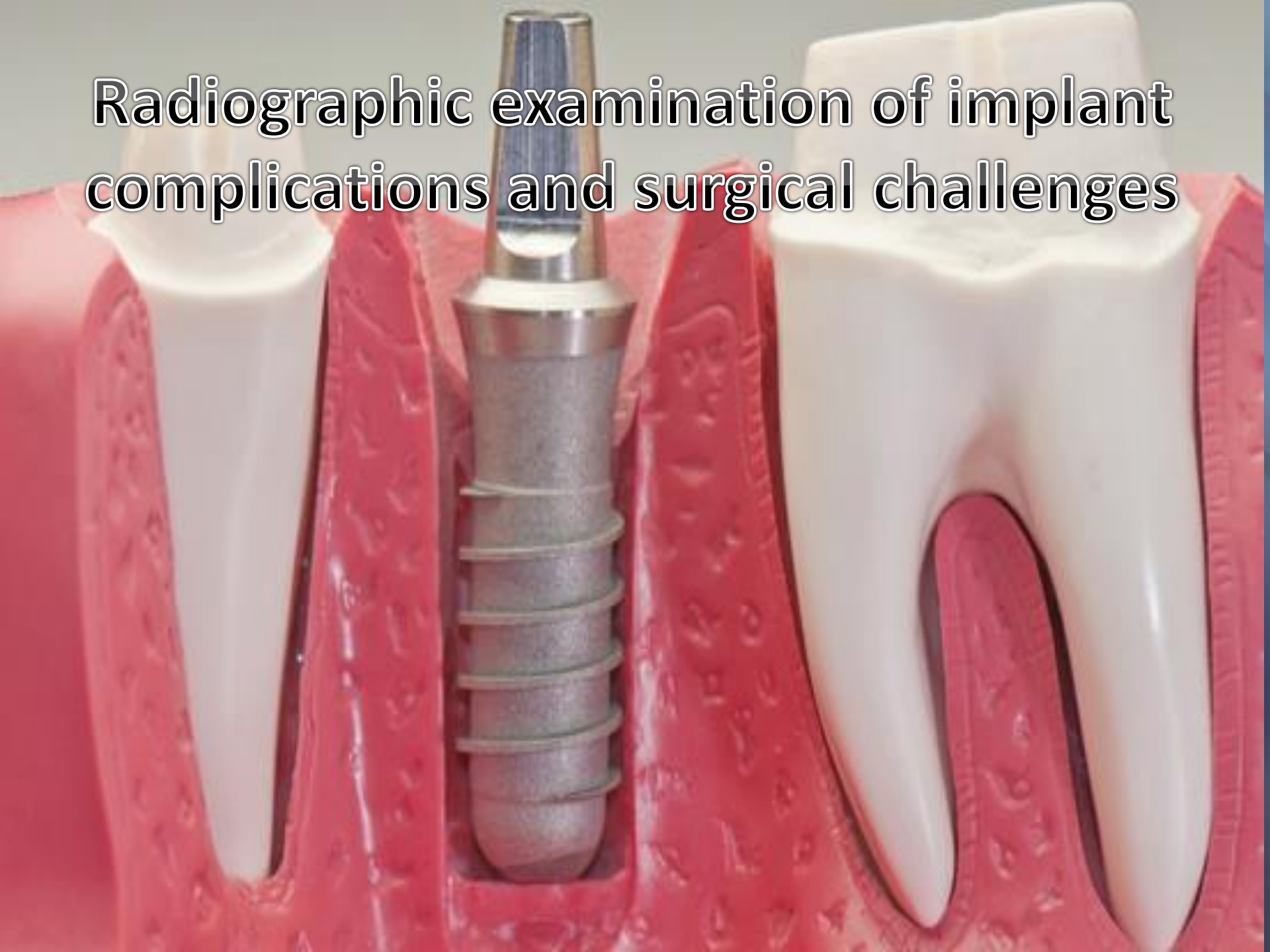
In the Name of God

Radiographic examination of implant complications and surgical challenges



Dr. Alireza Deljavan

- Oral and Maxillofacial Surgeon
- Assistant Professor at Tabriz Islamic Azad University

Introduction

- Implantology is an ever growing field.
- Nevertheless, it has, as every surgical procedure, several complications that can occur and that must be known in order to prevent or solve them.
- It is mandatory to classify all those clinical complications that can arise.

Local complications in dental implant surgery.

Early-stage complications

- Infection
- Edema
- Ecchymoses and haematomas
- Emphysema
- Bleeding
- Flap dehiscence
- Sensory disorders

Late complications

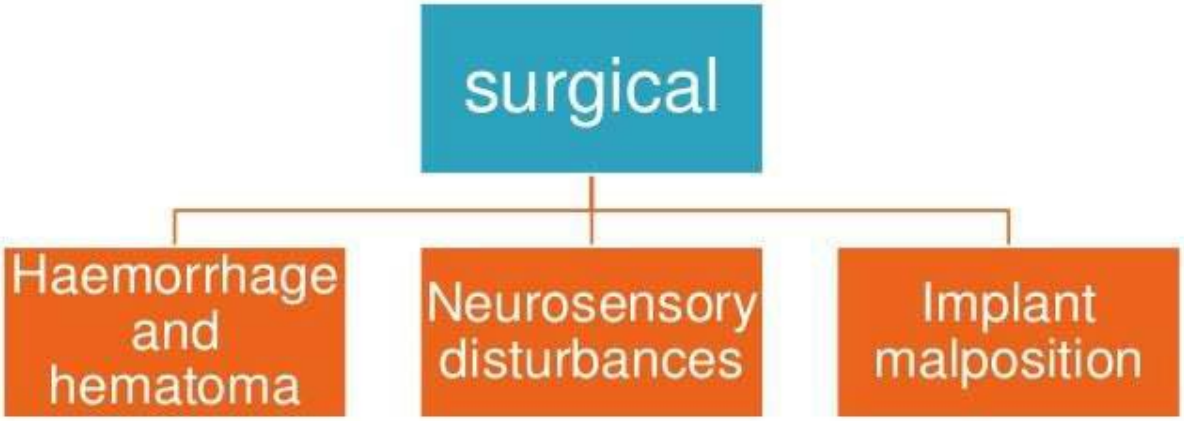
- Perforation of the mucoperiosteum
- Maxillary sinusitis
- Mandibular fractures
- Failed osseointegration
- Bony defects
- Periapical implant lesion

(Misch and Wang,2008)

Prevalence of Implant Complications

- Pjetursson et al found that the most common technical complication:
- fracture of veneers (13.2% after 5 years),
- loss of the screw access hole restoration (8.2% after 5 years),
- abutment/occlusal screw loosening (5.8% after 5 years), and
- abutment/occlusal screw fracture (1.5% after 5 years).
- Fracture of implants occurred infrequently (0.4% after 5 years; 1.8% after 10 years).
- biologic complications, such as periimplantitis and soft tissue lesions, occurred in 8.6%

Surgical complication



- Problems due to surgical complications are:
  1. Damage to adjacent teeth
  2. Impingement on anatomic structures
  3. Compromised esthetic/prosthetic outcome
  4. Soft tissue and bone dehiscence

Postoperative Ecchymose and haematoma

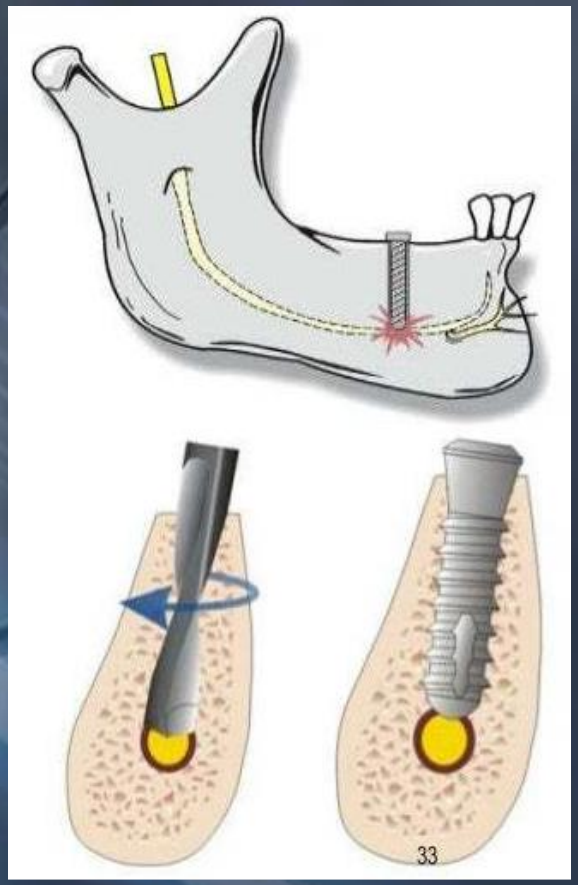
Neurosensory disturbances

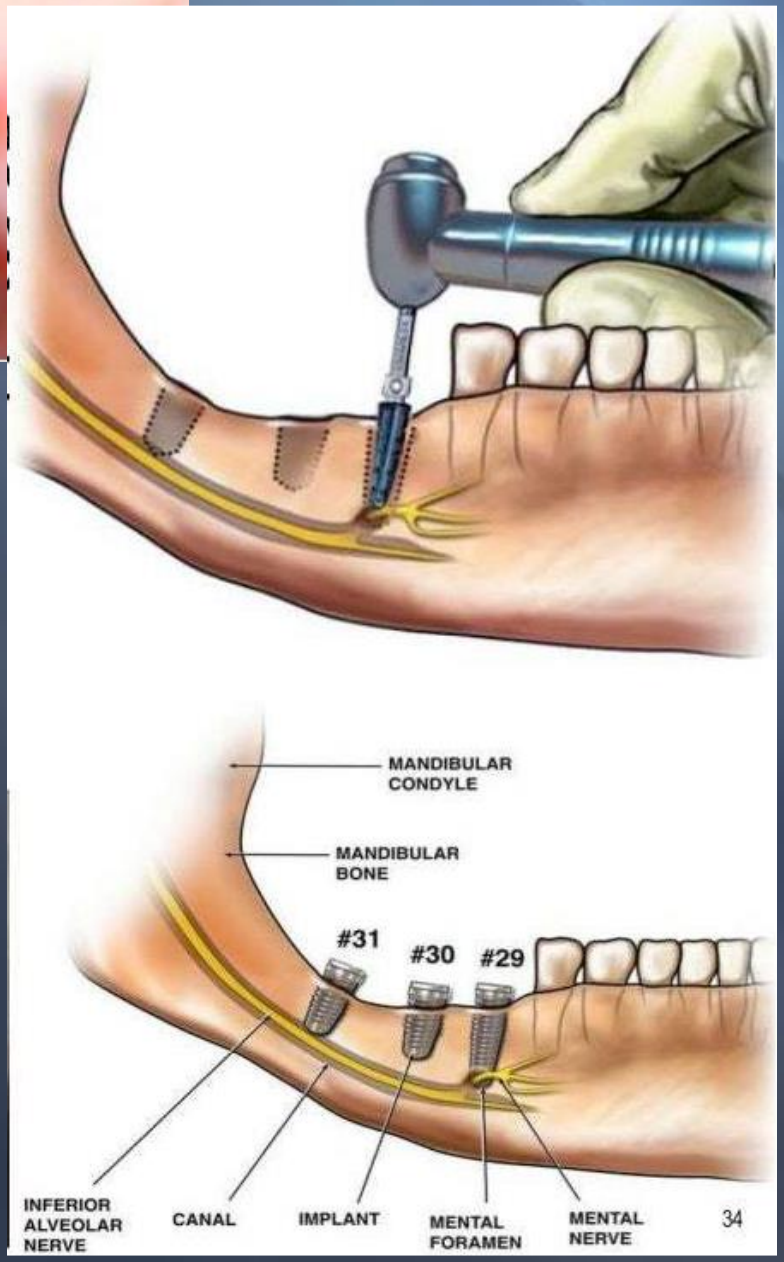
- Nerve lesions are both an intraoperative accident and a postoperative complication that can affect the infra-orbital nerve, the inferior alveolar nerve, or its mental branch and the lingual nerve.

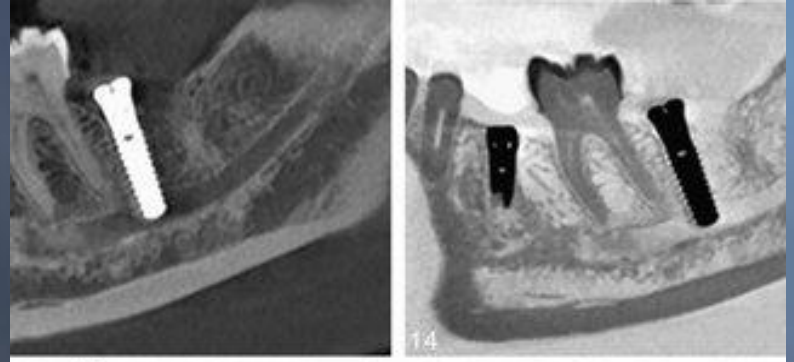
- These complications have a low incidence (reported between 0%-44%)

(Misch & Resnik, 2010)

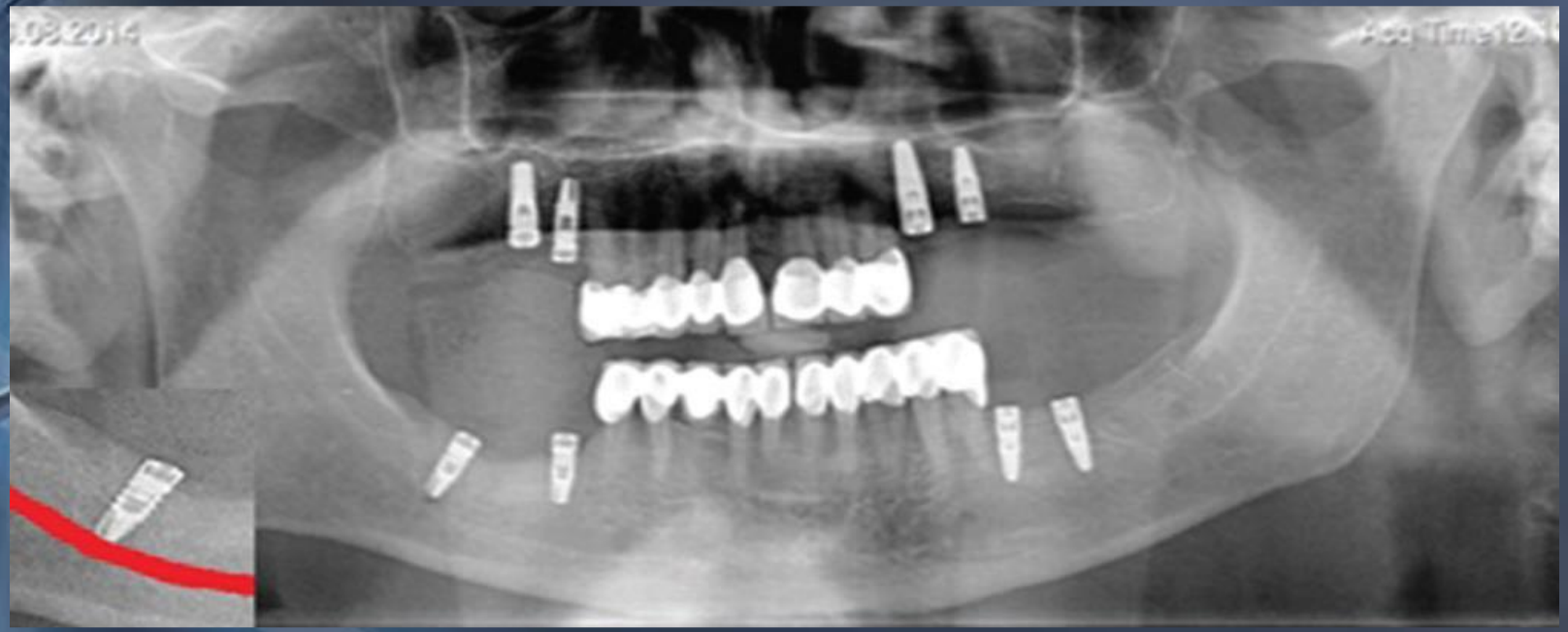
MENTAL NERVE & FORAMEN






14


16



Causes

- INDIRECT

Postsurgical intra-alveolar edema or hematomas- produce a temporary pressure increase, especially inside the mandibular canal

- DIRECT

Compression, stretch, cut, overheating, and accidental puncture

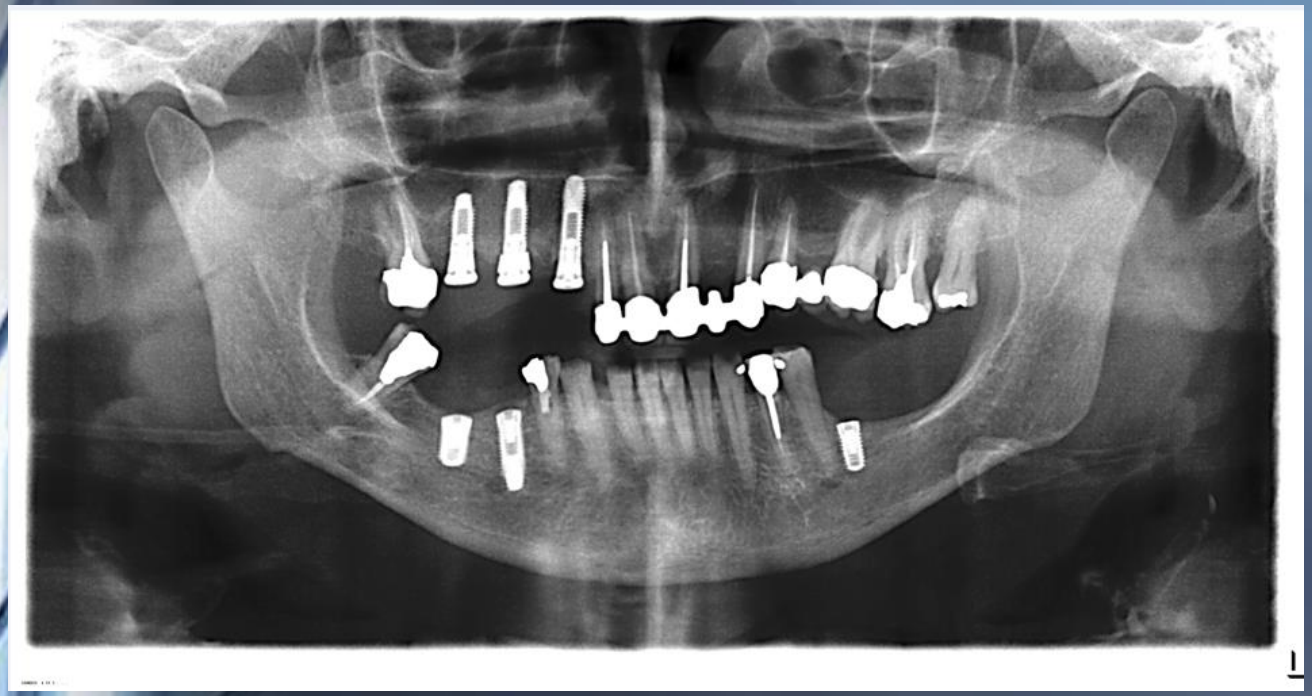
(Annibali et al., 2009)

- Poor flap design,
- Traumatic flap reflection,
- Accidental intraneural injection,
- Traction on the mental nerve in an elevated flap,
- Penetration of the osteotomy preparation
- Compression of the implant body into the canal

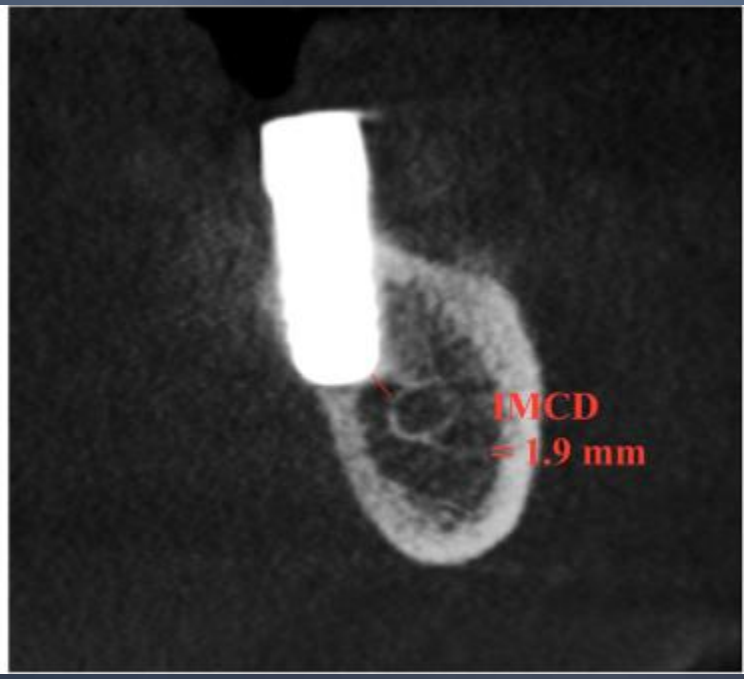
(Misch & Wang, 2008).

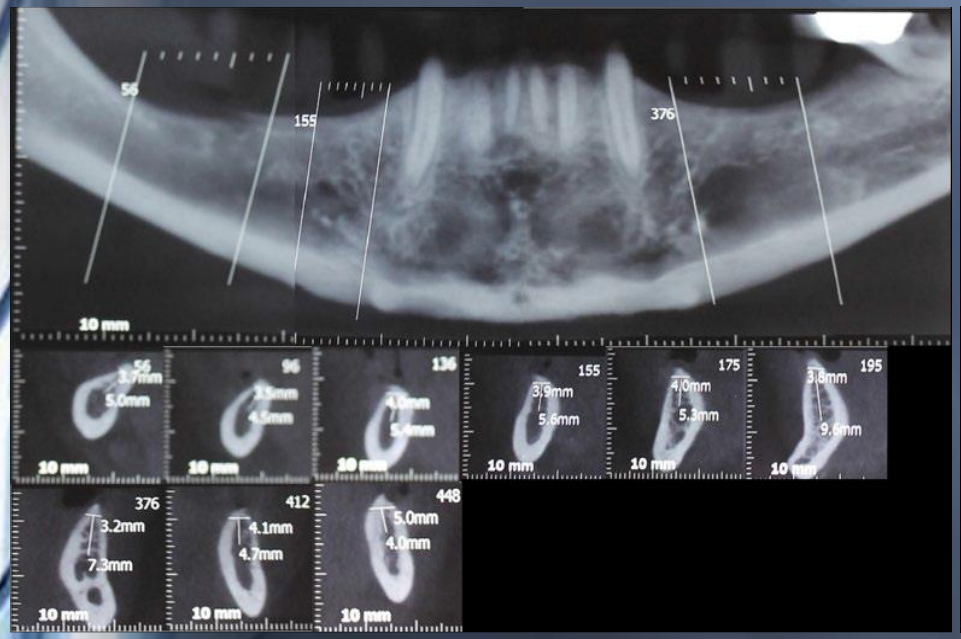
Recommendations to avoid nerve injuries during implant placement (Worthington,2004)

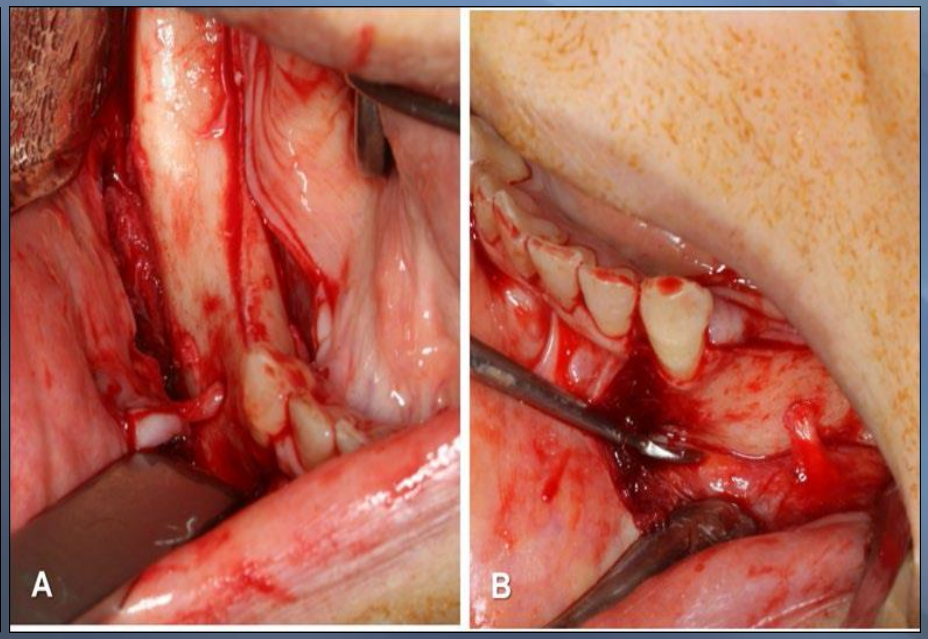
Be sure to include nerve injury as an item in the informed consent document. Measure the radiograph with care. Apply the correct magnification factor. Consider the bony crestal anatomy: Is the buccolingual position of the crestal peak of bone influencing the measurement of available bone? Consider the buccolingual position of the nerve canal.	Use coronal true-size tomograms where needed. Allow a 1 to 2 mm safety zone. Use a drill guard. Take care with countersinking not to lose support of the crestal cortical bone. Keep the radiograph and the calculation in the patient's chart as powerful evidence of meticulous patient care.

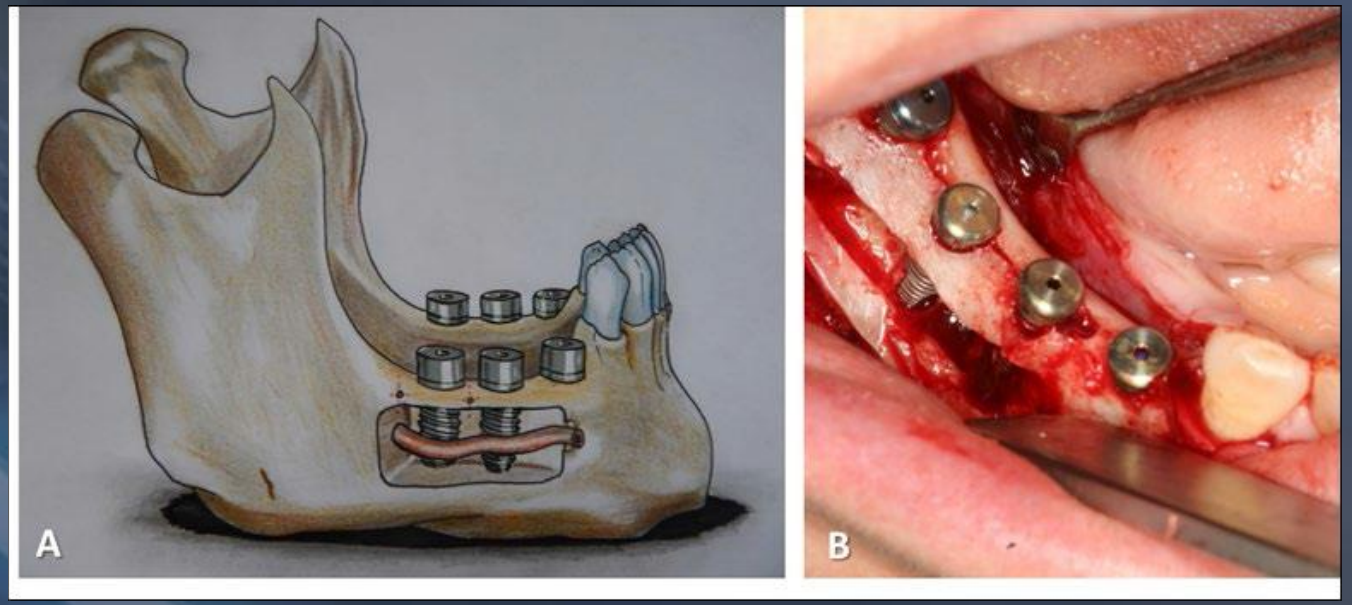


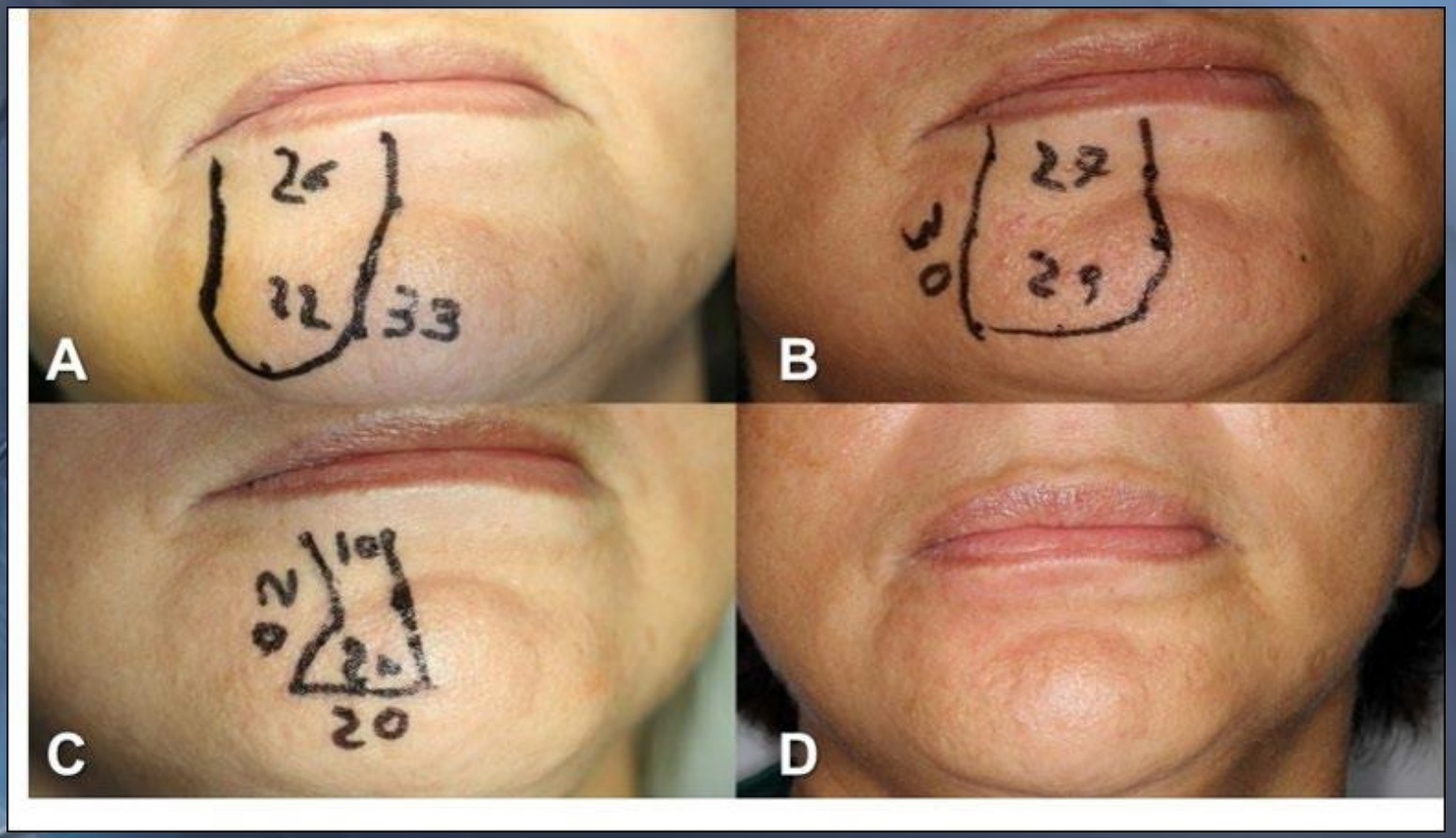

IMCD
= 1.0 mm


IMCD
= 1.9 mm

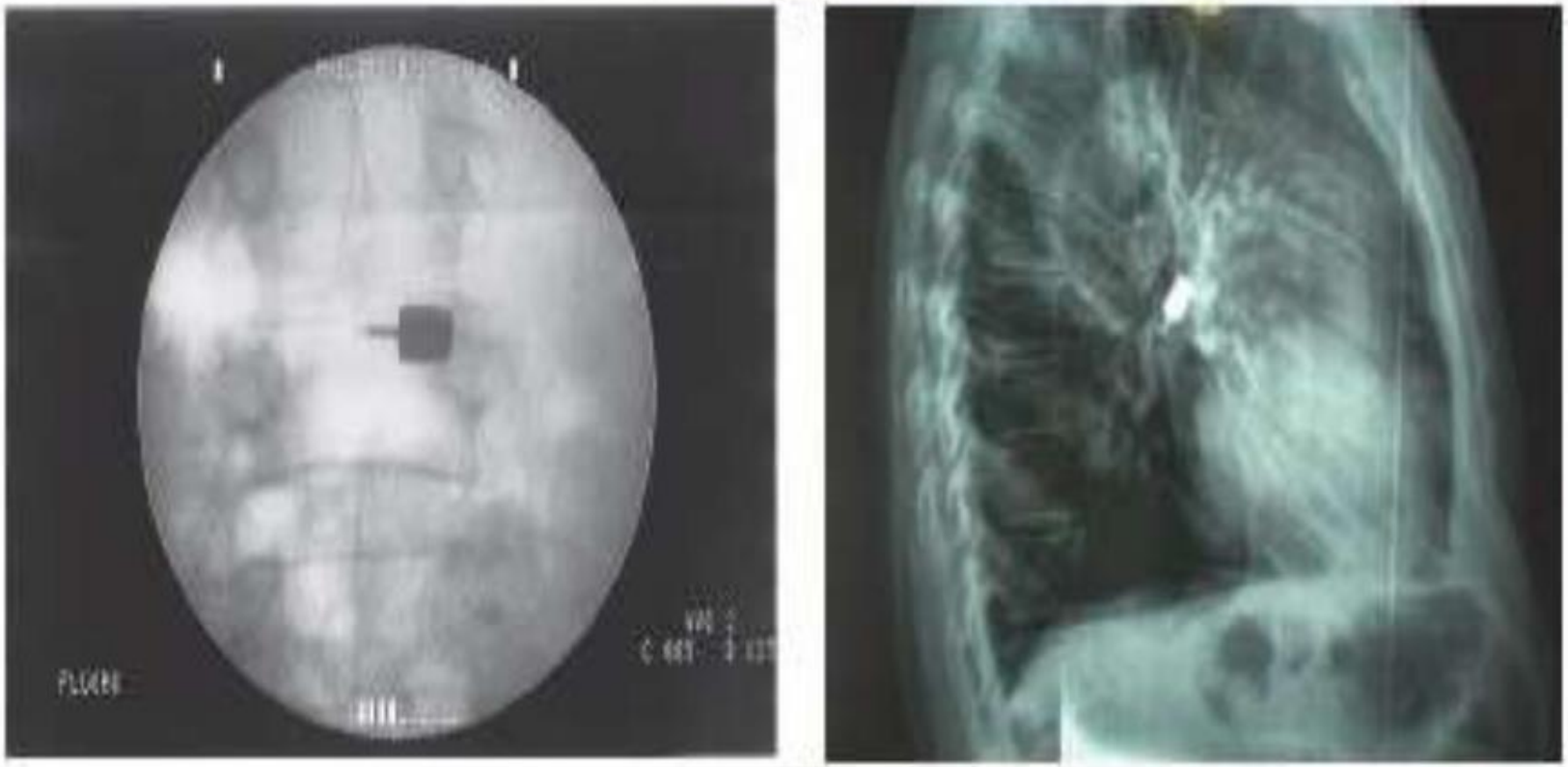

56
155
376
10 mm
56
3.9mm
5.0mm
96
136
155
3.9mm
5.6mm
175
4.0mm
5.3mm
195
3.8mm
9.6mm
376
3.2mm
7.3mm
412
4.1mm
4.7mm
448
5.0mm
4.0mm


A
B


A
B


A
B
C
D

Aspiration and swallowing of instruments



Images of a screw driver in the digestive tract. (b) Screw driver into pulmonary tissue.

- Vital emergency if the instrument has entered the airways.

- Recommended to tie all tiny and slippery instruments with silk ligatures or else use a rubber dam **(Bergermann et al., 1992)**.

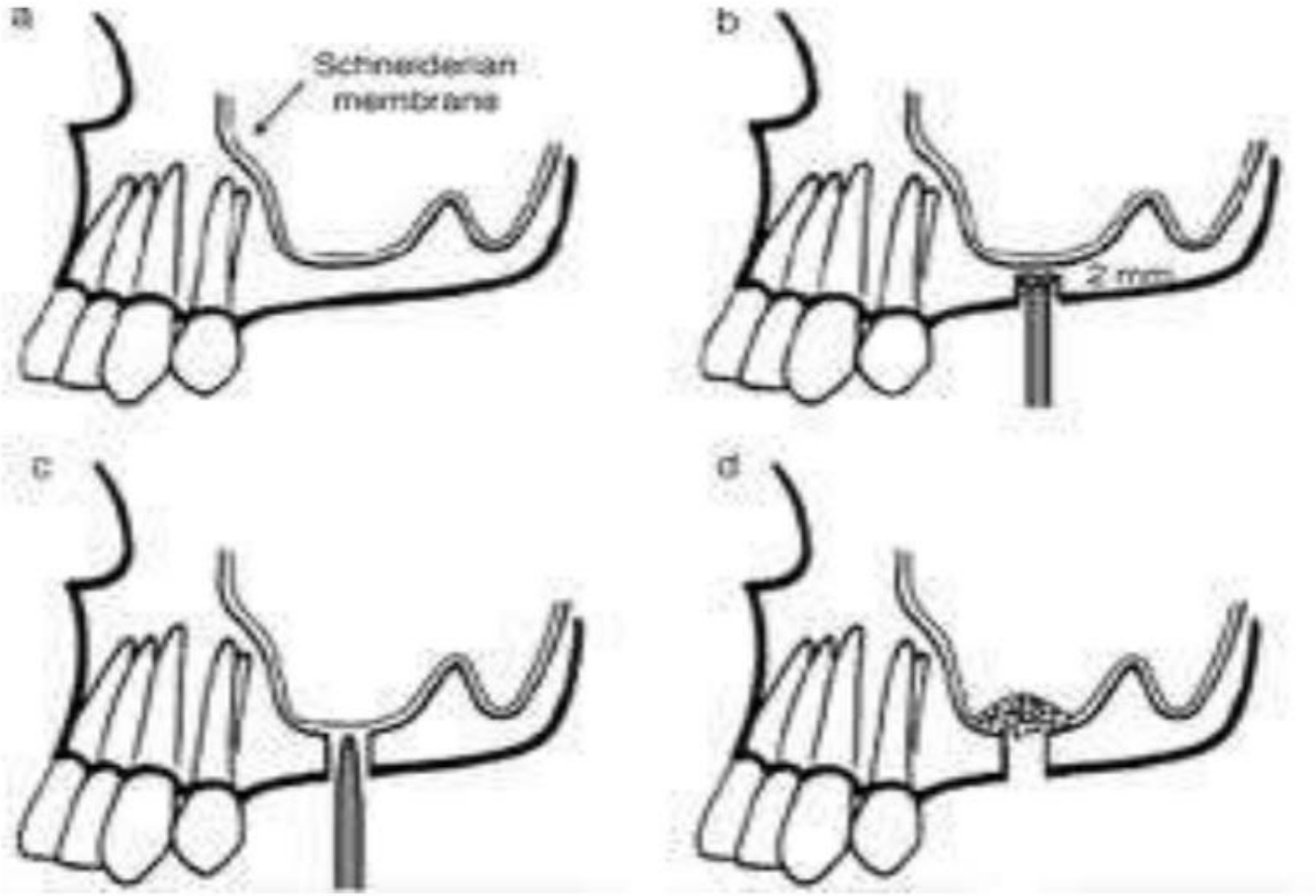
- Gastroscopy or colonoscopy with a proper medical follow-up required to locate.

Complications associated with maxillary sinus lift

SCHNEIDERIAN MEMBRANE PERFORATION

- The Schneiderian membrane- characterized by periosteum overlaid with a thin layer of pseudociliated stratified respiratory epithelium,

- Constitutes an important barrier for the protection and defense of the sinus cavity.



Schneiderian membrane perforation occurs in 10% to 60% of all procedures

- **Causes:**

Anatomical variations such as a maxillary sinus septum, spine, or sharp edge are present

Very thin or thick maxillary sinus walls

Angulation between the medial and lateral walls of the maxillary sinus seemed to exert an especially large influence on the incidence of membrane perforation.

Management:

Small tears (<5 to 8 mm)	• folding the membrane up against itself as the membrane is elevated
Larger tears	• do not lend themselves to closure by infolding • Repaired with collagen or a fibrin adhesive

Loss of the implant or graft materials into the maxillary sinus

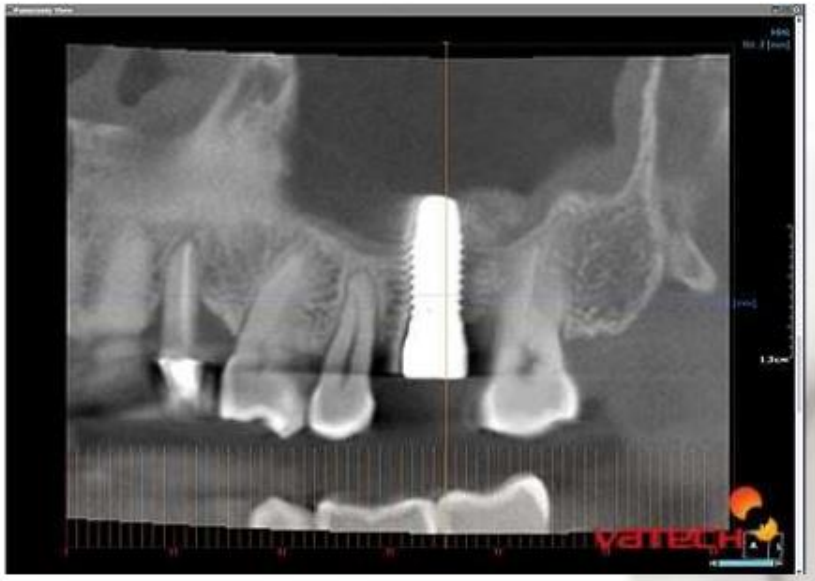
Causes:

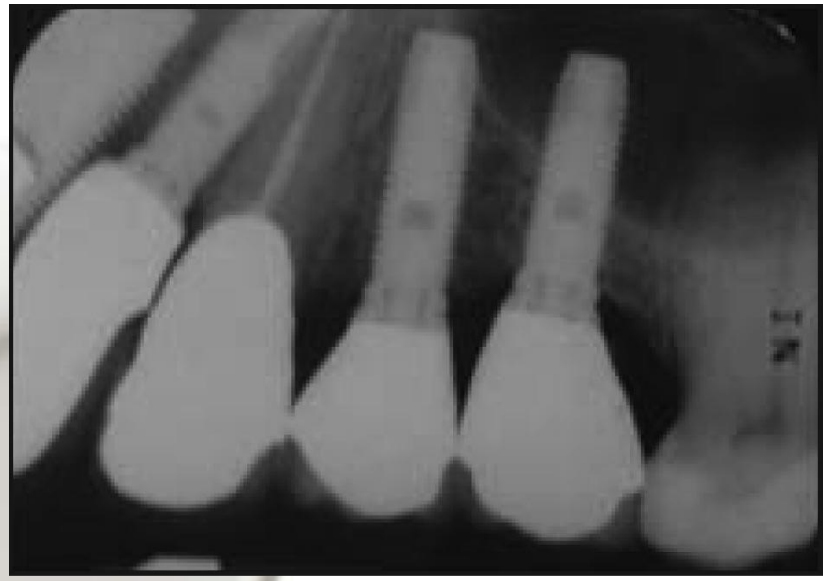
Changes in intrasinal and nasal pressures;

Autoimmune reaction to the implant, causing peri-implant bone destruction and compromising osseointegration; and

Resorption produced by an incorrect distribution of occlusal forces

(Galindo et al., 2005)



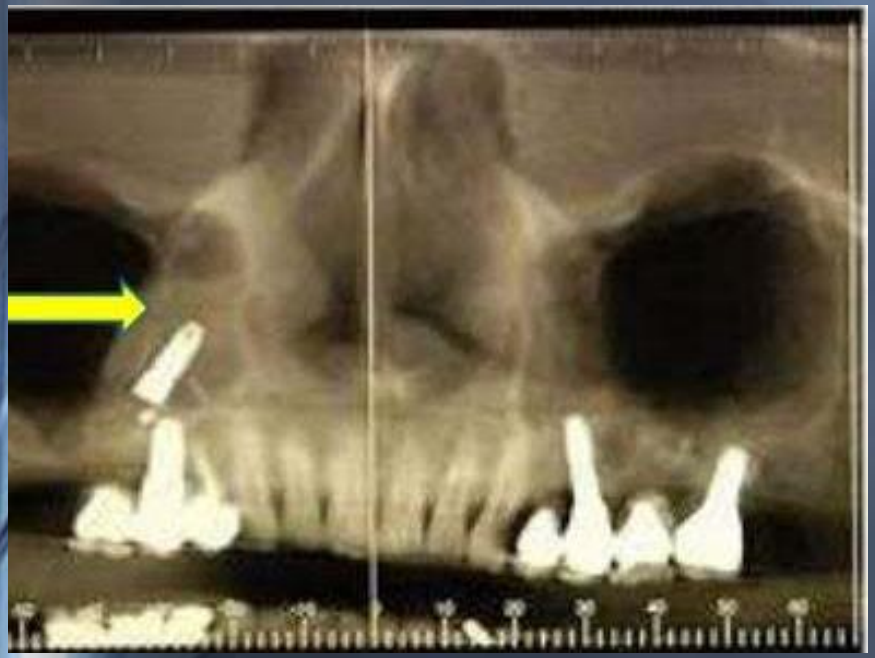


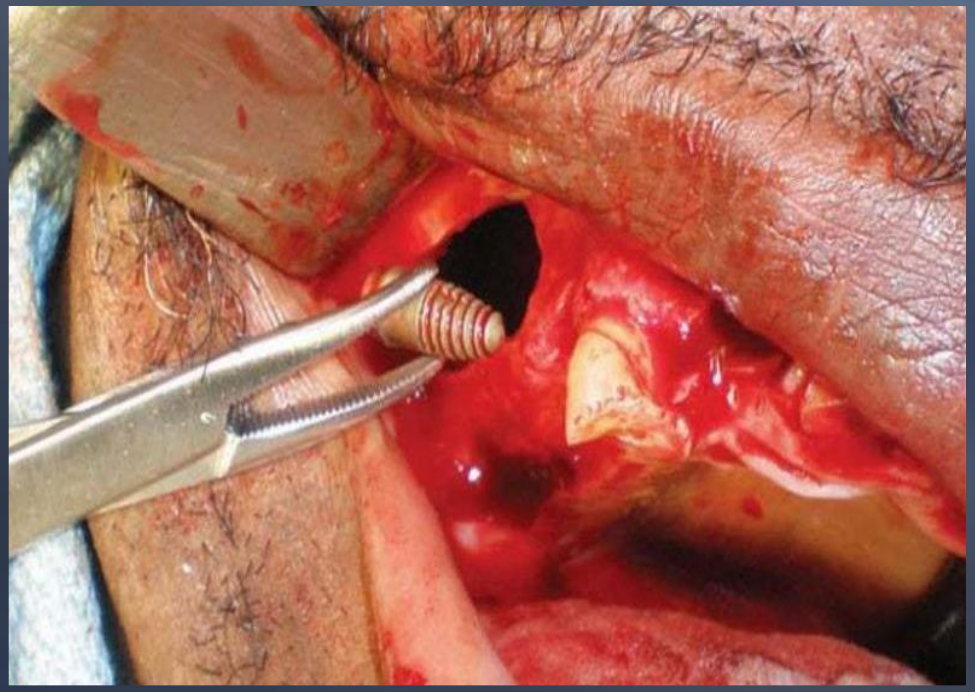
Management:

Immediately retrieved surgically via an intraoral approach or endoscopically via the transnasal route to avoid inflammatory complications

Prevention;

a bone reconstruction procedure of the maxilla should be performed.





Postoperative maxillary sinusitis

- Maxillary sinusitis can occur

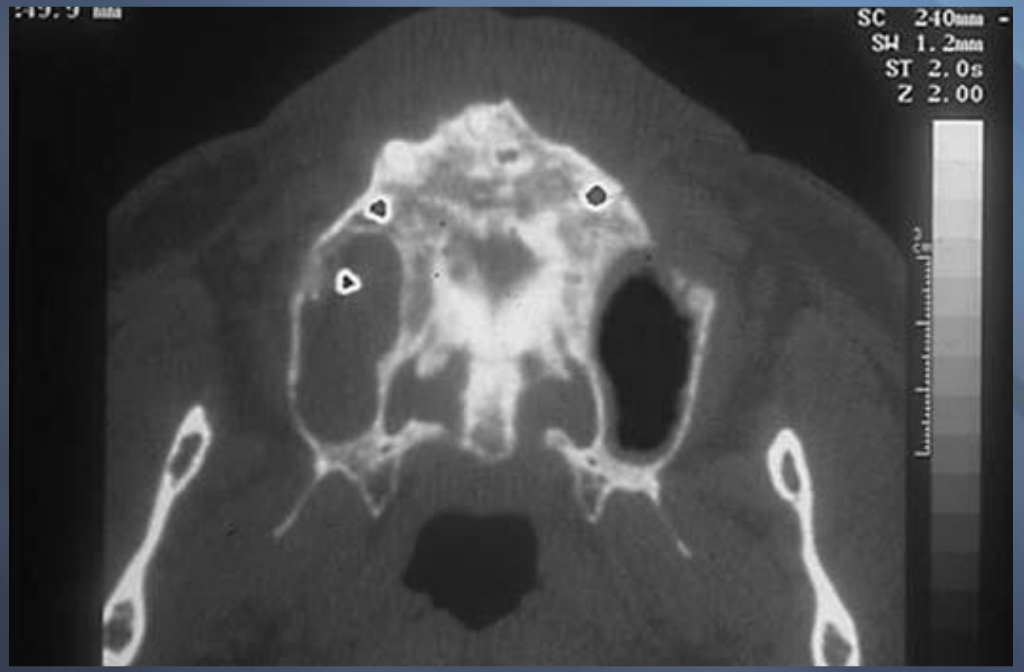
- Contamination of the maxillary sinus with oral or nasal pathogens or
- via ostial obstruction caused by postoperative swelling of the maxillary mucosa,
- Non-vital bony fragments floating freely in the maxillary sinus.
- Lack of asepsis during sinus augmentation

- **General guidelines for the prevention of transient and chronic maxillary sinusitis after maxillary sinus augmentation (Timmenga et al., 2001)**

Preoperative evaluation of sinus clearance-related factors

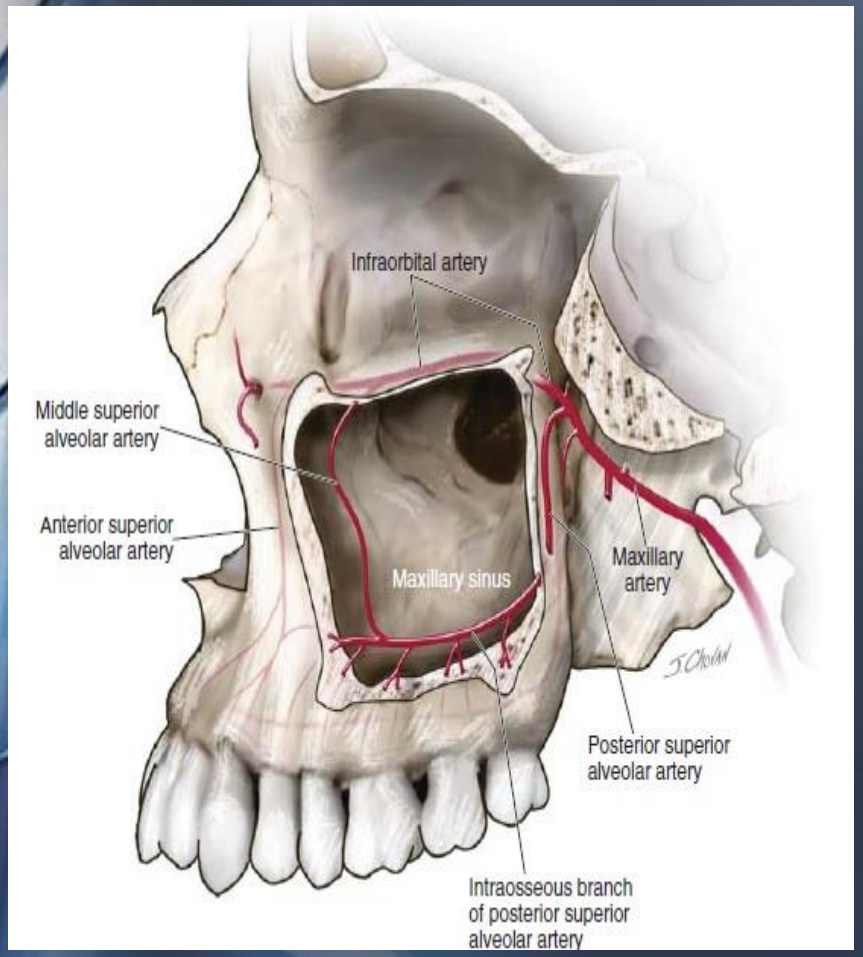
Postsurgery: a nasal decongestant (xylomethazoline 0.05%) and topical corticosteroid (dexamethasone 0.01%) to prevent postsurgery obstruction of the ostium

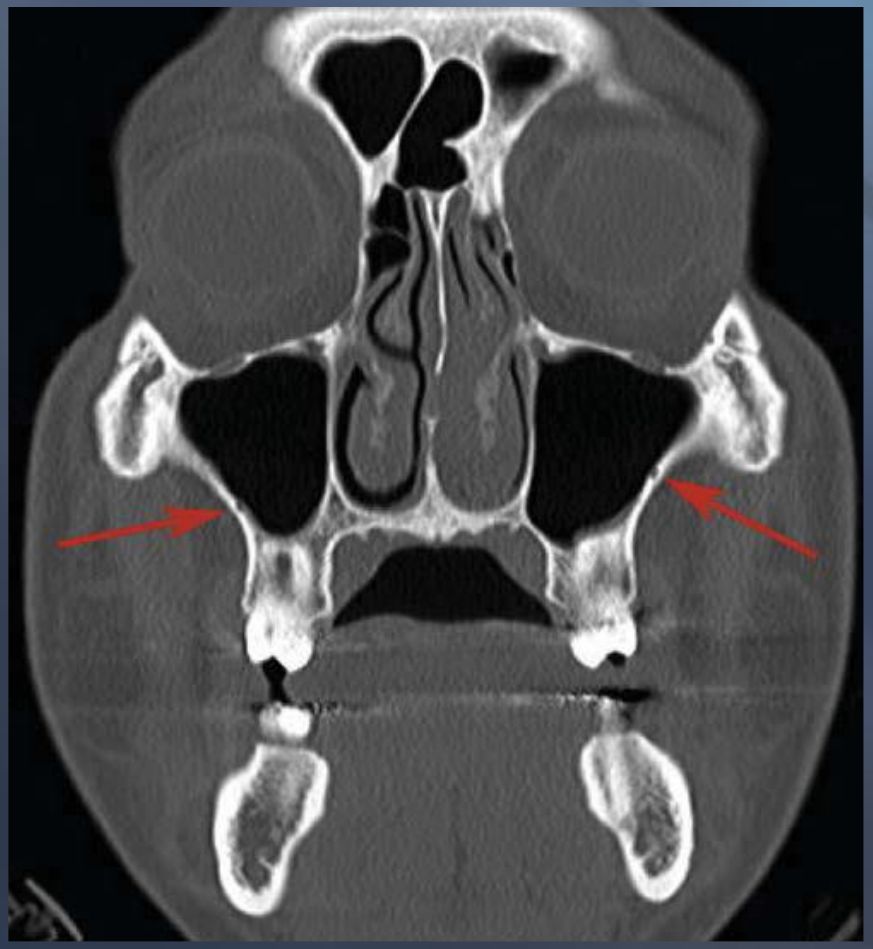
Perioperative antibiotic prophylaxis (cephradine 1 g 3 times daily, starting 1 hour before surgery and continued for 48 hours after surgery)



Maxillary sinusitis for implant displacement into the sinus

- Studies reported that PSA and IO arteries may anastomose to form an intraosseous branch
- detectable by CT scan at least 50% of the time,
- with approximately 80% greater than 15 mm from the alveolar ridge
- Preoperative CT scan may aid in avoiding potential hemorrhage





Malposition or angulation of an implant

- The definition of a 'malpositioned implant' is an implant placed in a position that created restorative and biomechanical challenges for an optimal result.

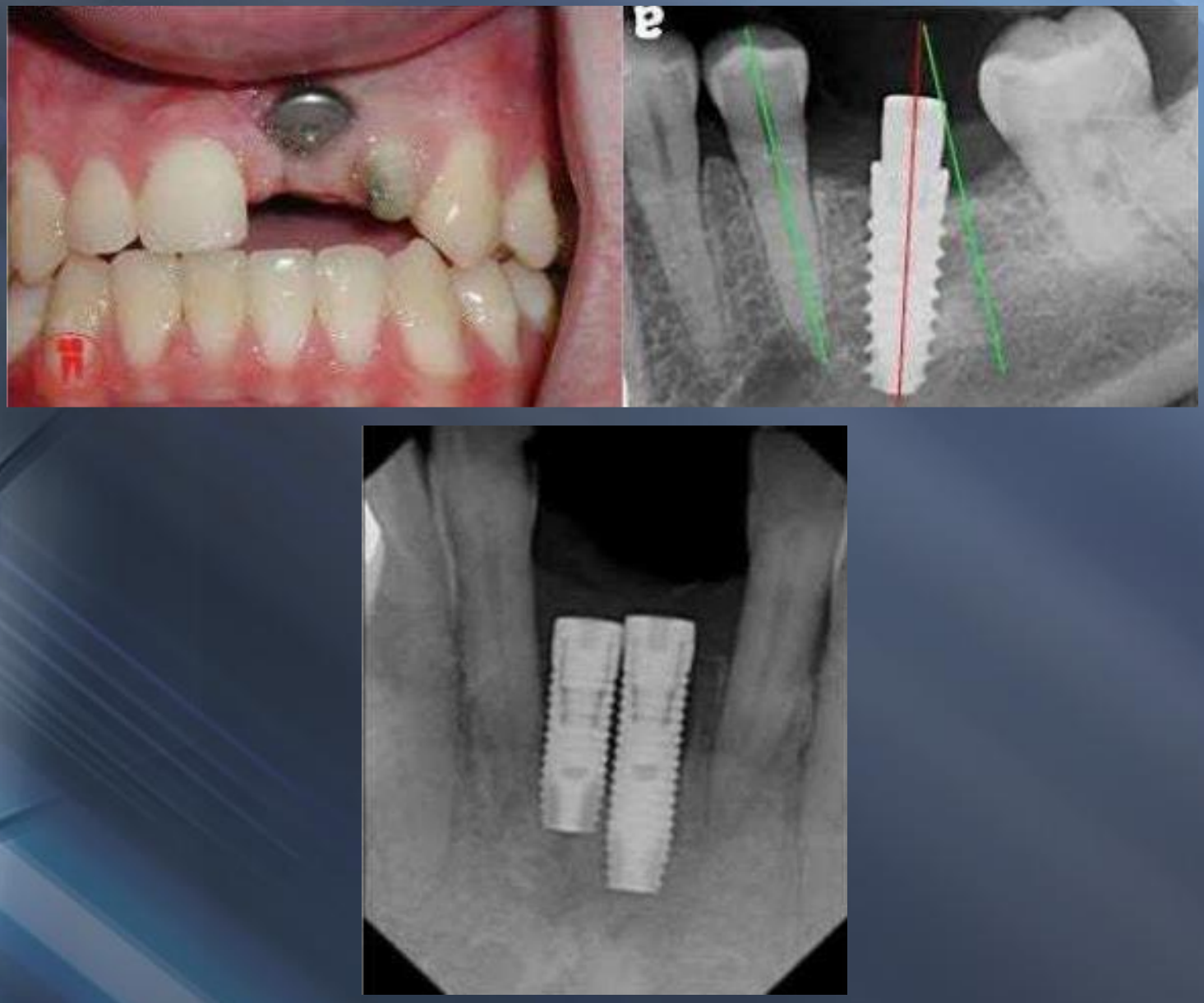
Causes :

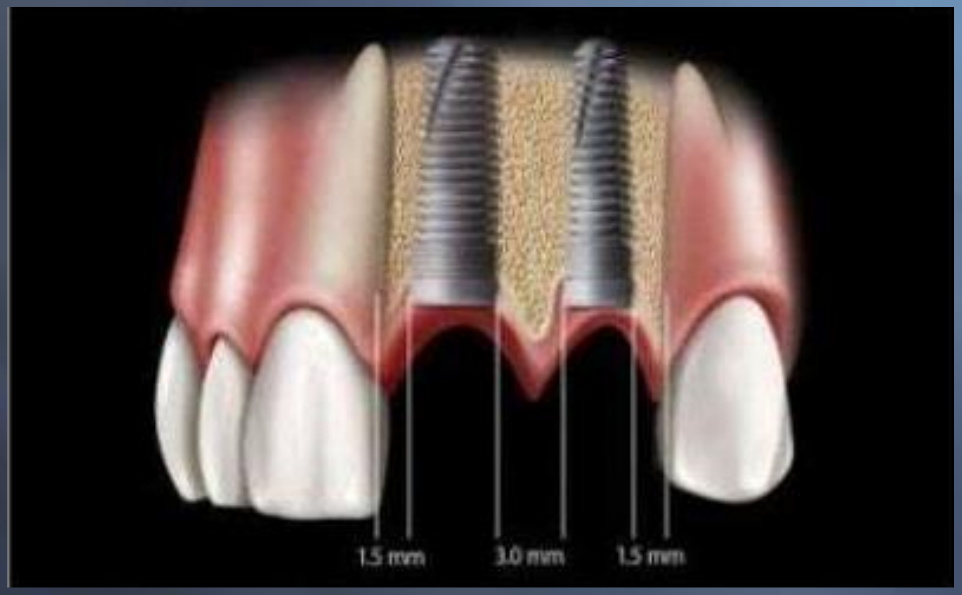
most common - deficiency of the osseous housing around the proposed implant site.

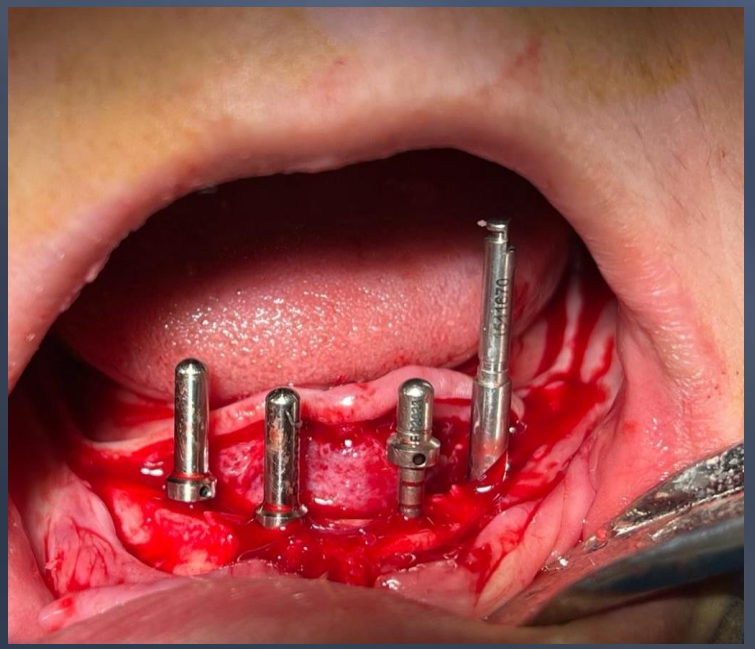
Bone resorption :

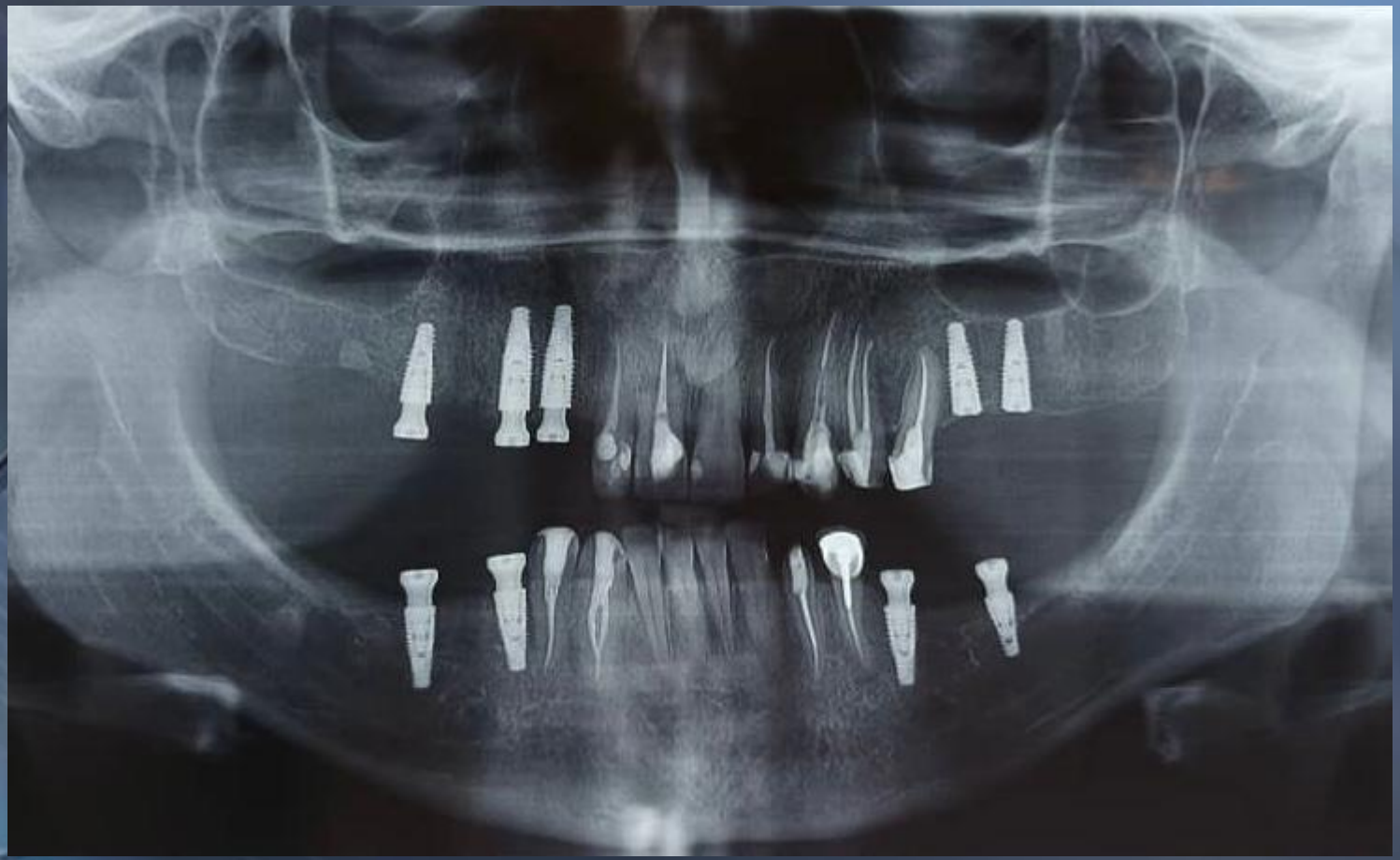
osseous remodeling following tooth loss,

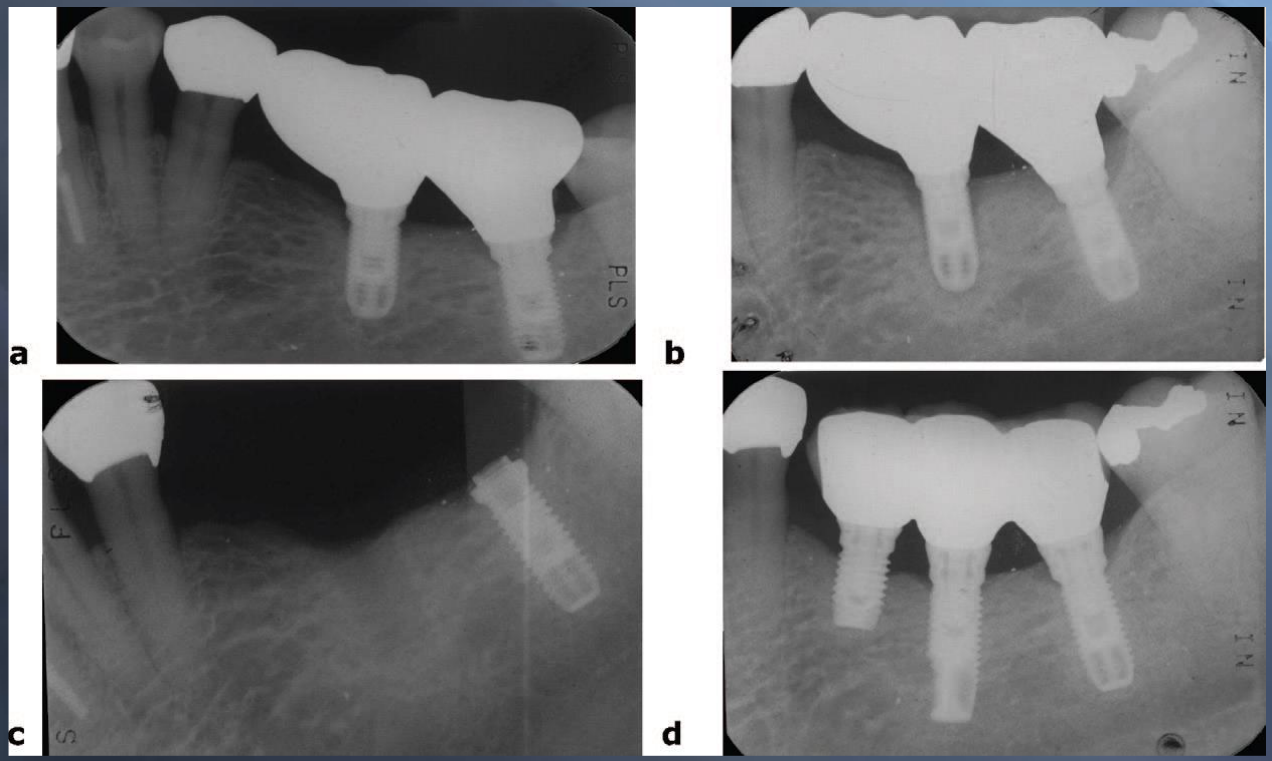
osteoporosis, etc.




1.5 mm
3.0 mm
1.5 mm







Example of a poor initial treatment plan

- No. 19 implant (a) was placed too far from the second premolar causing the fixed crown to be cantilevered mesially to obtain contact with the adjacent tooth
- but (b) too much stress may have caused the alveolar bone loss evident at the crest and surrounding the implant body.
- The mesial implant (c) was removed and replaced (d) with 2 additional implants to alleviate complications.

Precautions:

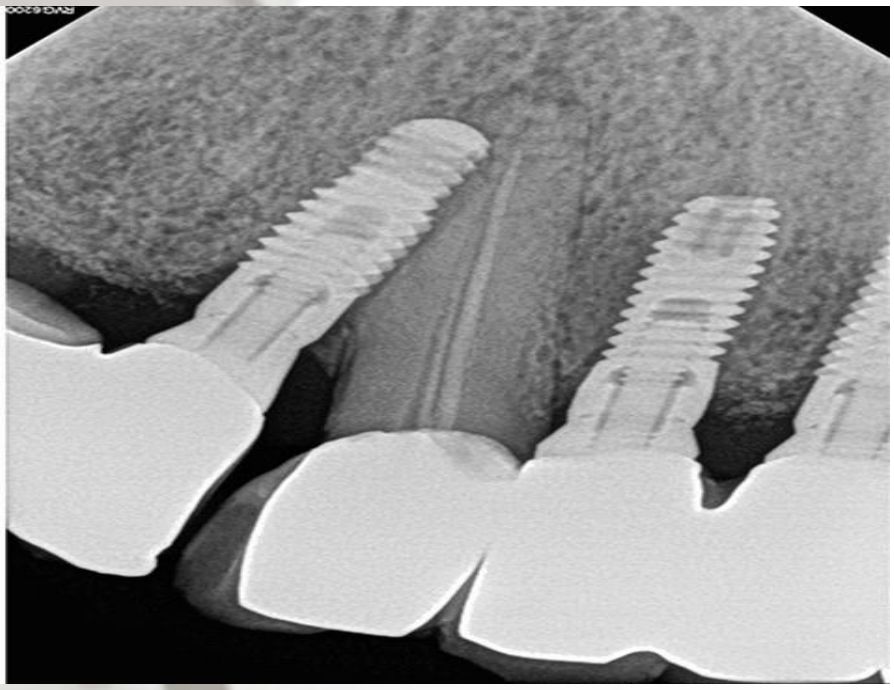
- Assess the characteristics of the edentulous zone subject to rehabilitation using clinical and radiological CT, or cone beam CT imaging

(Dreiseidler et al., 2009)

- Use short or tilted implants (aproximately 30°) or"
- avoid anatomical structures (mental nerve, maxillary sinus).

Injury to adjacent teeth

- This problem arises more frequently with single implants



A malpositioned implant hitting an adjacent tooth

- Damage to teeth adjacent to the implant site- subsequent to the insertion of implants along an improper axis or after placement of excessively large implants.

- Risk of a retrograde Periimplantitis- distance between tooth and implant apexes is shorter and when the lapse of time between the endodontic procedure and the implantation is also shorter

(Quirynen et al., 2005; Tozum et al., 2006; Zhou et al., 2009).

Precautions:

- Use of a surgical guide, radiographic analysis and CT scan can help locate the implant placement.

- Inspection of a radiograph with a guide pin at a depth of 5 mm will facilitate osteotomy angulation corrections **(Greenstein et al., 2008)**.

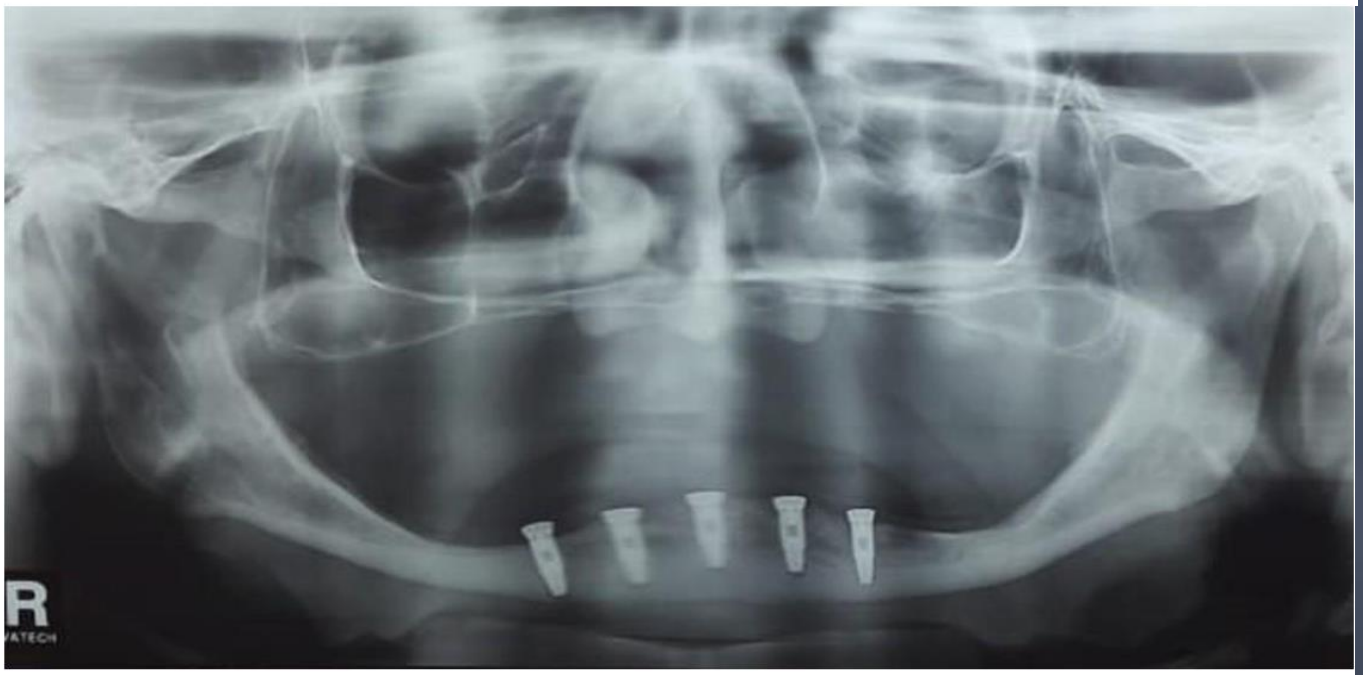
- Prevent a latent infection of the implant from the potential endodontic lesion, endodontic treatment should be performed

Mandibular fracture

Infrequent complication

Perforation of the lingual cortical during drilling.


R


R

- Associated with atrophic mandibles
- Central area of the mandible has a greater risk for this complication

- **Treatment:**

Reduction and stabilization of the fracture with titanium miniplates or resorbable miniplates.

Splinting implants to reduce and immobilize the fracture

- **Precautions:**

Thin mandibular alveolar crests- increase width by performing bone grafts

Accurate tomography imaging study

Implant fracture

- Infrequent complication (among 0,2 y- 1.5% of cases) **(Eckert et al., 2000)**

- Complications is higher in implants supporting fixed partial prosthesis than in complete edentulous patients.

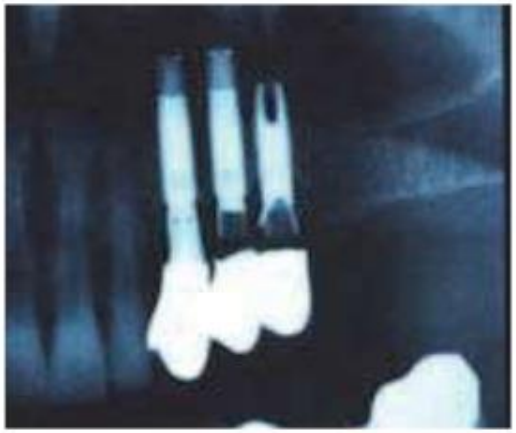
- Causes:

Defects in the implant design or materials used in their construction,

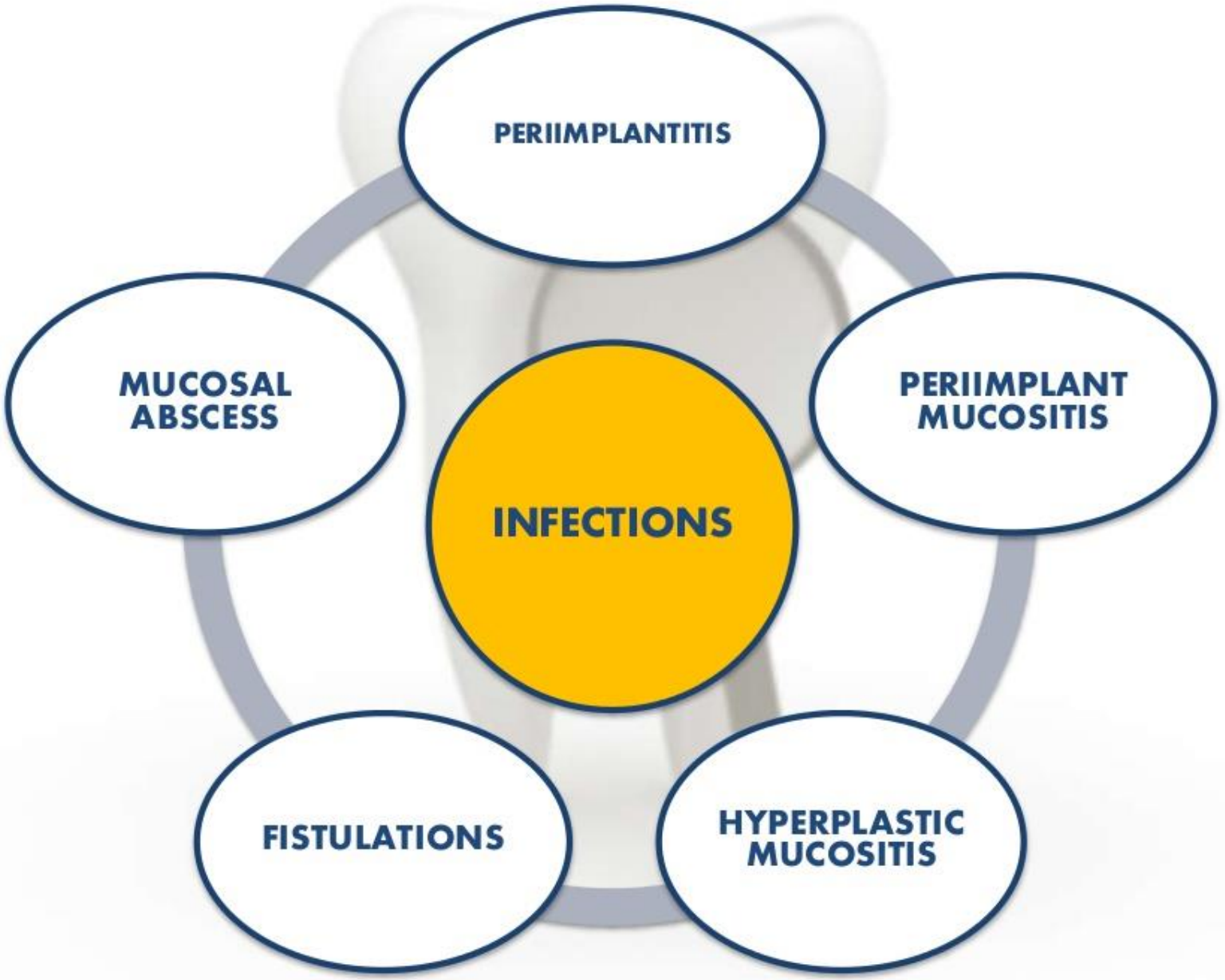
A non-passive union between the implant and the prosthesis or by mechanical overload,

Management:

Removal of the implant and its replacement by another one

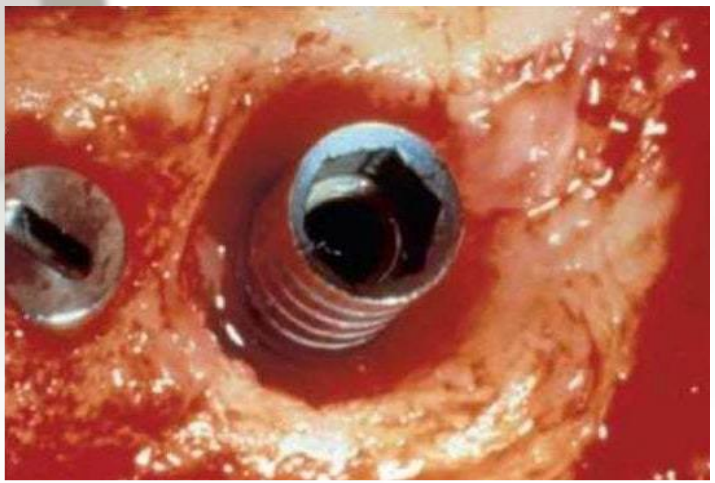


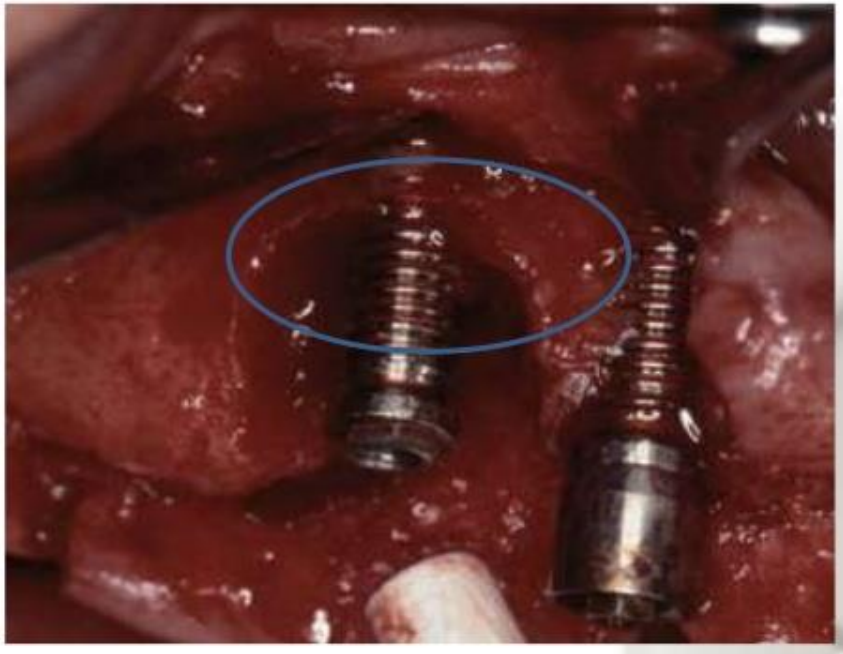
(a) Implant fractured in maxillary posterior region. (b) Implants retrieved. (c) Substitution for a wider diameter in the same surgery


PERIIMPLANTITIS
MUCOSAL ABSCESS
PERIIMPLANT MUCOSITIS
INFECTIONS
FISTULATIONS
HYPERPLASTIC MUCOSITIS

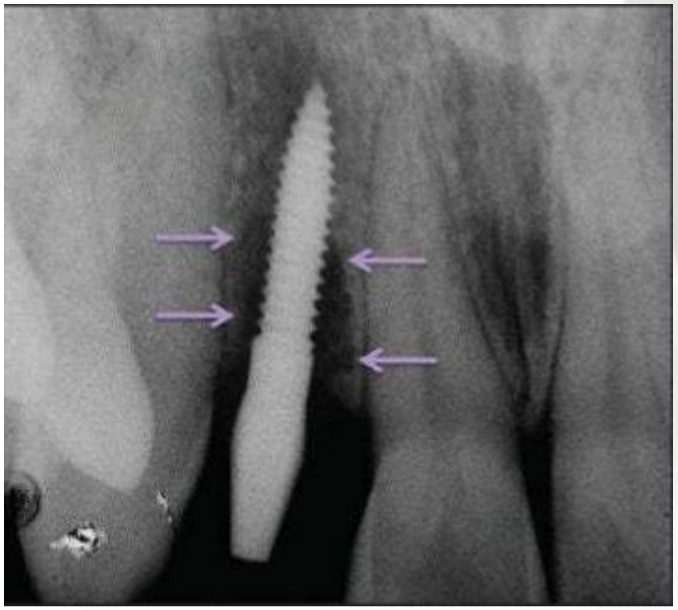
Periimplantitis

- Peri-implantitis is defined as an inflammatory process which affects the tissues around an osseointegrated implant in function, resulting in the loss of the supporting bone, which is often associated with bleeding, suppuration, increased probing depth, mobility and radiographical bone loss.





Periimplantitis



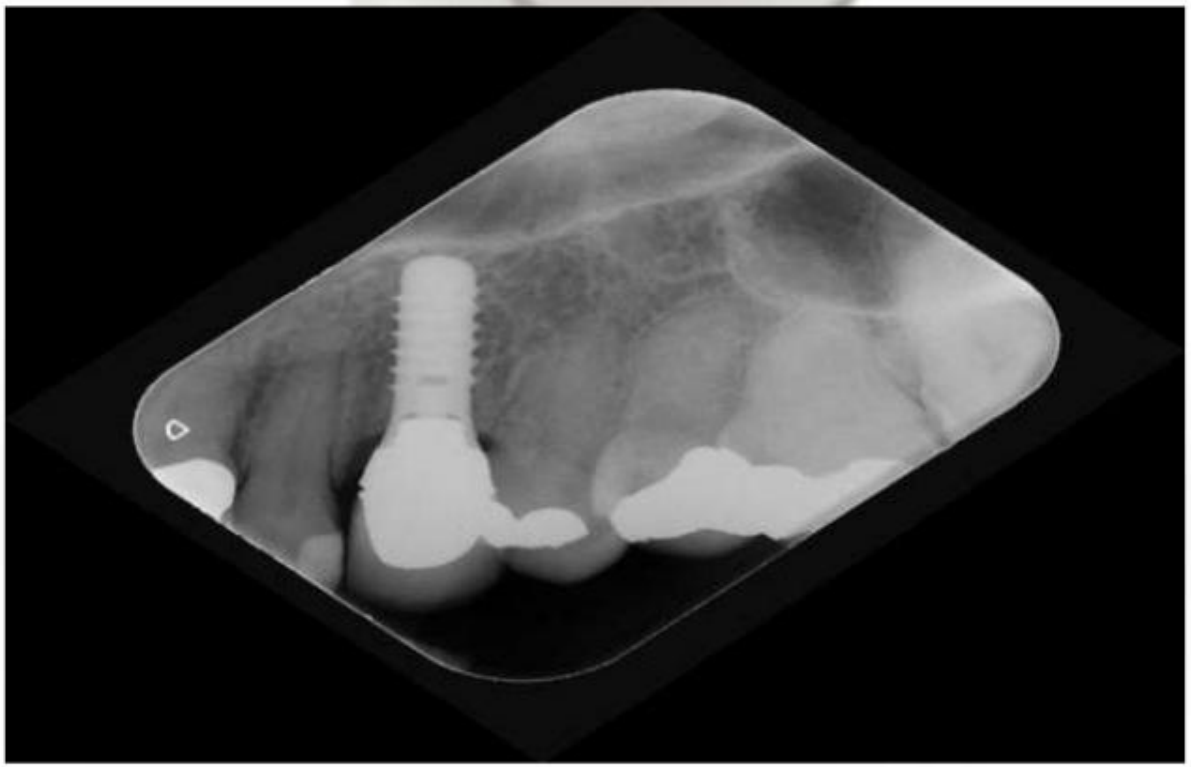
- Peri-implant mucositis was defined as reversible inflammatory changes of the peri-implant soft tissues without any bone loss

(Albrektsson & Isidor 1994)

In a systematic analysis, 2003

- Incidence of periimplmant mucositis- 8-44%
- Incidence of periimplantitis- 1- 19%

Periimplant mucositis



Risk factors for peri-implantitis

- History of periodontitis
- Smoking
- Poor oral hygiene
- Exposed threads
- Exposed surface coatings (roughened surfaces)
- Deep pockets (placed too deep, placed into deficiencies)
- No plaque removal access (ridge lap crown, connected prostheses)

Features

Radiological evidence for vertical destruction of the crestal bone

Saucer shaped defect

Formation of a peri-implant pocket

Bleeding and suppuration on probing

Pain

Swelling of the peri-implant tissues and hyperplasia

Diagnosis

- Clinical indices,
- peri-implant probing,
- bleeding on probing (BOP),
- suppuration,
- mobility,
- peri-implant radiography
- microbiology.

Cumulative Interceptive Supportive Therapy (CIST) modalities (Lang et al, 2004).

- A. **Mechanical cleansing**

using rubber cups and polishing paster, acrylic scalers for chipping off calculus.

Effective oral hygiene practices.

- B. **Antiseptic therapy**

Rinses with 0.1% to 0.2% chlorhexidine digluconate for 3 to 4 weeks,

- supplemented by irrigating locally with chlorhexidine (preferably 0.2% to 0.5%)

C. Antibiotic therapy:

1. SYSTEMIC ornidazole (2 x 500 mg/day) or metronidazole (3 x 250 mg/day) for 10 days

OR combination of metronidazole (500 mg/day) plus amoxicillin (375 mg/day) for 10 days.

2. LOCAL: application of antibiotics using controlled release devices for 10 days (25% Tetracycline fibers).

D. Surgical approach:

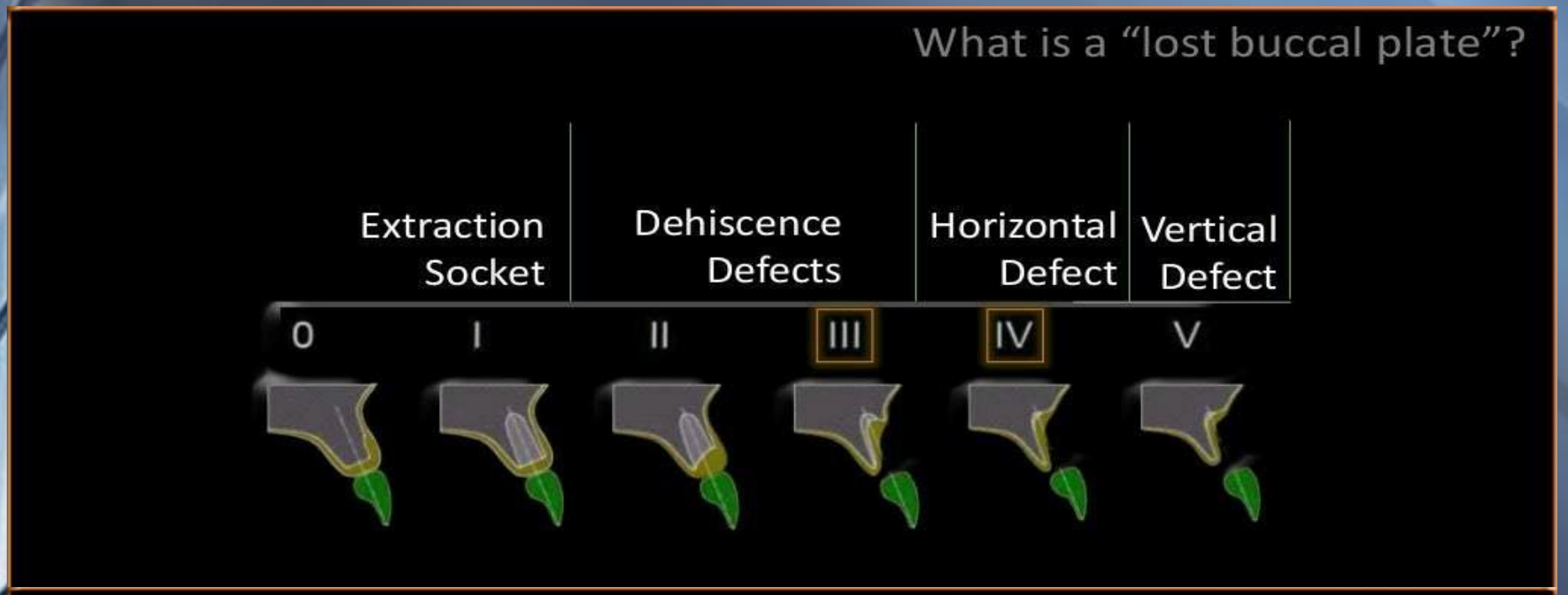
1. **REGENERATIVE SURGERY**

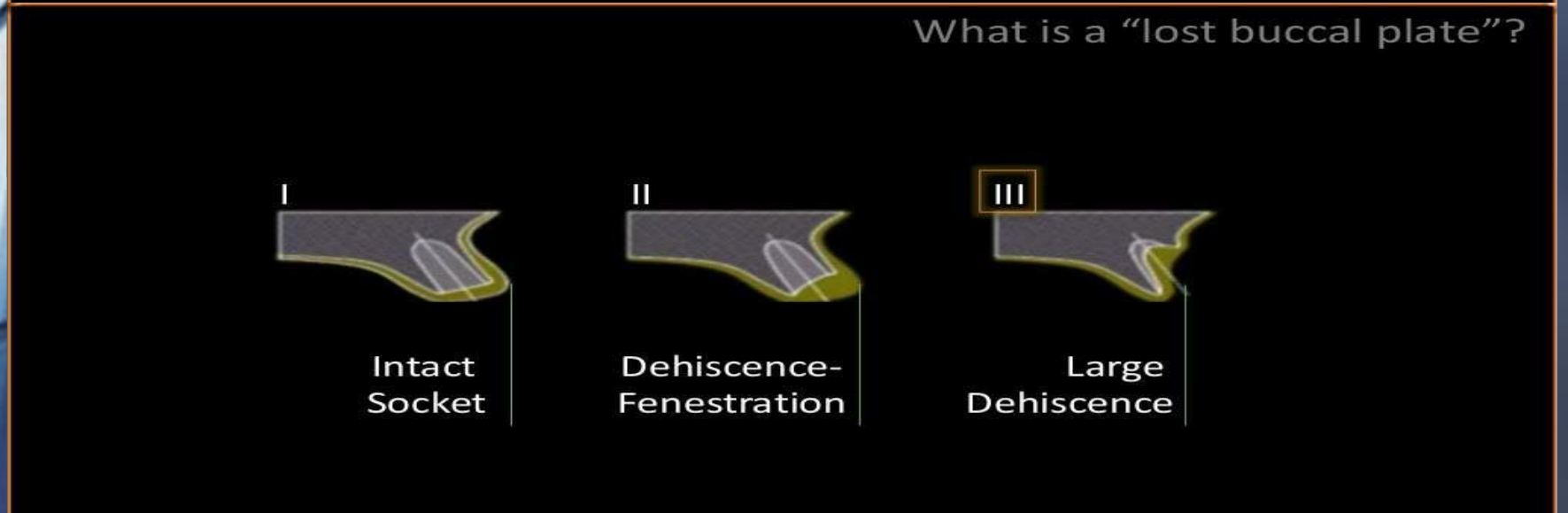
- using abundant saline rinses at the defect,
- barrier membranes,
- close flap adaptation and
- careful post-surgical monitoring for several months.
- Plaque control is to be assured by applying chlorhexidine gels.

2. **RESECTIVE SURGERY**

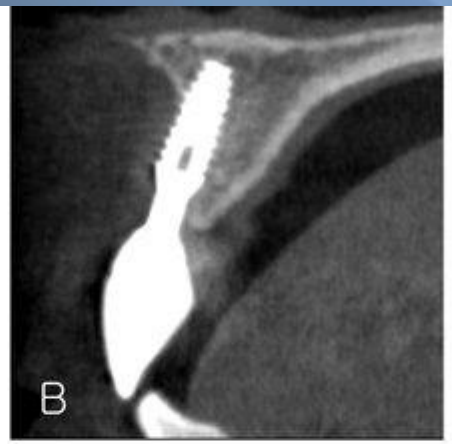
- Apical repositioning of the flap following osteoplasty around the defect.

Buccal plate complications





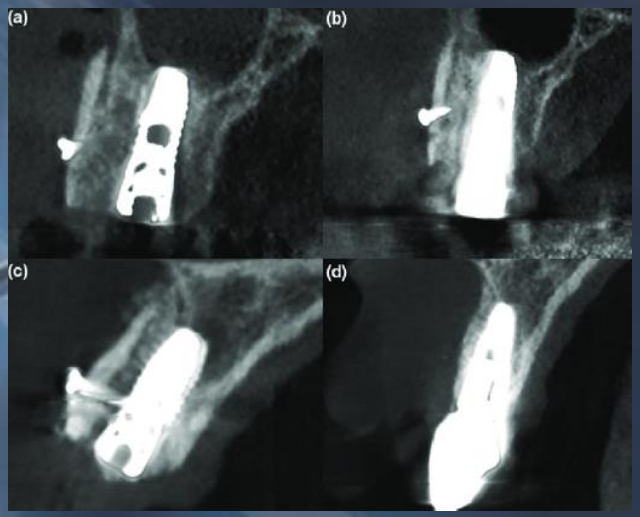

A

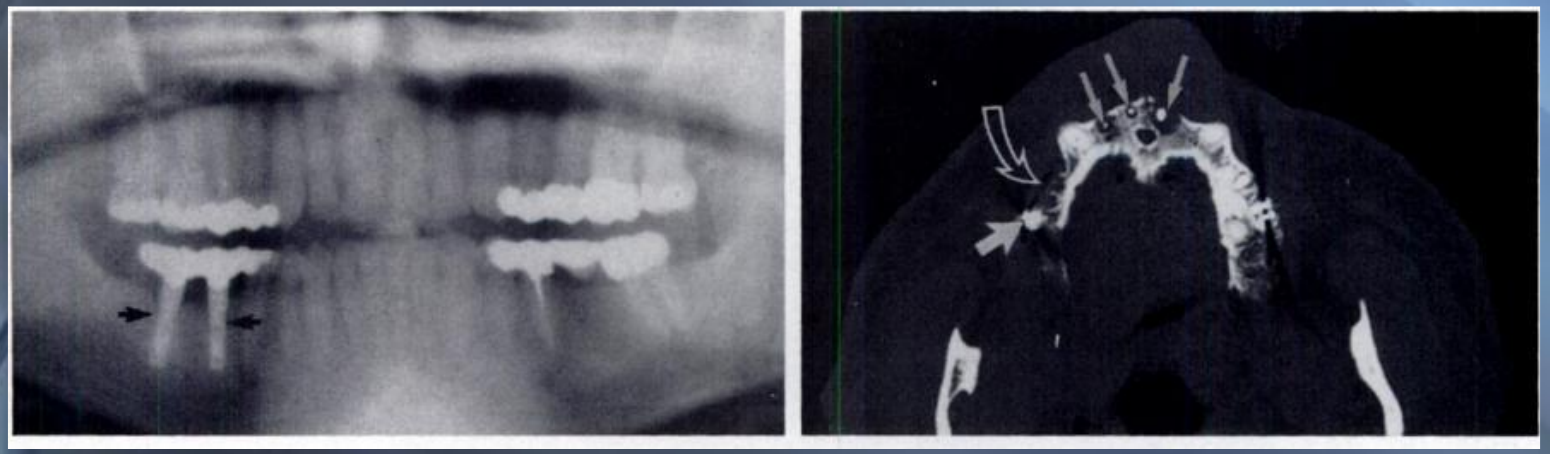

B

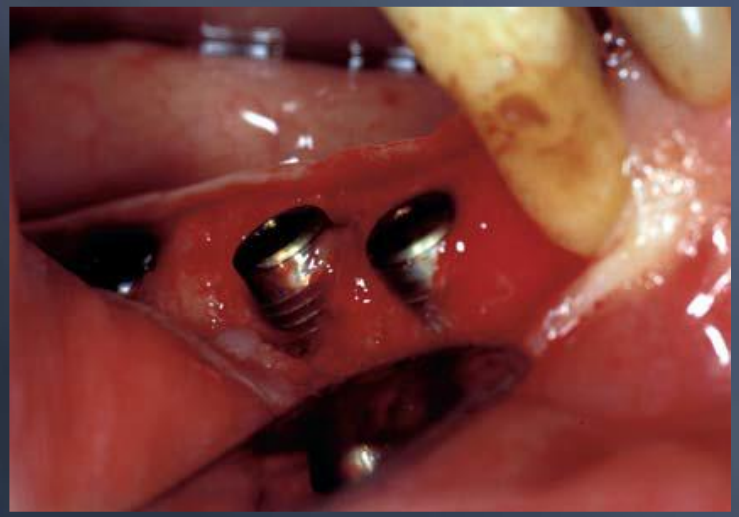

C


D


E


(a)
(b)
(c)
(d)





A vertical bony defect around two implants at the time of phase II surgery

Signs of a “losing or lost buccal plate”

Immediate Implant
Metal Show
(IIM)

Delayed Implant
Shadow Show
(DISS)

Delayed Implant
Actual Show
(DIAS)

Mazen Almasri. Surgical Science. 2013:4;110-113.

Failed osseointegration

- Osseointegration was originally defined as a direct structural and functional connection between ordered living bone and the surface of a load-carrying implant

(Albrektsson et al. 1994).

Osseointegration between an endosseous titanium implant and bone can be expected greater than 85% of the time when an implant is placed.

Loss of the implant for lack of osseointegration

Clinical signs of Failure

1) Signs of infection during healing (6-9 months)
2) Swelling, fistulas, suppuration, early/late mucosal dehiscence, and osteomyelitis
3) Pain
4) Mobility
5) Dull sound at percussion

Radiographic signs of failure

1) A thin peri-implant radiolucency surrounding the entire implant, suggesting the absence of a direct bone-implant contact and possibly a loss of stability
2) An increased marginal bone loss

Indication for implant removal

- Severe peri-implant bone loss (> 50% of implant length).
- Bone loss involving implant vents or holes.
- Unfavorable advanced bone defect.
- Rapid, severe bone destruction (within 1 yr of loading).
- Nonsurgical or surgical therapy ineffective.
- Esthetic area providing implant surface exposure

FACTORS ASSOCIATED WITH INCREASED FAILURE RATE:

Endogenous

Systemic

- Compromised medical status
- Smoking

Local

- Irradiation
- Poor bone quality/quantity
- Bone grafting
- Para functions

Exogenous

Operator related

- Non-optimal experience
- High degree surgical trauma
- Bacterial contamination
- Immediate loading
- Non-submerged technique
- Non-optimal number of supporting implants
- Lack of prophylactic antibiotics.

Biomaterial related

- Non-optimal surface properties
- Non-optimal implant design.

Tips to avoid complications

- Presurgical diagnosis and Rx planning
- Use of surgical guide and adherence to proven principles
- Through understanding of anatomy, biology and wound healing
- No substitute for training and clinical experience for preventing, recognizing and managing complictions

Conclusion

Dental implant placement is not free of complications, as complications may occur at any stage.

Careful analysis via imaging, precise surgical techniques and an understanding of the anatomy of the surgical area are essential in preventing complications.

Prompt recognition of a developing problem and proper management are needed to minimize postoperative complications.

References:

1. Fermin A. Carranza, Jr., Michael G. Newman,Textbook of Clinical periodontology.,1oth ed., WB saunders &Co.,2008
2. Jan Lindhe, Thorkild Karring . Niklaus P. Lang, Textbook of Clinical Periodontology and Implant Dentistry, 4th ed. by Blackwell Munksgaard, a Blackwell, Publishing Company, 2003.
3. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. Int J Oral Maxillofac Implants. 1986;1:11–25.
4. Misch CE. Implant Success, Survival, and Failure: The International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. *Implant Dent 2008;17:5–15*
5. K. Karthik. Evaluation of implant success: A review of past and present concepts. J Pharm Bioallied Sci. 2013 Jun; 5(Suppl 1): S117–S119.