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DENTAL IMPLANT ASSOCIATED COMPLICATIONS: A REVIEW

Dental Science

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ABSTRACT

Complications associated with implant surgery are frequent occurrences in dental practice and knowledge in the management of these cases is essential. The aim of this review was to highlight the challenges of treatment plan-related, anatomy related, procedure-related surgical complications and postoperative complications as well as to discuss the etiology, management and treatment options to achieve a satisfactory treatment outcome.

KEYWORDS

dental implants, implant complications, implant failures.

INTRODUCTION

The introduction of endosseous dental implants as an option for restoring partially and fully edentulous patients has revolutionized dental treatment. High survival rates reported for single and multiple missing tooth replacement have validated the use of implant supported restorations as a predictable method for oral rehabilitation.[1] However complications should be taken into consideration because they can follow dental implant surgery as with any other surgical procedure. Many of the complications can be resolved without severe problems; however, in some cases they can cause dental implant failure or even life threatening circumstances.

Avoiding complications begins with careful treatment planning based on accurate preoperative anatomic evaluations and an understanding of all potential problems. Hence the focus of implant research is shifting from descriptions of clinical success to the identification of factors associated with failure.[2] Use of available technology and diagnostic tools can aid the clinician in obtaining more predictable planning, placement, and restoration of implant –supported restorations. Finally, knowledge, learning, and experience are paramount in reducing the number of and severity of complications that will inevitably occur.

CLASSIFICATION OF DENTAL IMPLANT COMPLICATIONS

No single universally accepted classification system for implant –related complications exists. Several approaches to classifying all or some implant complications have been suggested.

Classification

I. TREATMENT PLAN RELATED COMPLICATIONS

1. Wrong angulation
2. Improper implant location
3. Lack of communication

II. INTRA –OPERATIVE COMPLICATIONS

1. Anatomy related
- Haemorrhage
- Damage to adjacent teeth
- Nerve damage
- Maxillary sinus perforation
- Cortical plate perforation

2. Procedure related
- Adjacent soft tissue damage
- Lack of primary stability
- Mechanical complication
- Mandible fracture
- Ingestion/aspiration
- Other (iatrogenic/human error)

III. POST –OPERATIVE COMPLICATIONS

1.Edema
2. Infection
3. Wound dehiscence and exposure of barrier membrane or graft material
4. Neurosensory disturbances
5. Peri –implantitis
6. Failed osseointegration
7. Prosthetic complications

COMPLICATIONS ASSOCIATED WITH TREATMENT PLANNING.

WRONG ANGULATION: Implant angulation is yet another determinant for implant success. Proper angulation should be determined according to the future prosthesis with the consideration of bucco-lingual, apicocoronal, and mesio-distal positions. Although, there are many "rescue techniques" for restoring cases placed outside of the occlusion (eg, having to be with custom and angled abutments), the surgery should be planned for suitable angulation at the onset. Surgical guides can help control the implant placement angle if they are made and used correctly.

Mandibular teeth in the natural dentition are lingually inclined in relation to both the mandibular base,[3] specifically as 109 degrees,[4] as well as the maxillary opposing arch dentition (eg, lingual cusp buccal inclination) and therefore implants should be placed at a similar inclination. Failure to do so may result in perforation of the lingual concavity, constriction of the lingual space or damage of the lingual artery.

IMPROPER IMPLANT LOCATION: Adjacent teeth should be at least 1.5 mm from the implant body[5] and more than 3 to 4 mm between adjacent implants to prevent horizontal bone loss as well as to preserve esthetics.[6] Preoperative measurements and planning are essential to achieve an ideal implant placement that facilitates future implant prosthesis. Placing an implant in the wrong location is a frustrating, embarrassing and avoidable complication. Measurements (eg, interocclusal, interdental, ridge height, and ridge width) confirm whether implants are indicated in the first place.

LACK OF COMMUNICATION: An informed consent form is an excellent way of communicating potential surgical risks and complications to a patient. Common problems to address include but are not limited to postoperative infection, bleeding, swelling, facial discoloration, transient pain, paresthesia, neuralgia, fracture, joint pain, muscle spasm, tooth looseness and sensitivity, recession, speech change, trismus, and swallowing of foreign objects. Should a complication occur during the post operative healing time, it is recommended to give emergency contact information as well.

INTRA –OPERATIVE COMPLICATIONS

ANATOMY RELATED

HEAMORRHAGE: The amount of bleeding associated with a

surgical procedure is dependent on numerous factors such as extent of flap reflection, soft tissue management, the patient's anatomy, and systemic health. In general, several type of hemorrhagic patches can develop as a result of injury. Petechiae (<2 mm in diameter), purpura (2 to 10mm), and ecchymosis (>10mm).[2] These findings reflect blood within the tissue due to injuries of small capillaries and blood vessels in the skin and mucous membrane. These patches are non elevated, rounded, or irregular and initially are a red –blue or purplish colour. A hematoma (contusion) is a collection of blood, usually clotted in an organ, space, or tissue, which is due to break in a blood vessel wall. The excessive fluid may form an elevated, hard lump. The potential causes include incision of arteries in soft tissue, osteotomy preparation and lateral wall sinus lift procedure.[7]

DAMAGE TO ADJACENT TEETH: Damage to teeth adjacent to the implant site may occur subsequent to the insertion of implants along an improper axis or after placement of excessively large implants. This problem arises more frequently with single implants **(Annibali et al., 2009).**[8] Adjacent teeth should be evaluated before implant placement. The tilt of adjacent tooth by implant placement may cause the tooth to become non vital, and tooth may require subsequent endodontic treatment. This will not only result in damage to an adjacent tooth but also implant failure.

NERVE DAMAGE: Neurosensory alterations may occur subsequent to implant therapy. Intrusion into the inferior alveolar or mental canal during osteotomy preparation can cause tearing, or laceration of nerve. Implant insertion can also result in bone compression on the nerve. In addition, within the soft tissue, the lingual or mental nerve may be injured by compression, stretching, the scalpel, or needle penetration.
After nerve injury, the patient will manifest one or more of the symptoms like paraesthesia (numb feeling, burning, and pricking), hypoesthesia (reduced feeling), dysesthesia (painful sensation) or aesthesia (complete loss of feeling of the teeth, the surrounding skin).

SCHNEIDERIAN MEMBRANE PERFORATION: The most common intraoperative complications seems to be Schneiderian membrane perforation, which occurs in 10 %to 60% of all procedures (**Ardekian et al., 2006)**[9] the risk of membrane perforation increases when anatomical variations such as a maxillary sinus septum, spine, or sharp edge are present. Very thin or thick maxillary sinus walls create higher risk of perforating the Schneiderian membrane. Other complications associated with maxillary sinus lift constitute haemorrhage, loss of implant or graft material into maxillary sinus and postoperative maxillary sinusitis.

CORTICAL PLATE PERFORATION: The buccal cortical plate varies in thickness throughout the mouth and traumatic dental extraction can cause markedly thin plates or concavities, as well as overall ridge width deficiency. When preparing osteotomy sites or placing implant fixtures in areas with minimal labial plate thickness, or if the implant is placed too buccally, a fenestration or dehiscence implant defect is a common finding. A fenestration leaves intact bone coronally with the exposed threads at the apical portion of the crest, whereas a dehiscence defect has the coronal portion of the implant exposed.

PROCEDURE RELATED

ADJACENT SOFT TISSUE DAMAGE: Damage to adjacent soft tissue is usually related to mishandling of surgical instruments. These injuries can range from abrasion to lacerations and may or may not require treatment. Damage to intraoral tissues may lead to complications in wound healing and bleeding, whereas damage to extra – oral tissues may lead to cosmetic complications and possible legal problems.

LACK OF PRIMARY STABILITY: Lack of primary stability is a surgical complication that should be dealt with at the time of implant surgery. There are several options available to correct lack of primary stability after an implant is placed. When there is adequate apical bone height, the osteotomy can be made deeper, and a longer implant can be inserted. However, if there is no additional available bone apically, then a wider implant might be able to be inserted.

MECHANICAL COMPLICATIONS: Situation demanding an implant as hopeless are usually associated with surgical trauma during osteotomy preparation with the drill. **Ericksson and Albrektsson 1983**[10] showed bone resorption occur at 47^0C when drilling was applied for more than 1 minute in rabbits. The result obtained from this study leads to the conclusion that if temperature or duration increases while drilling in bone, necrosis can occur causing detrimental effects for osseointegration.

MANDIBULAR FRACTURES: Mandibular fractures are rare complications which may occur during osseointegration (before the implants are uncovered and loaded), after restoration (for the removal of non- osseointegrated implants) or as the result of a trauma.[7] The exact mechanism through which mandibular fractures occur is unknown, but the consistent finding of fractures lines passing through implant sites strongly suggests that this is the weakest and most susceptible area during osseointegration where stresses converge and the greatest loss of bone density occurs.

INGESTION/ASPIRATION: Intraoperative ingestion or aspiration of a dental screwdriver or an implant can present a life threatening complication. If a device is aspirated, it is necessary to refer a patient to an otolaryngologist for evaluation and treatment. Usually aspiration of a foreign body will be accompanied by coughing; however it is possible for a patient to aspirate an object without coughing. In general these type of mishaps can be avoided if a piece of silk suture is tied to the screwdriver or another device before it is inserted into the mouth. This provides the clinician a fast way to identify and retrieve a dropped instrument.

OTHER (IATROGENIC/HUMAN ERROR): A study done by the dental implants clinical research group 1994 found that inexperienced surgeons (<50 implants) were twice as like to have implant failure compared with more experienced surgeons. Such a statistic is a good reminder in realising that some of our literature is based on the work of graduate students who start out as amateur implant surgeons hence the data cannot be generalized. The realization also exists that many general dentists starting to place implants may have more failures and complications compared with experienced specialists.

POST OPERATIVE COMPLICATINS

EDEMA: Edema is the complication when there is a considerable accumulation of fluid because this may negatively affect healing and create discomfort to the patient during food intake and oral hygiene maintenance. Atraumatic surgical techniques minimizing tissue damage, the application of ice packs and the administration of corticosteroids will prevent or limit edema after implant surgery.

INFECTION: Infections arising during the first few postoperative days present with edema, exudates and pain. They are caused by bacterial contamination during surgery either directly via accidental contact with the implants or indirectly from gloves or instruments. The risk of such a complication may be reduced by following the surgical principles of asepsis. Besides a sterile working area and a clean environment, an aseptic protocol includes disinfection of the perioral skin with solution containing povidone-iodine and alcohol, disinfection of the oral mucosa with 0.2% chlorhexidine, and cleansing of surgical gloves in sterile saline to remove dust or contaminants.

WOUND DEHISCENCE AND EXPOSURE OF BARRIER MEMBRANE OR GRAFT MATERIAL: Dehiscence is opening of the surgical wound edges exposing part or all of the implant head and/or surrounding bony tissue. Etiologically flap dehiscence may result from a number of causative factors: a very thin mucosa, failure to ensure reapproximation and closure of the flap margins, presence of a large edema or hematoms; insufficient or excessive tension on the suture, functional movements, such as mastication, phonation or deglutition; previous prosthodontic surgery or radiation therapy affecting the vascularity of the flap etc.

Dehiscence may be prevented by careful preoperative assessment of the soft tissue, minimally invasive flap elevation and reflection with careful removal of any bone debris beneath, proper suturing, sensible temporization with appropriate modifications, rebasing and relining; and delaying the use of removable dentures until two weeks after surgery.

NEUROSENSORY DISTURBENCES: Unless nerve damage occurs by direct injury, postoperative nerve damage is usually caused by edema and compression of a nerve in the days following surgery and does not require any intervention. Recovery of an affected nerve can

take from a few days to several months. Careful monitoring of the patient and the affected area throughout the recovery process is indicated.

PERI- IMPLANTITIS: According to a study by **Manor et al. (2009),**[11] the common causes of late failures were periimplantitis, implant overloading and fracture. The name peri-implant disease refers to the pathological inflammatory changes that takes place in the tissues surrounding a load bearing implant.[12] Swelling, redness of the peri-implant marginal tissue, calculus build up and bleeding on probing are important signs of peri-implantitis. Suppuration is a clear indicator of the disease activity and indicates the need for anti-infective therapy. Probing the peri- implant sulcus with a blunt, straight plastic periodontal probe such as the automated probe or the True Pressure Sensitive (TPS) probe, allows the assessment of the following parameters: a) Peri-implant probing depth, b) Bleeding on probing, c) Exudation and suppuration from the peri-implant space.

FAILED OSSEOINTEGRATION: Lack of osseointegration is diagnosed at phase II surgery or restoration when the implant is loaded. It is one of the worst complications since it inevitably results in loss of the implant. The main causes for the lack of osseointegration include reduced healing capacity, occlusal loading during osseointegration, failure to follow the planned protocol, technical errors during surgery (such as accidental contamination of the implant surface)[13] and especially bone over heating during implant site preparation.

PROSTHETIC COMPLICATIONS: Occurs due to improper implant location and/or angulation can be due to lack of bone in the preferred location for the implant owing to anatomic deformation, bone resorption, disease or trauma. It can also occur because of a lack of planning, failure to follow the locations and angulations identified by the surgical template or inadequate surgical technique.

CONCLUSION

Local complications arising during implant surgery may be the main determinants of the outcome of the entire rehabilitations program. Hence, the prevention of complications is a priority objective for the surgeon. Careful clinical and radiographic examination of each case, accurate planning of procedures, the use of proper surgical techniques and appropriate instruments and the correct management of healing and osseointegration all concur in preventing such events.

Serious complications associated with dental implant placement are uncommon and less severe situations can often be avoided. Preplanning using diagnostic radiographs, wax-ups and attention to detail before and during implant procedures can help to avoid problems. Other methods that can be used to enhance success include the following: create a checklist of things that might be overlooked, confirm equipment is working before it is needed, carry out routine tasks with care and attention, follow procedures as planned and modify as required, check and recheck procedures for possible errors and assess completed work with respect to what was planned. Recognition of a developing problem and prompt management reduce postoperative complications. Finally, proper training should be obtained before advanced surgical or prosthodontic procedures are undertaken.

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