consequently, this area of weakness is more prone than others to applied functional forces. Repeated submaximal functional forces may lead to a spontaneous fracture with no associated macrotrauma. With these factors in mind, several extra precautions should be taken when implants are placed in thin or weak mandible like short implants, autogenous bone grafts or implants, and distraction osteogenesis for augmenting mandibles 10 mm or less in height (Manson *et al*., 1990). The use of short implants is an attractive treatment option because it requires a simple surgical procedure with limited morbidity. The disadvantages of placing short implants in an atrophic mandible include long vertical lever arms and, often, the need for a tissue-borne prosthesis.The effective treatment for these fractures is open reduction with the application of a large bone plate placed through an extraoral approach. In 2009 and again in 2012 (Lopes *et al*., 2009; Lopes *et al*., 2012), Lopes and co-workers described novel approaches to the prevention of fracture of the mandible with a 2-mm locking reconstruction bone plate. The plate was placed to reinforce the atrophic mandible before the placement of implants (Fig.2).

Fig.2. Reconstruction bone plate

Displacement or infringement on adjacent spaces

Displacement of dental implants can occur due to low bone density, thin cortical bone, anatomic variances, previous

infection, osteopenia or osteoporosis, and poor surgical technique. Displacement and migration of dental implants have been reported to occur in the maxillary sinus, sphenoid sinus, and ethmoid sinus (Korpi *et al*., 2013). When implants migrate into the sinuses, its most likely that there will be an oral–antral communication. If infection occurs, it may involve the adjacent sinuses. We recommend the removal of displaced implants. Implants that are displaced into the maxillary sinus can be removed by a Caudwell-Luc procedure or by a transnasal approach with functional endoscopic sinus surgery. Although displacement of implants into the maxillary sinus is well known, there are fewer reports of displacement of a dental implant into the medullary space of the mandible. Focal osteoporotic bone marrow defects of the jaws and other asymptomatic radiolucent lesions occur predominantly in the molar region of middle-aged women and may be associated with a higher risk of implant displacement.

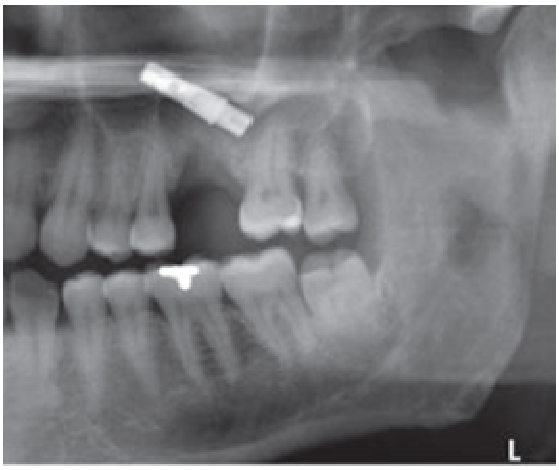

Fig.3. Displacement of a dental implant in the maxillary sinus

Swallowing or aspiration of surgical devices

Implant dentistry requires handling a significant number of small components, ranging from prosthetic and cover screws to screwdrivers and torque wrenches. These instruments can become very slippery during treatment and may be aspirated or swallowed by the patient. Swallowing will require periodic monitoring to ensure that the component passes through the digestive tract. Aspiration leads to more profound consequences and will require bronchoscopic retrieval along with radiographic analysis**.**The key to managing aspiration and ingestion of foreign bodies is prevention. Techniques which can be used for prevention are the use of rubber dam or the use of a gauze screen to protect the oropharynx as a barrier, providing instructions to the patient before the procedure, ensuring proper positioning of the patient, using powerful suction equipment, keeping a firm grip on instruments during the dental procedure, and attaching dental floss to small objects.

Post surgical complications

Post-operative infections in implant dentistry are usually low-grade and can be easily treated with administration of an antibiotic. However, if an infection is not detected early and managed properly, it may progress and require incision and drainage. In rare cases, the infection can spread to fascial spaces and become life threatening.It is believed that bacterial contamination during implant insertion can cause early failure of the dental implant. Contamination of the implant surface by bacterial biofilms during operative procedures can lead to an inflammatory process in the hard and soft tissues, thus decreasing the implant success rate. Infections around biomaterials are very difficult to treat and nearly all infected implants may fail at some time after placement. Although massive infection after the placement of dental implants is possible, most early infections occur when grafts are used, and most of these occur with a sinus lift. Prophylactic antibiotics may prevent postoperative infections and thus decrease implant failure. A number of regimens have been suggested including preoperative single or multiple doses, postoperative single or multiple doses for several days, or a preoperative dose followed by a postoperative dose.

Fig.4. Periimplanitis

Table. Prosthetic complications (Goodacre *et al*. 2003)

Prosthetic complications
Overdenture loss of retention/adjustment (30%)
Resin veneer fracture (22%)
Overdenture relines (19%)
Overdenture clip/attachment fracture (17%)
Porcelain veneer fracture (14%)
Overdenture fracture (12%)
Opposing prosthesis fracture (12%)
Acrylic resin base fracture (7%)
Prosthesis screw loosening (7%)
Abutment screw loosening (6%)
Prosthesis screw fracture (4%)
Metal framework fracture (3%)
Abutment screw fractures (2%)
Implant fractures (1%)

Peri-implantitis

The term “peri-implantitis” was introduced in literature more than 3 decades ago (Mombelli *et al*., 1987). This term was modified in the 1990s to describe an inflammatory process around an implant that includes both soft tissue inflammation and progressive loss of supporting bone beyond biological remodelling. In studies by Roos-Jansa˚ ker and colleagues (Roos-Jansa˚ker *et al*., 2006), peri-implantitis was described as a condition in which implants with varying degrees of bone loss are accompanied by a probing depth of at least 4 mm, bleeding on probing, and purulent discharge on gentle probing. Peri-implantitis seems to be increasing gradually, with reported incidence reaching 16% (Pagni *et al*., 2012). To date, no clear consensus exists in regard to treatment of peri-implantitis. A variety of treatments have been proposed to battle this destructive process, including mechanical debridement, pharmaceutical therapy (subgingival chlorhexidine irrigation, local or systemic antibiotics); and surgical procedures

including: open flap debridement aimed at removing bacteria, smoothing the implant surface and removing unsupported implant threads that accumulate bacterial plaque, and decontamination of the implant surface using various chemical agents or lasers.

Prosthetic complications

A large number of studies report on the incidence of prosthetic complications, or complications after loading. Goodacre *et al*. (2003) published a classification and incidence of such complications. Six categories of technical or mechanical complications were reported with partially fixed implant supported prosthesis: (1) loosening of screws, (2) fracture of screws, (3) fracture of framework, (4) fracture of abutment, (5) chipping or fracture of veneering material, and (6) decementation. Most prosthetic complications are related to overdentures. The following mechanical complications of implant supported overdentures have been reported: loss of retention of attachment systems, replacement or activation of retentive elements, loosening of screws, the need for relining or repairing the resin portion of the denture base, pop-out of denture teeth, and implant fracture. The most common mechanical complication associated with overdenture is maladjustment of the attachment system, regardless of the type of attachment used. An important question is whether the attachment systems should be splinted or left unsplinted. Stoumpis and Kohal (2011) reported no difference in implant survival rates between splinted and unsplinted systems. They also concluded that an unsplinted design requires more prosthetic maintenance. Naert and colleagues (Naert *et al*., 2004) found that the most common problem with mandibular overdentures is replacement of the O-ring on ball attachments. The Locator attachment, which was introduced in 2001, is usually unsplinted.

Esthetic complications

Even though the parameters of implant success have evolved, the early concern in implant dentistry was primarily osseointegration, and even today, osseointegration remainsthe predominant parameter of success in implant dentistry. However, because of patient and clinician demands and the increased certainty of osseointegration, new parameters are now being used to assess implant success. The focus is shifting from implant survival to the creation of lifelike implant restorations with natural-looking peri-implant soft tissues. Patients today have a high demand for esthetics and want not only improved function but also normal appearance. On the basis of objective indices, esthetic failures in implant dentistry can be categorized as pink-tissue failures and white-tissue failures. The most frequently reported pink-tissue failures are facial recession, gingival asymmetry, papillary deficiency, and graying of the gingival tissue. Pink-tissue complications within the esthetic zone can be caused by various errors committed before, during, or after the placement of implant. Several factors can lead to these failures, but the incidence of these factors can be substantially reduced by proper implant spacing, cautious timing of site preparation, and careful implant placement. White-tissue failures are related to the general form of the tooth, the outline and volume of the clinical crown, color (hue and value), surface texture, and translucency and characterization. Butler and Kinzer (Butler and Kinzer, 2012) indicated that the restorative failures are easier to correct than malpositioning problems. Nevertheless, most of these failures depend on technique and are fortunately always reversible. For avoiding white-tissue failures, a team approach is highly recommended including a dental technician with advanced knowledge and clinical experience.

Conclusion

Although endosseous implants have reported predictable outcome and long-term success, so are the reported complications. Implant dentistry has gained popularity in the past decade, and it is no longer restricted to dental specialists. Likewise, the number of dental implant companies has increased exponentially; they may not submit their products to meticulous research. These two factors combined may relate to the increase in complication rates.Adequate patient selection, treatment planning, and careful execution should help prevent these complications.

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