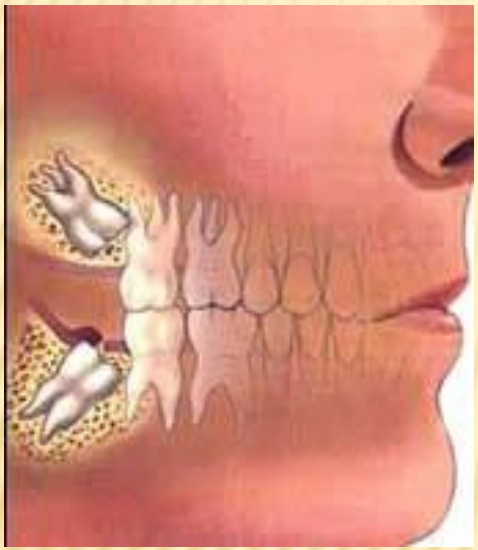
Wisdom Tooth Extraction: What should we know.



DR.ADNAN SHAH.

BSC,BDS,MDS(UK),FDSRCS(EDINBURGH),FFDRCS(IRELAND),FRACDS(AUSTRALIA), FCPS(PAKISTAN).FDSRCPS(GLASGOW),FRCDC(CANADA)

DIPLOMATE AMERICAN BOARD OF ORAL AND MAXILLOFACIAL SURGERY.

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COLLEGE OF DENTISTRY, UNIVERSITY OF MANITOBA.

CANADA.

PRESENTATION OUTLINE

- Definitions
- Development
- Classification
- Indication and contraindications of removal
- Assessment of difficulty index
- What are the risk factors.
- Role of imaging
- Therapeutic considerations..
- Armamentarium.
- Informed consent.
- Surgical procedure.
- Postoperative instructions
- Incidence of complications
- Minor and Major complications.
- How do we assess these complications
- Treatment strategies

- 80% of the population have four third molars and 5% have missing third molars
- 10 Million third molars are removed in North America with an over all cost of 2 billion dollars and accounts for 50% OMFS service revenues.

(Swedish population studies by Hogoson A.et al: The prevalence of third molars in Swedish population:Comm Dental Health:1988:5:121-38.)

(Flick W G. The third molar contraversy:JOMS;57;438;1999.)

DEFINITIONS

- Impaction
  - Occurs when there is prevention of complete eruption into a normal functional position <u>beyond the chronological age.</u>
  - This can involve only soft tissues or hard and soft tissues.
  - This can predispose to pathological changes.

UN-ERUPTION

- Un-erupted tooth partially or entirely covered by bone and/or soft tissue before the Chronological age.
- Ankylosed tooth = fused with alveolar bone
- Ectopic tooth = Malpositioned due to congenital factors.
- Displaced tooth =Malpositioned due to presence of pathology

DEVELOPMENT

Demirjian's Classification

- A dental system assessing 7 teeth (central incisors to 2nd molars) to achieve dental maturity scores
- Clearly defines the stages of tooth development, leading to minimal inter & intra-observer variability and most accurate correlation between estimated and true age

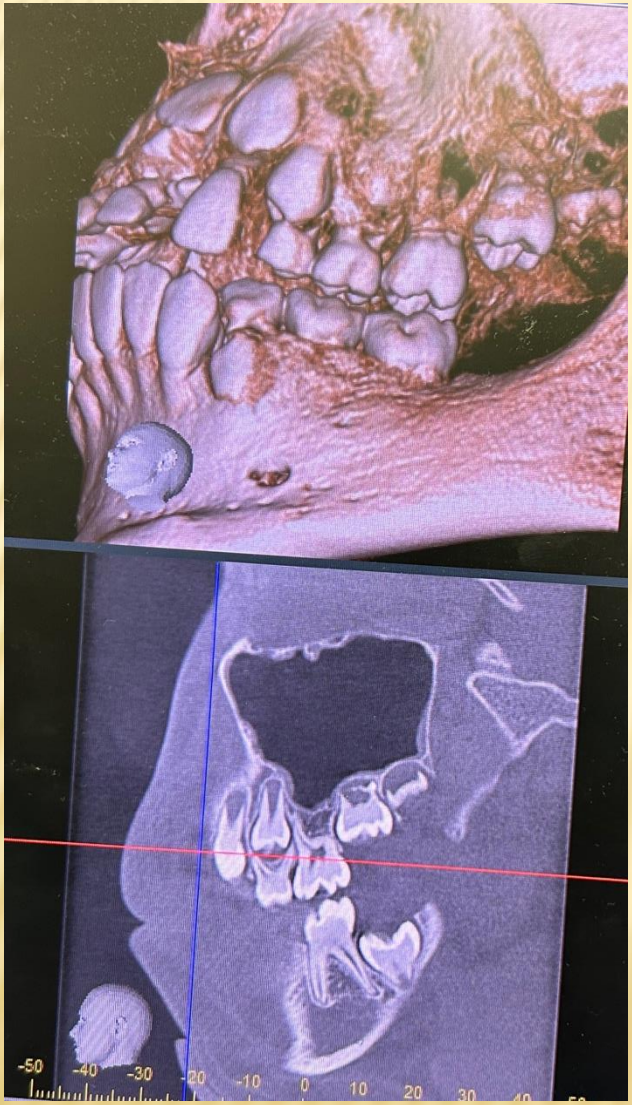
DEVELOPMENT

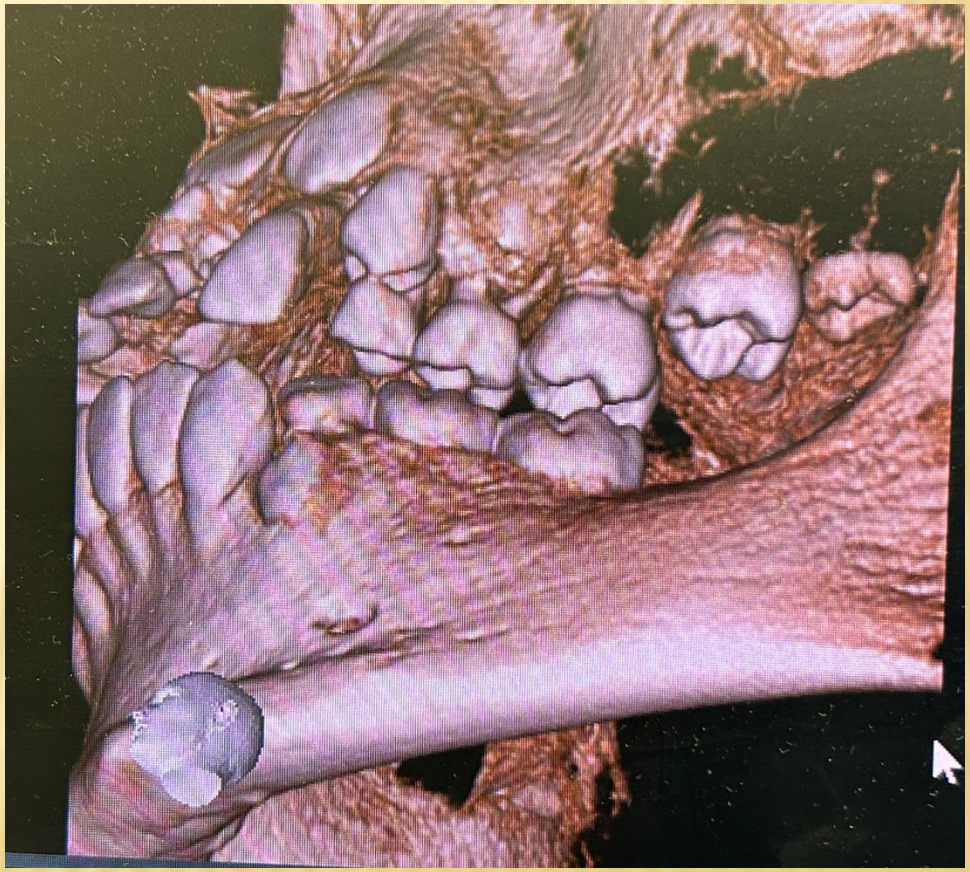
DEMIRJIAN'S CLASSIFICATION

Stages

- 0 – Radiolucent bud with no calcification
- A – Cusp tips mineralized but not yet coalesced
- B – United mineralized cusps and well-defined mature coronal morphology
- C – Crown about half formed, evident pulp chamber, visible dentin deposition
- D – Crown formation completed to CEJ, pulp chamber with a trapezoidal form
- E – Commencement of inter-radicular bifurcation, root length < crown length
- F – Root length: crown length 1:1 (or more), roots have funnel shaped endings
- G – Root walls parallel, root apices open
- H - Root apices closed, uniform width of PDL around the root

DEVELOPING THIRD MOLAR IN A 6-YEAR-OLD





DEVELOPMENT OF 3RD MOLARS VS. ARCH

- Development stage of 3rd molars was overall more advanced in the maxillary arch versus the mandibular arch.

Table 5. Mean age and standard deviation for the developmental stages of the third molars

Stage	Maxillary third molar			Mandibular third molar			Total			*P*
	N	Mean	SD	N	Mean	SD	N	Mean	SD	
0*	27	8.78	1.25	128	8.52	1.40	155	8.57	1.38	0.342
A	229	9.64	1.44	350	10.01	1.58	579	9.86	1.54	0.006*
B	188	11.15	1.66	224	11.70	1.47	412	11.45	1.58	0.000*
C	286	12.74	1.68	338	13.31	1.62	624	13.05	1.67	0.000*
D	233	14.52	1.74	220	15.04	1.58	453	14.77	1.68	0.000*
E	368	16.10	1.73	438	16.37	1.92	806	16.25	1.84	0.074
F	384	17.48	1.87	389	17.68	1.80	773	17.58	1.84	0.100
G	612	18.93	1.47	679	19.06	1.48	1291	19.00	1.48	0.140
H	987	21.87	1.74	1001	22.05	1.66	1988	21.96	1.70	0.033*
Total	3314	17.31	4.34	3767	17.01	4.52	7081	17.15	4.44	

*Stage 0 was added to Demirjian's classification system for representing follicle with no calcification.

DEVELOPMENT OF 3RD MOLARS VS. GENDER

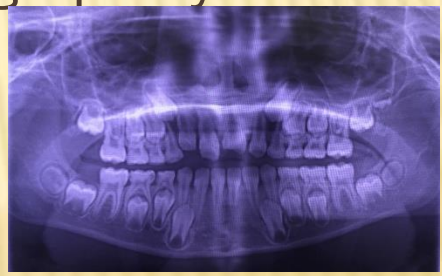
- Males tend to reach the developmental stages of third molars earlier than females

Table 6. Mean age and standard deviation for the developmental stages of the third molars in relation to gender

Stage	Male			Female			*P*
	N	Mean	SD	N	Mean	SD	
0*	107	8.36	1.32	48	9.02	1.41	0.002*
A	348	9.82	1.51	231	9.94	1.58	0.487
B	204	11.43	1.58	208	11.47	1.59	0.735
C	306	12.99	1.38	318	13.11	1.90	0.282
D	155	14.58	1.73	298	14.87	1.66	0.031*
E	347	16.06	1.70	459	16.39	1.93	0.012*
F	293	17.17	1.44	480	17.83	2.01	0.000*
G	698	18.70	1.44	593	19.35	1.45	0.000*
H	1104	21.85	1.70	884	22.10	1.69	0.000*
Total	3562	17.03	4.59	3519	17.28	4.27	

*Stage 0 was added to Demirjian's classification system for representing follicle with no calcification.

DEVELOPMENT OF THIRD MOLAR.



- The third molar tooth germ is visible on the radiograph by the age of 9 years.
- Cusp mineralization is complete by 11 years.
- Crown formation is usually complete by 14 years.
- Root is 50% formed at 16 years.
- Complete root formation by the age 18 years with an open apex
- By age 24 years , 95% of all third molars that will erupt have completed their eruption.
- The change in orientation of the occlusal surface from straight anterior to straight vertical inclination occurs primarily during root formation and the tooth rotates from horizontal to mesioangular to vertical.
- Approximately half do not follow the eruption sequence and hence do not assume the vertical position and remain mesioangularly or horizontally impacted .

RADIOGRAPHIC DEVELOPMENT OF 3RD MOLARS

Jung & Cho Study: retrospective analysis of panoramic radiographs of 2490 patients, between the ages 6-24 years old, using Demirjian's classification

- Results:
  - 3rd molars begin development as early as 6 years and are fully formed by 24 years old
  - Almost no 3rd molar bud formation after the age of 12 years in Maxilla and 13 years in Mandible
  - 3rd molars were fully developed in 98.5% in Mx and 98.7% in Md of 24-year-olds
  - Developmental stages of Mx 3rds molars were more advanced than in Md
  - Males reach developmental stages earlier than females
  - Average age of initial mineralization = 8.57 years
  - Average age of apex closure = 21.96 years
  - Average age of crown completion (Stage D)
    - Maxillary = 14.52 years
    - Mandible = 15.04 years

CONTRIBUTING FFACTORS IN DEVELOPMENT OF THIRD MOLAR IMPACTIONS.

- Differential root growth between the mesial and distal roots.
- Allowing the tooth to either remain mesially inclined or rotate to a vertical position depending on the amount of root development.
- Relationship of the bony arch length to the sum of the mesio-distal widths of the teeth in the arch.
- Lateral position of the lower third molar to the normal position almost always fails to erupt due to dense bone present in the external oblique ridge.
- Retarded maturation of the third molar lags behind the skeletal growth and jaw maturation .
- Angulation of third molars and space available for emergence
- Lack of attrition of teeth with no mesial drift (soft diet)

COMMONEST IMPACTED TEETH

- Mandibular third molars
- Maxillary canines
- Mandibular premolars/canines
- Maxillary third molars
- Maxillary incisors
- Mandibular Canines

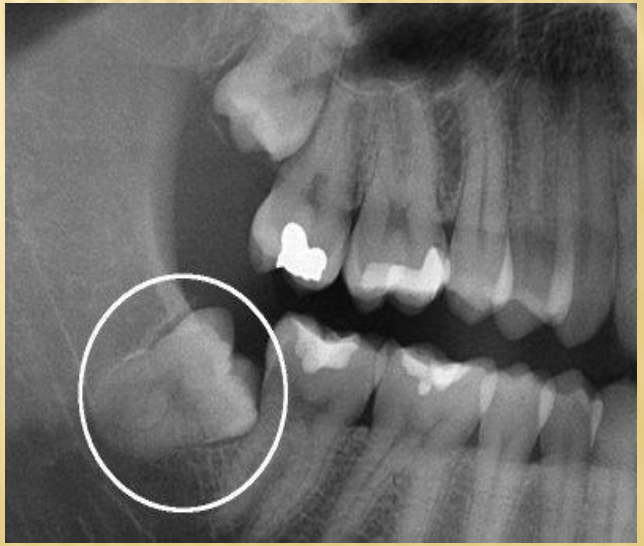
Look for (Impacted Canines)

Retained deciduous teeth
Palpable buccal/palatal mass
Lack of space
Erupted mesiodens/supernumeraries


IMPACTED TEETH
NON-IMPACTED TEETH

TOOTH GERM(9 YRS)

CUSP MINERALIZATION(11 YRS)



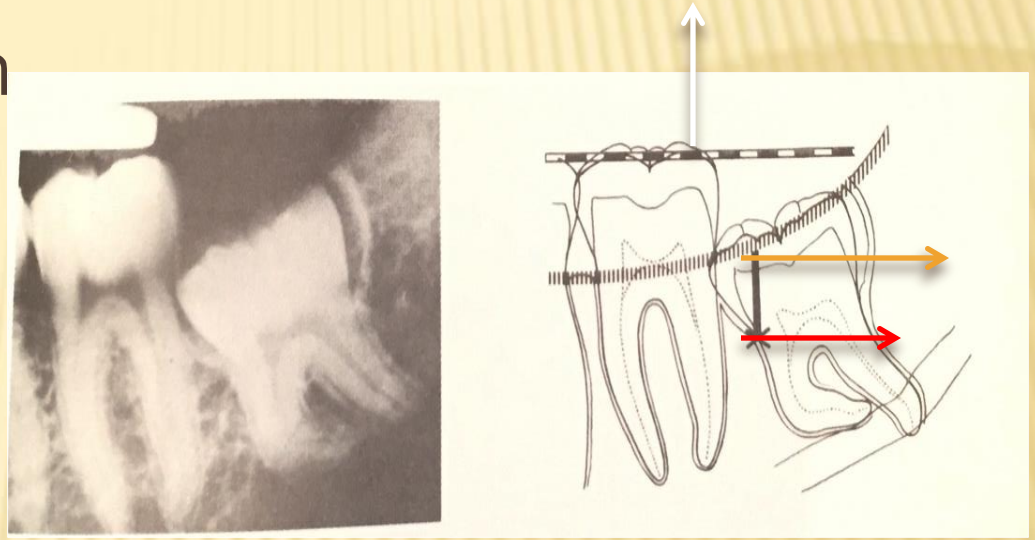
Association of different stages of root formation with the IAN

IMPACTION

- Soft Tissue Impactions are
  requiring soft tissue reflection but may also require bone cutting and tooth sectioning.
- Partial Bony Impactions are defined as one requiring soft tissues reflection and bone removal with and without tooth sectioning.
- Full Bony Impactions are defined as completely covered in bone requiring soft tissues reflection and bone cutting with tooth sectioning.

ASSESSMENT OF DIFFICULTY INDEX IS ASSOCIATED WITH THE CONTEMPOARY CLASSIFICATIONS.

- Winters classification
  - White line
  - Amber line
  - Red line

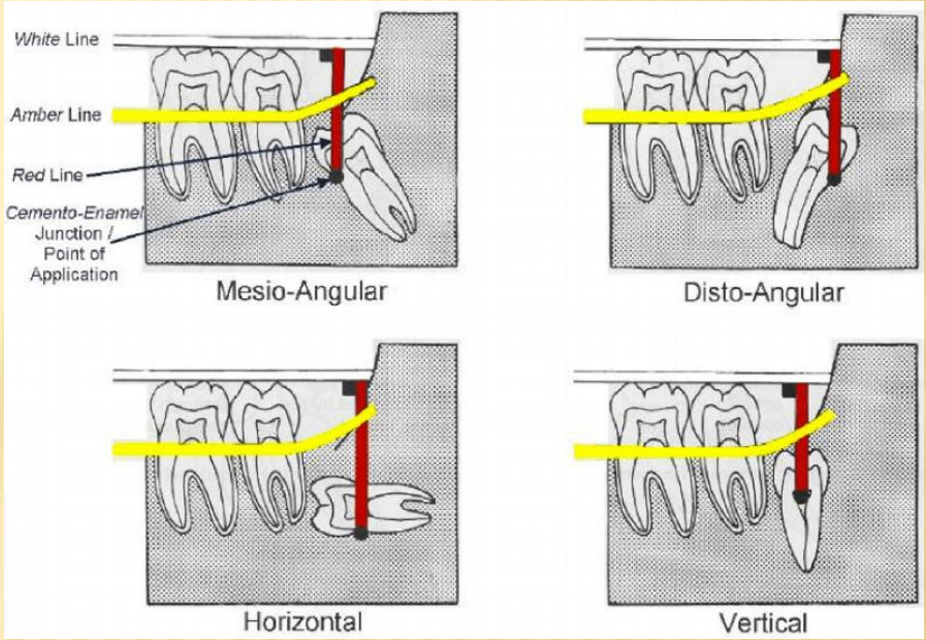


- Angulation Classification
- Pell and Gregory's classification

1mm increase of red line increases the difficulty by three times.
Red line greater than 5mm should not be carried under LA.

MD CLASSIFICATION SYSTEMS
WINTER'S CLASSIFICATION

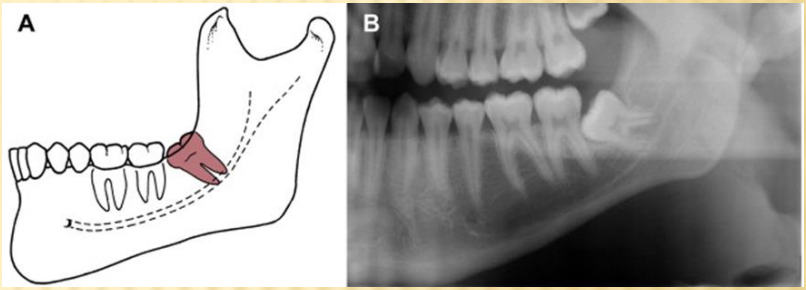
- Evaluated by angulation of the impacted third molar with respect to long axis of the second molar
- WAR lines
  - White → corresponds to occlusal plane of second and third molar
  - Amber → corresponds to alveolar bone covering impacted molar
  - Red → corresponds to depth of tooth in bone and difficulty in removal
    - > 5mm indicated difficult extraction, with every additional 1mm increasing difficulty 3-folds



WINTER'S CLASSIFICATION

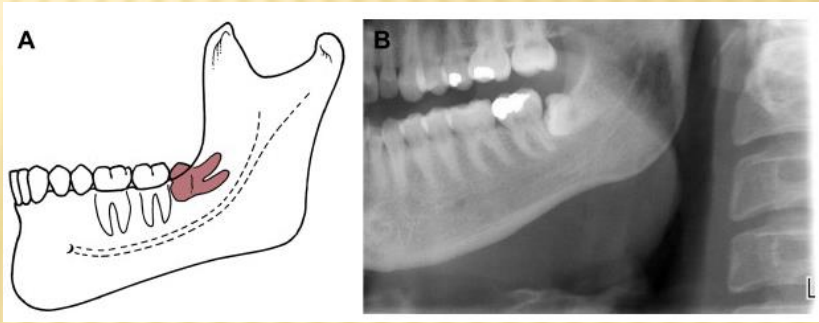
Mesioangular

- 43% occurrence – most common
- Crown positioned mesial to root apex
- Least complicated removal



Horizontal

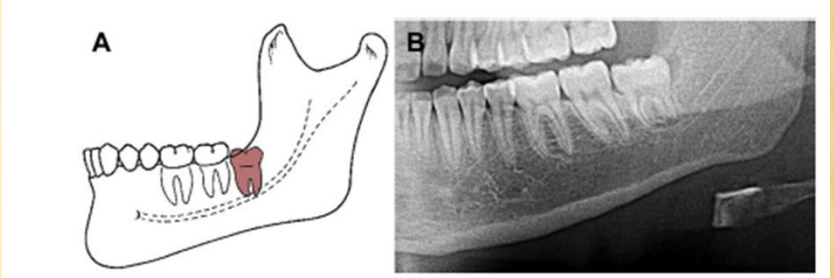
- 3% occurrence
- Tooth is perpendicular to ideal long-axis of 2nd molar
- Second least complicated to remove



WINTER'S CLASSIFICATION

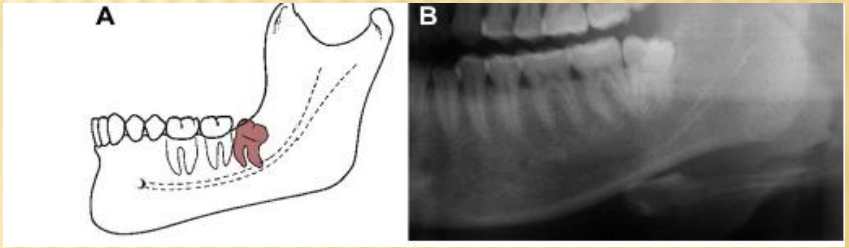
Vertical

- 38% occurrence - second most common
- Crown positioned over root structure vertically
- Not fully erupted to occlusal plane
- More difficult than horizontal



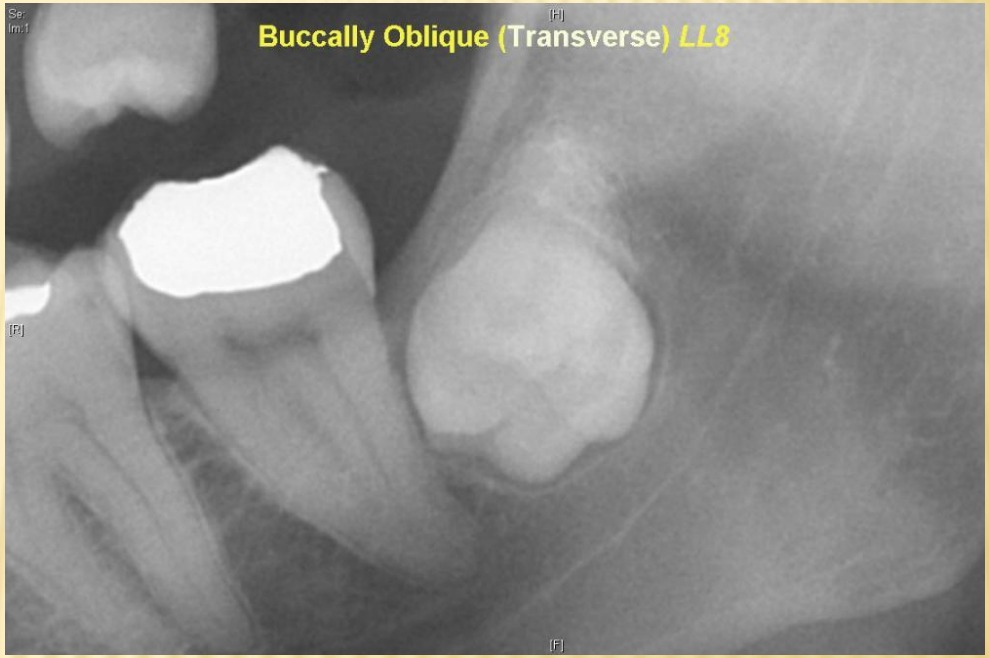
Distoangular

- 6% occurence
- Crown positioned distal to the root apex
- Most difficult to remove
- Typically requires significant bone removal
- Mesial root in close proximity to distal root of second molar



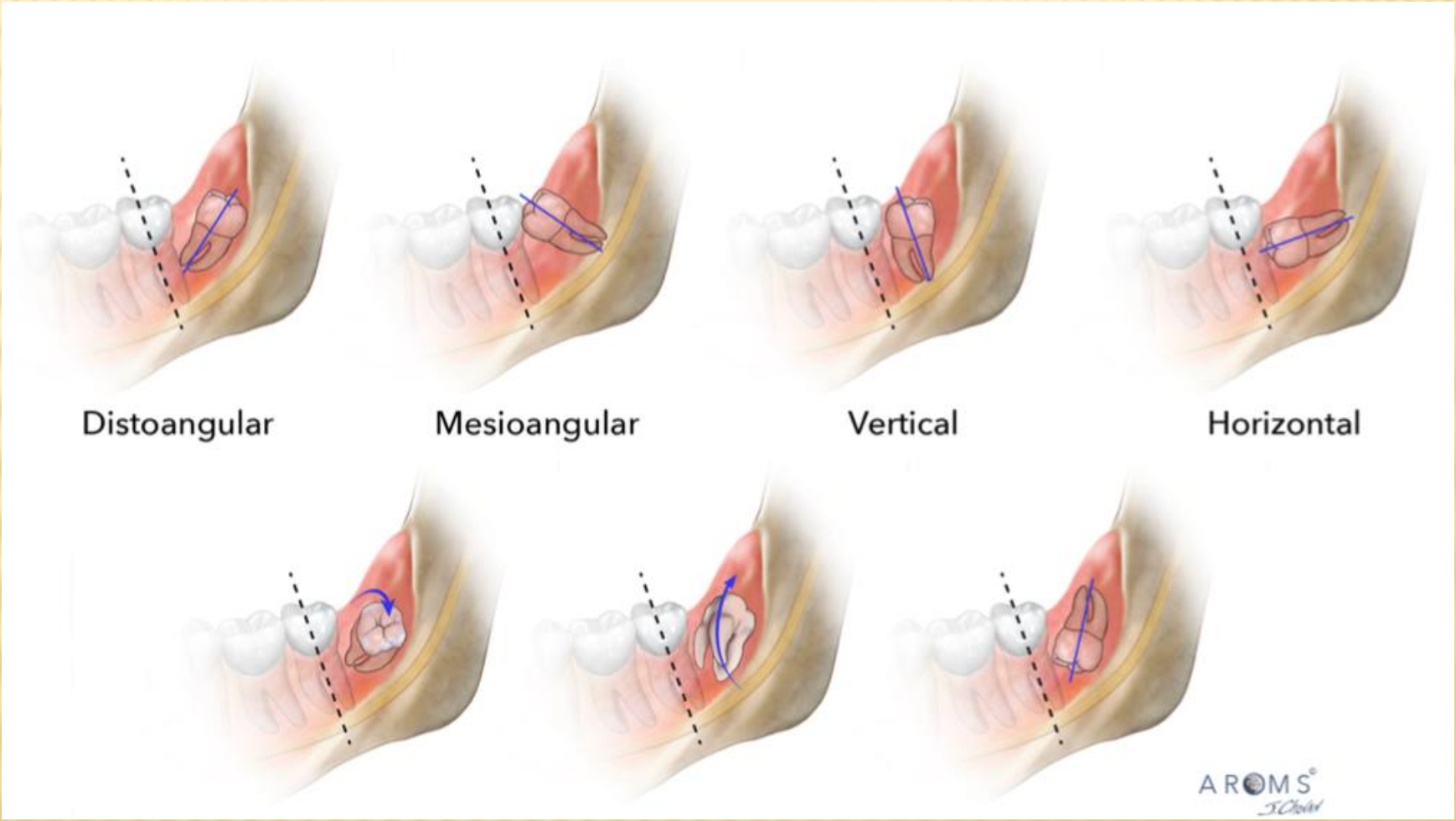
BUCCAL OBLIQUE(TRANSVERSE)

- 3.12% occurrence
- Difficult to remove
- Less removal of bone than distoangular impaction



WINTER'S CLASSIFICATION

WINTER'S CLASSIFICATION: ANGULATION



WINTER'S CLASSIFICATION

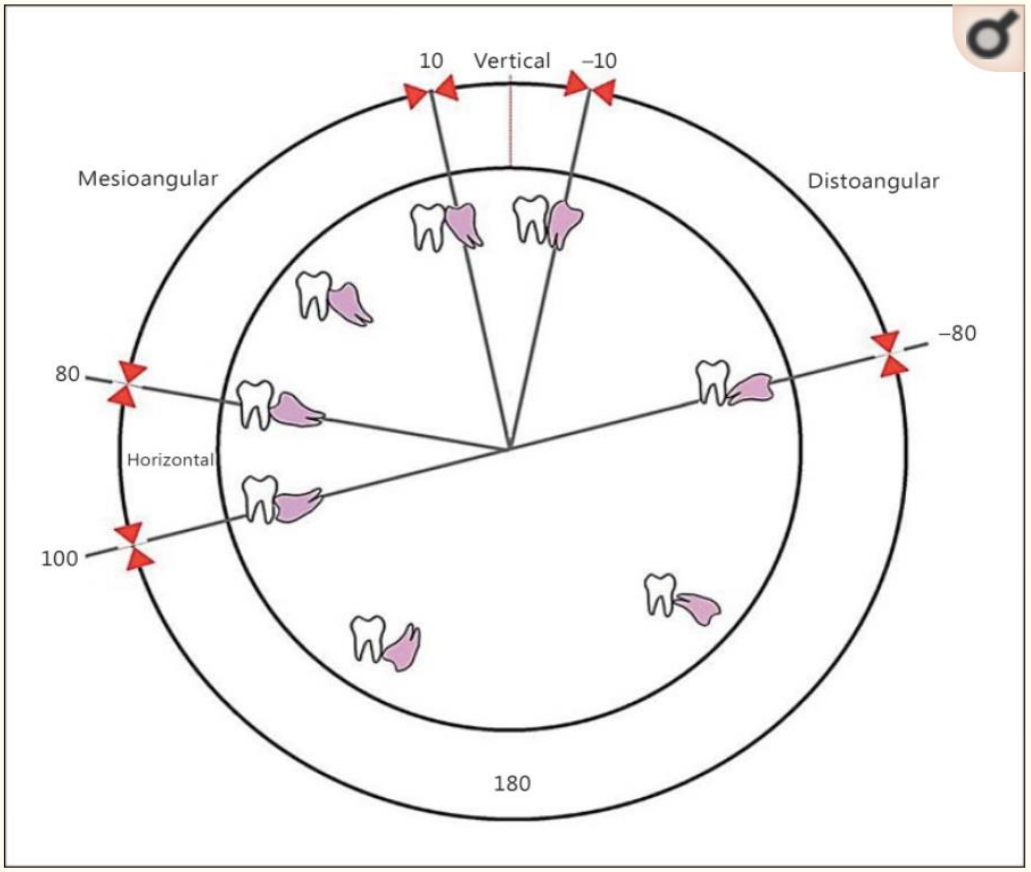
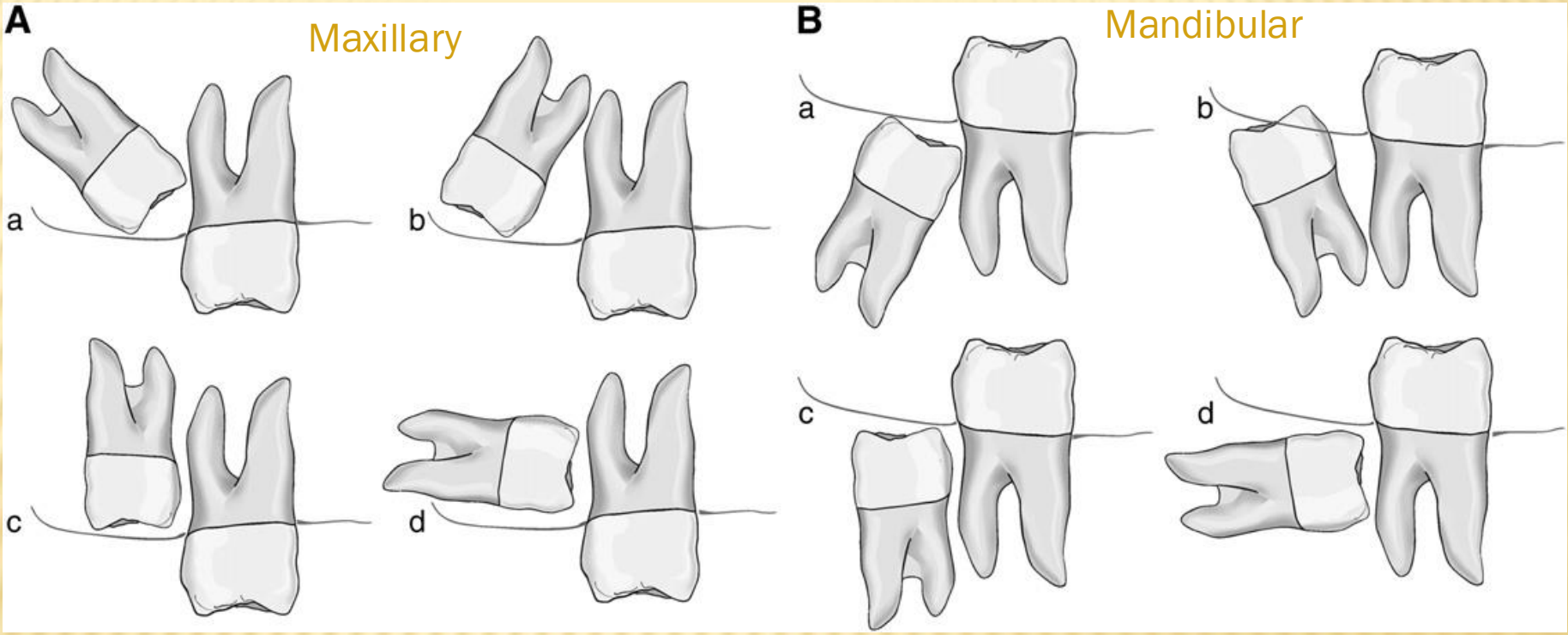


Fig. 2

Winter's classification. Vertical impaction: the long axis of the third molar is parallel to the long axis of the second molar (from 10 to −10°); mesioangular impaction: the impacted tooth is tilted toward the second molar in a mesial direction (from 11 to 79°); horizontal impaction: the long axis of the third molar is horizontal (from 80 to 100°); distoangular impaction: the long axis of the third molar is angled distally/posteriorly away from the second molar (from −11 to −79°); others (from 101 to −80°).

CLASSIFICATION OF IMPACTED THIRD MOLARS



1.Mesioangular.

2.Distoangualar.

3.Vertical.

4.Horizontal.

Angulation Classification

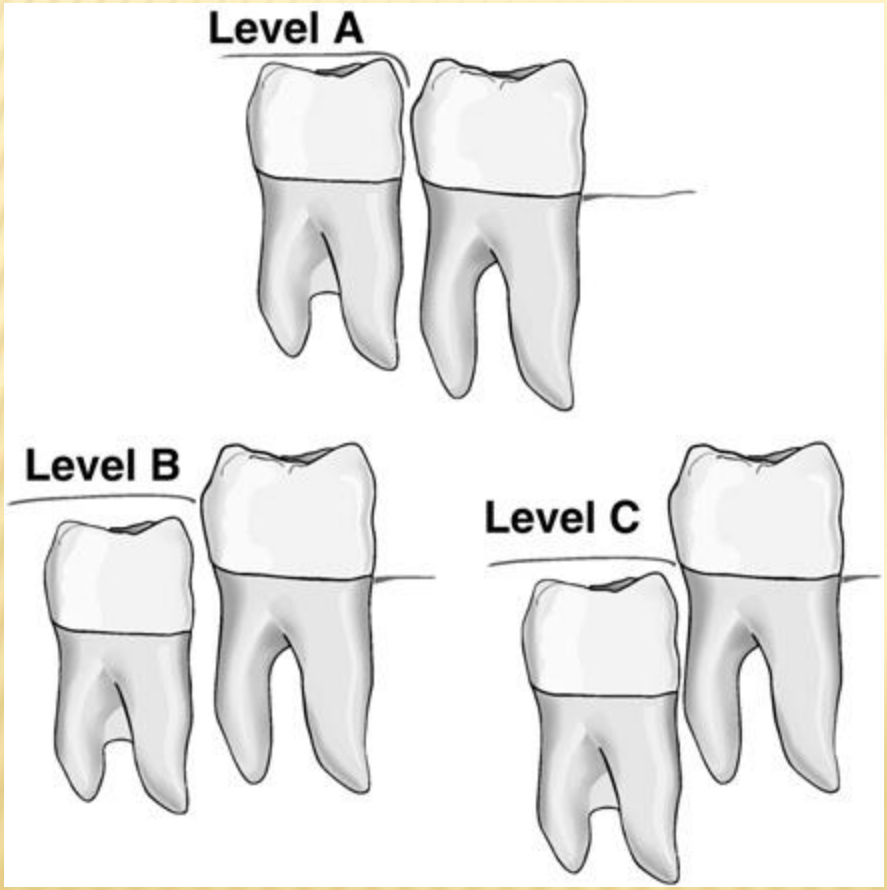
PELL & GREGORY'S MANDIBULAR CLASSIFICATION

- Occlusal position of the tooth in relation to the adjacent tooth.

- Position of the impacted tooth in relation to the Ramus

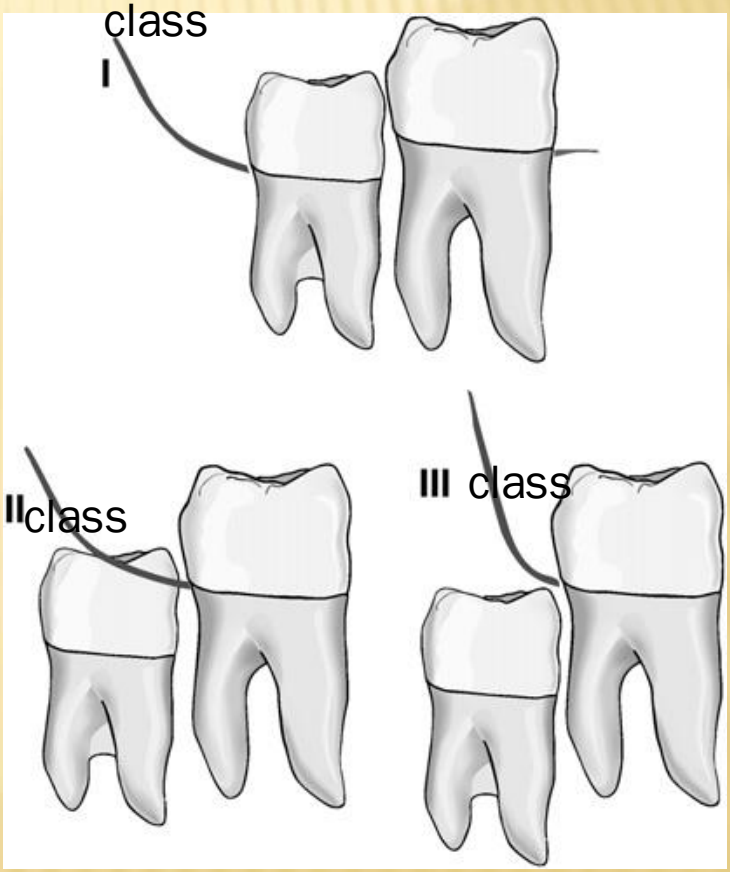
PELL AND GREGORY'S CLASSIFICATION DEPTH CLASSIFICATION.

Level A: at same occlusal plane
Level B: between occlusal plane and CEJ
Level C: below CEJ



Position relative to 2nd molar occlusal plane (Occlusal Classification)

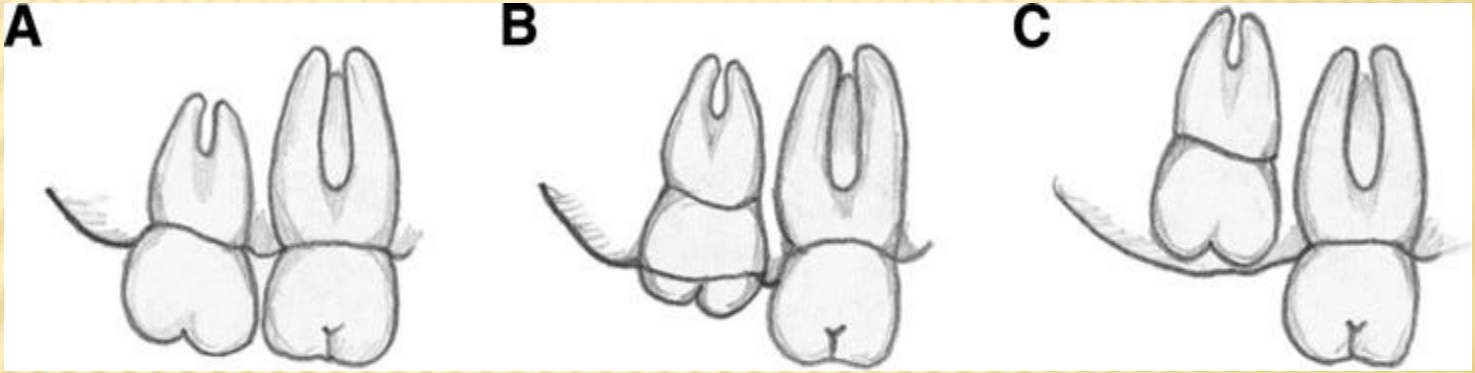
Class I: M-D diameter of crown is anterior to anterior ramus border
Class II: crown is partially covered by ramus
Class III: crown is completely embedded in ramus

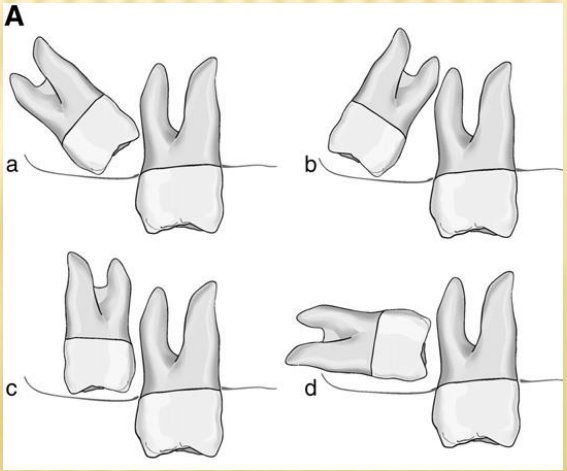


Position relative to anterior border ascending ramus (Ramus Classification)

MAXILLARY OCCLUSAL CLASIFICATION

- Levels A, B and C along with the Angular classification





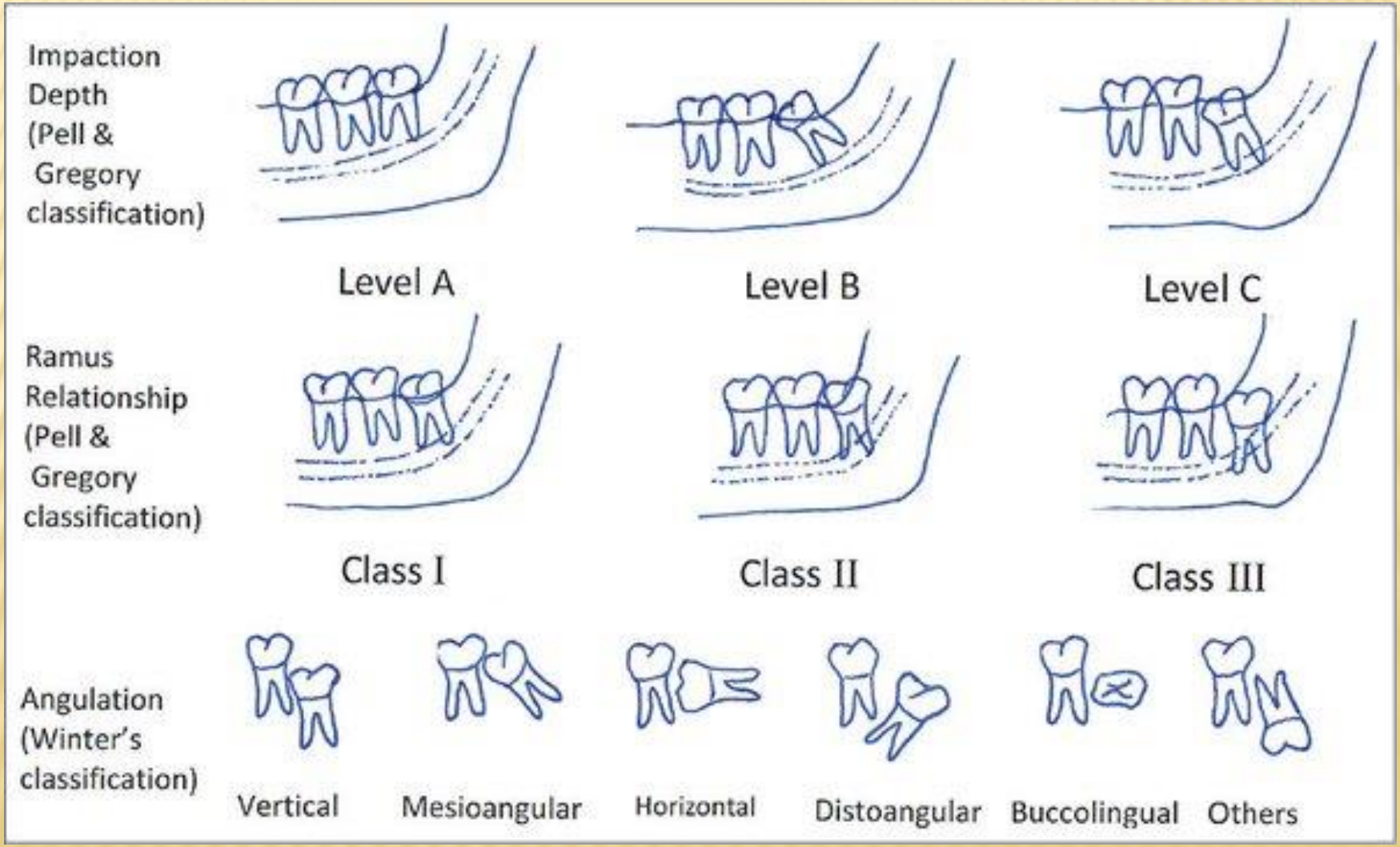
1.Mesioangular.

2.Distoangualar.

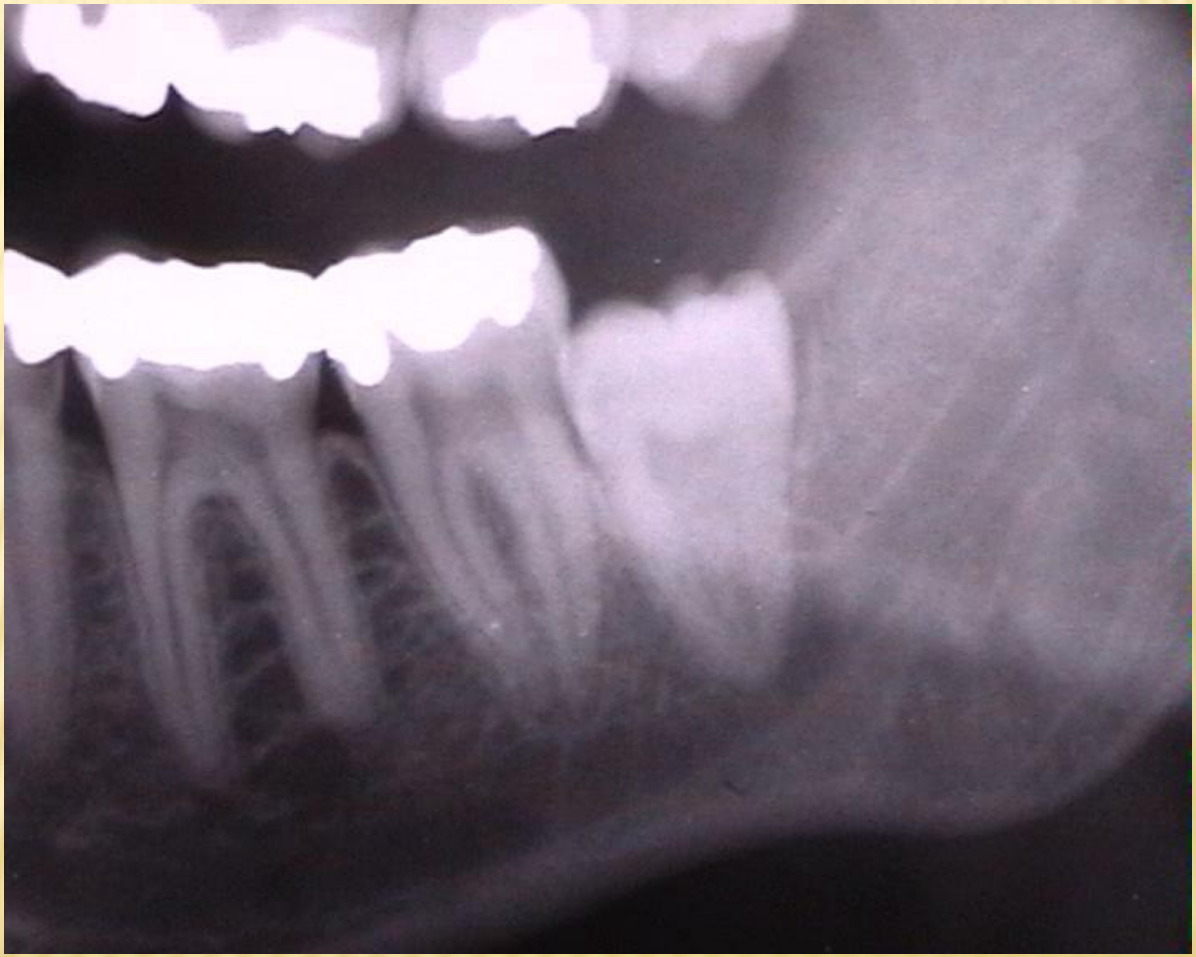
3.Vertical.

4.Horizontal.

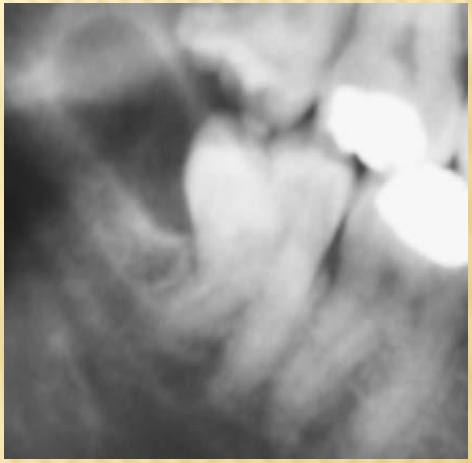
CLASSIFICATION OVERVIEW



LEVEL B CLASS 2 VERTICALLY IMPACTED MANDIBULAR THIRD MOLAR



INDICATIONS OF REMOVAL OF IMPACTED TOOTH. THE DECISION TO REMOVE SHOULD BE BASED ON A CAREFUL EVALUATION OF THE POTENTIAL BENEFITS VERSES RISKS.



- Pericoronitis prevention /treatment(25-30%)
- Prevention of dental disease.(5% 2nd molar))
- Orthodontic considerations.

  Crowding of mandibular incisors

  Obstruction of orthodontic treatment.

  Orthognathic surgery
- Prevention of odontogenic cysts and tumors (0.3%-35%)
- Adjacent root resorption
- Teeth under dental prostheses
- Prevention of mandible fracture. (Contact sports)
- Management of unexplained pain.

The Four P's: Prevention, Pathology, Pus, Periodontal disease

PATHOLOGY ASSOCIATED WITH THE FOLLICULAR TISSUE AROUND THIRD MOLAR.

- Dentigerous cyst 88%
- OKC 8.2%
- Odontoma 2.2%
- Ameloblastoma 1.2%
- Carcinoma 0.7%
- COC 0.7%
- Myxoma 0.1%

INDICATIONS FOR EXTRACTION

- With increasing age, extraction of teeth becomes more difficult.
- There is an increased incidence of local tissue morbidity, loss or damage to adjacent structures.
- **AAOMS Position Statement on 3rd Molar Management**
  - Extraction favored when:
    - Associated with or at high risk of developing disease
    - Current or future likelihood for non-functionality
    - Presence of overlying removable prosthesis
    - Orthodontic removal is justified
    - Orthognathic surgery planned

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Oral Maxillofacial Surg Clin N Am 19 (2007) 15–21

ORAL AND
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SURGERY CLINICS
of North America

Extraction Versus Nonextraction Management of Third Molars

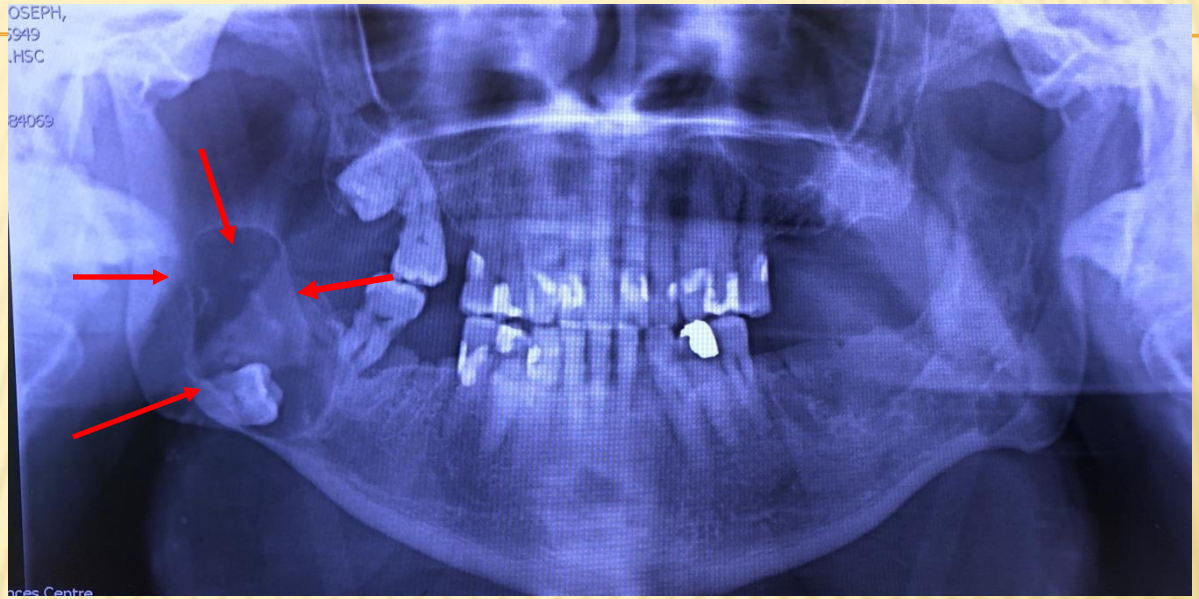
Shahrokh C. Bagheri, DMD, MD[a,b,*], Husain Ali Khan, DMD, MD[b]

[a]*Division of Oral and Maxillofacial Surgery, Emory University, Atlanta, GA, USA*
[b]*Private Practice, Atlanta Oral and Facial Surgery, Atlanta, GA, USA*

In the United States, most practicing oral and maxillofacial surgeons routinely perform prophylactic removal of impacted third molars. The indications for removal of asymptomatic impacted third molars have been challenged [1–3]. This controversy has initiated the search for evidenced-based data to justify or dispute this practice. Do the risks and costs accumulated from the extraction of third molars outweigh the lifelong benefits obtained from their removal?

Decisions regarding this question not only should consider the presence of ongoing symptoms or pathology but also anticipate future complications and morbidity associated with retention of the third molars and possible increased

Maxillofacial Surgeons (AAOMS) Third Molar Clinical Trials led by Dr. Raymond White published several scientific articles that link third molars to future health problems in adults. In light of these findings, in 2005, the AAOMS suggested that removing the third molars during young adulthood may be the most prudent option [4]. In contrast, the National Health Service of Great Britain and its associated arm, entitled the National Institute of Clinical Excellence, published a series of guidelines recommending that "The practice of prophylactic removal of pathology-free impacted third molars should be discontinued in the NHS" [1]. These guidelines, made public in 2000, acknowledged the ongoing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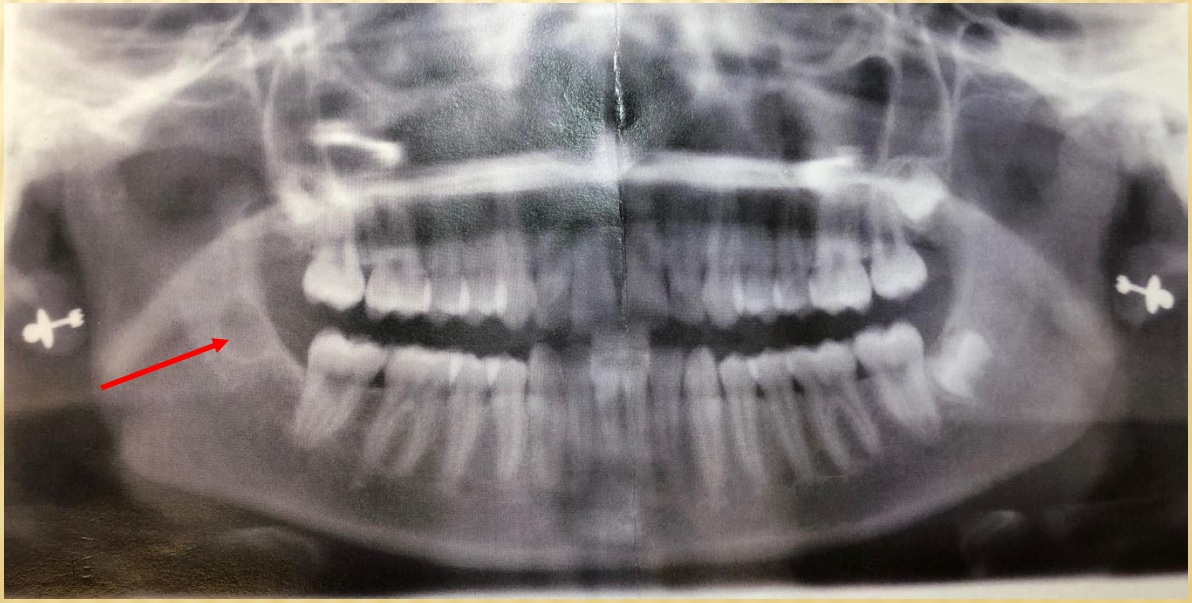

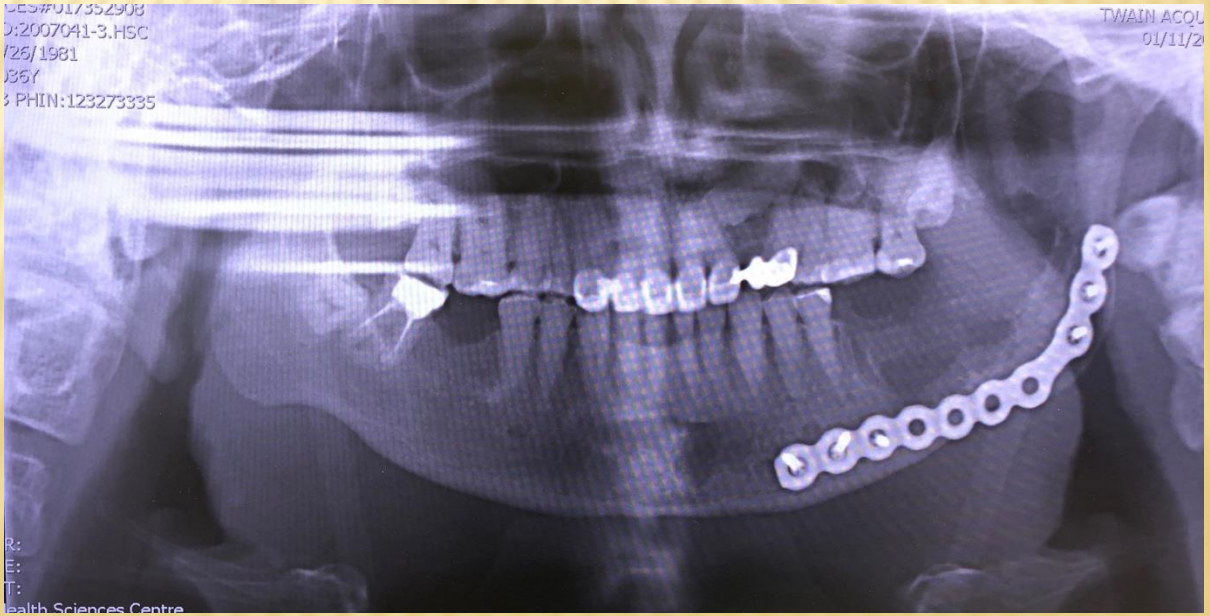
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TIMELY EXTRACTION

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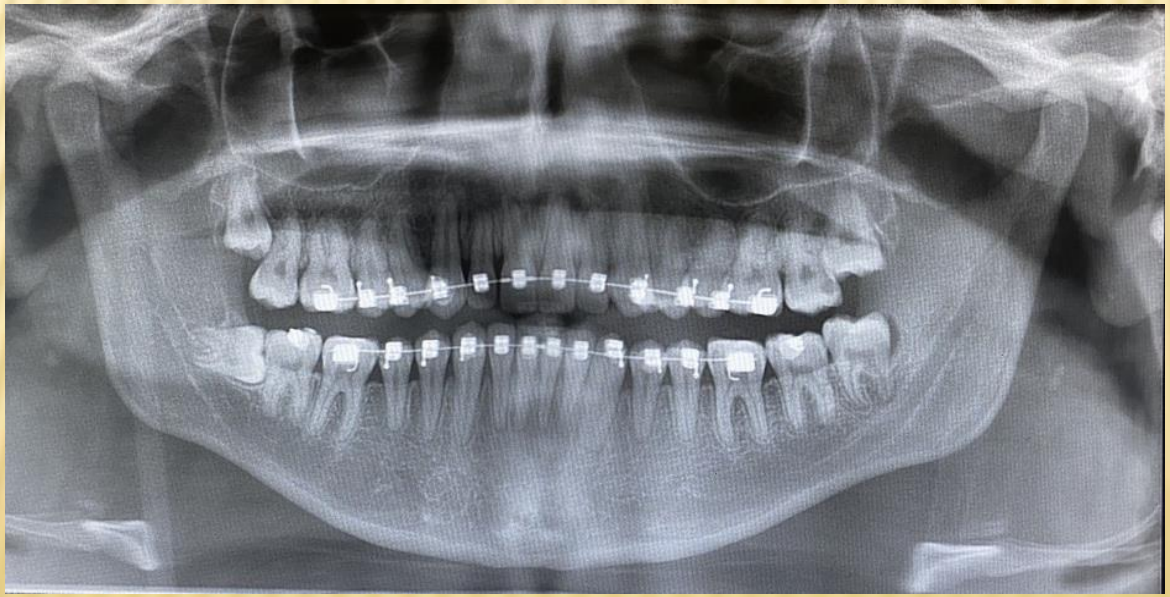

12 YR OLD

ROOTS OF 17 AND 47 2/3 FORMED


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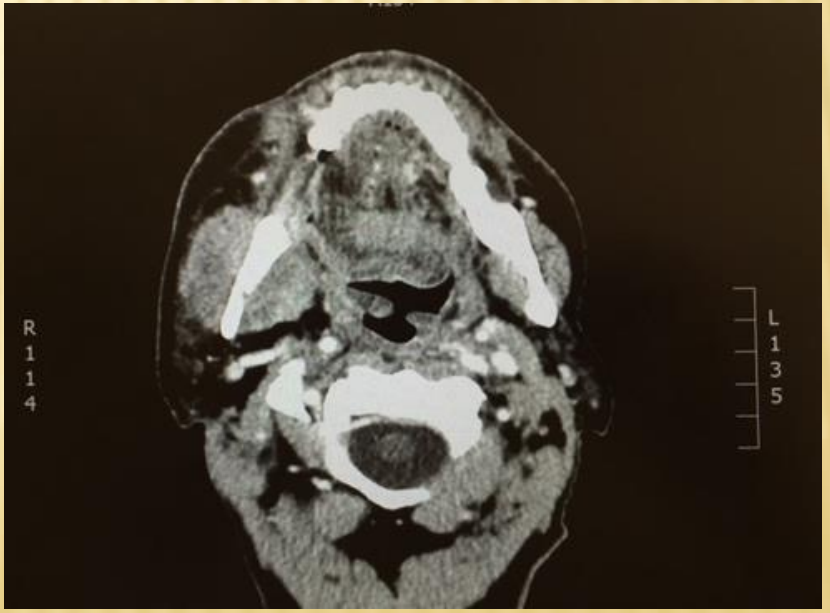
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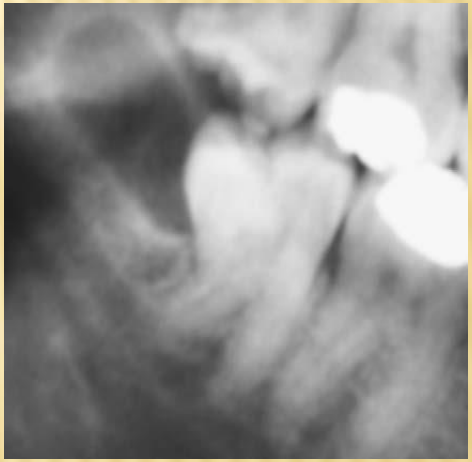
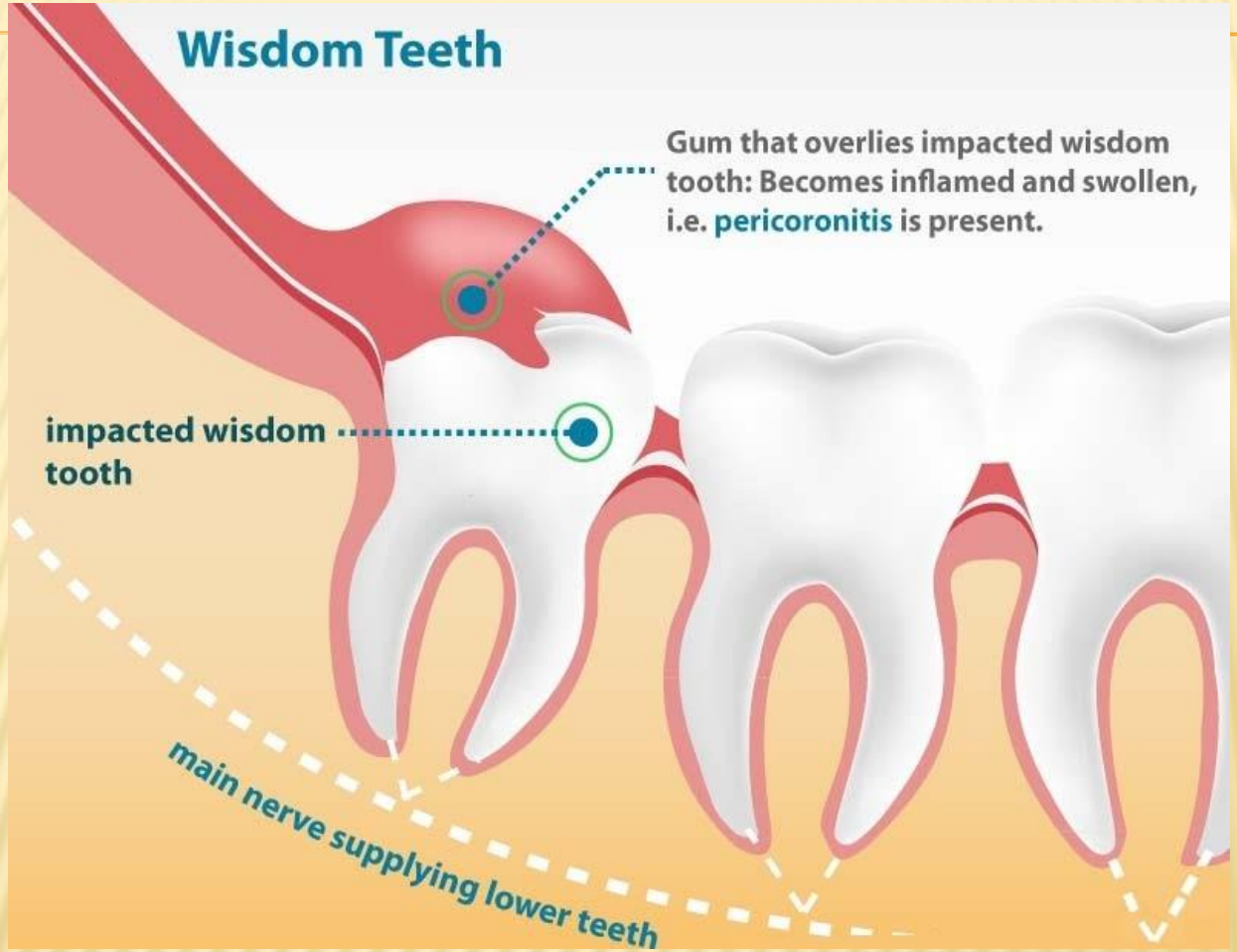
INDICATIONS OF THIRD MOLAR REMOVAL

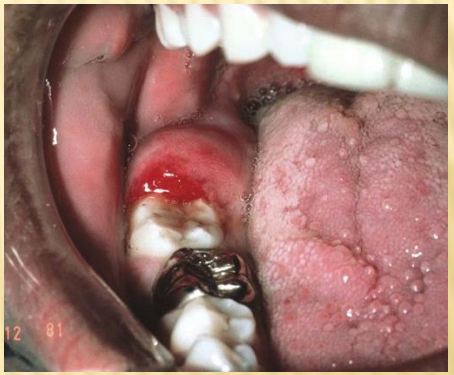
- Pericronitis prevention or Treatment
- Management of unexplained pain
- Prevention of caries.
- Root resorption of adjacent teeth
- Orthodontic considerations
- Teeth under dental prosthesis
- Crowding of mandibular incisors.
- Prevention of jaw fractures.
- Prevention of odontogenic cysts and tumors.
- Periodontal disease.
- Preparation for orthognathic surgery




Wisdom Teeth
Gum that overlies impacted wisdom tooth: Becomes inflamed and swollen, i.e. pericoronitis is present.
impacted wisdom tooth
main nerve supplying lower teeth

PERICORONITIS

- **Definition:** An infection of the soft tissue around the crown of a partially impacted tooth caused by anaerobic oral flora
- Most common reason for extraction of third molars after age 20
- Incidence of pericoronitis – 4.92%
  - 95% of cases involve mandibular third molars
- Studies have shown **vertically positioned** third molars with **grade A** ramus position are most commonly associated with pericoronitis
- Local risk factors
  - Poor oral hygiene
  - Soft tissue trauma
  - Debris entrapment
- Systemic risk factors
  - Impaired immune system
- Bacteria most commonly associated with pericoronitis
  - **Peptostreptococcus, Fusobacterium, Actinoymyces, Prophyromonas** (Ribeiro, 2020)




R
L
KODAK 8000 System

PERICORONITIS

- Most common cause of wisdom tooth removal
- Often associated with operculum(soft tissue flap)
- Acute inflammation with pain, swelling , trismus
- Erythema and purulence.
- Stages
- 1.inflammation only in pericoronal area
- 2.inflammation spread to contiguous submucosa
- 3.inflammation spread to adjacent spaces, facial planes and stimulates systemic response.

PERICORONITIS

Range of severity

- **Mild pericoronitis** – localized tissue swelling and soreness
  - Debridement and irrigation w/ hydrogen peroxide or CHX
- **Moderate pericoronitis** – swelling and local tissue trauma by upper molars
  - Extraction and curettage/irrigation
- **Severe pericoronitis** – facial swelling, minor trismus, possible low-grade fever
  - Extraction/curettage/irrigation + antibiotic coverage

PERICORONITIS

Timing of Pericoronitis Treatment

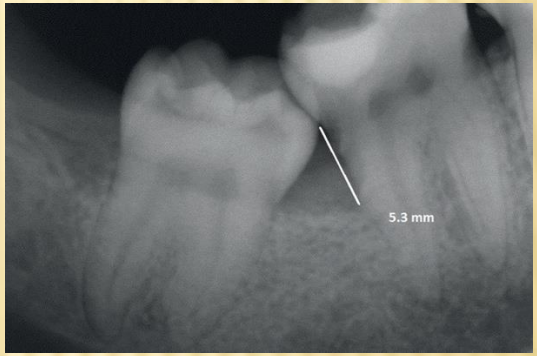
- Mandibular third molars should not be removed until the signs and symptoms of pericoronitis have completely resolved
  - Increased risk of dry socket, post-op infection
  - More bleeding, slower healing
- "Treatment of pericoronitis involves extraction of the offending tooth or opposing maxillary third molar, debridement of the periodontal pocket, and disinfection with an irrigation solution such as chlorhexidine or hydrogen peroxide" (Fonseca)

TREATMENT.

- Local measures , irrigation with chlorhexidine,
- Antibiotics
- Consider extraction of the offending tooth
- Extraction of the opposing third molar tooth.
- Operculectomy does not work.

PERIODONTITIS

- Retention of third molars in the presence of periodontal disease is associated with a significant increase in interleukin-6, intercellular adhesion molecule-1, and c-reactive protein, and leads to increased periodontal pocketing of adjacent second molar and predispose anterior teeth to periodontal disease.
- Removal of impacted teeth before the age of 25 years usually results in improved periodontal attachment at the distal of the second molar and reduces the incidence of periodontal pockets of 4mm or more in other teeth
- Young patients in otherwise good general periodontal health have significant increase in periodontal pocketing, attachment loss, pathogenic bacterial activity, and inflammatory markers at the distal of the second molar and around the third molar



DENTAL CARIES

- Often present as cervical carious lesions, with caries presenting on distal of second molar
- Inability to adequately clean the area
- Restorative inaccessibility

ORTHODONTIC CONSIDERATIONS

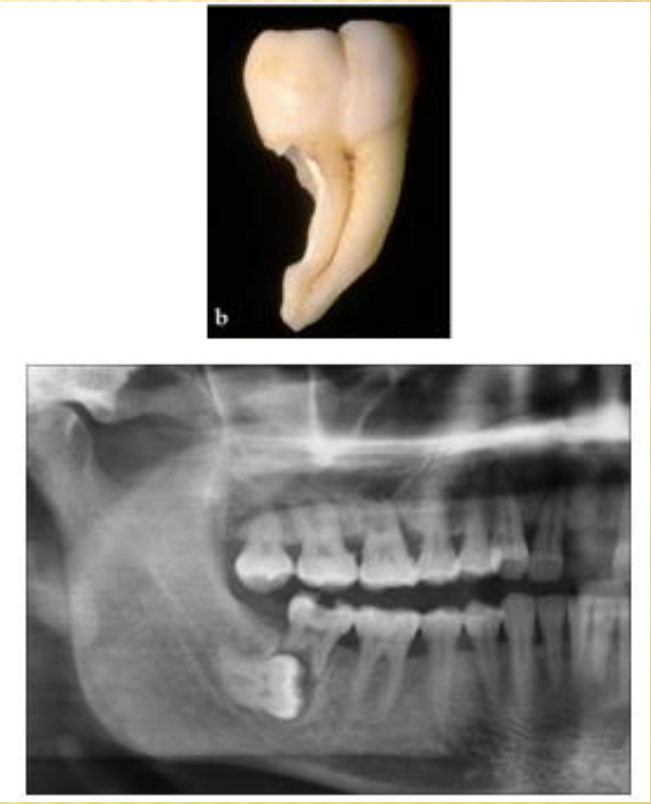
- Crowding of mandibular incisors
  - Controversial issue, but most literature including longitudinal reviews of orthodontically treated patients suggest that impacted third molars are not a significant cause of post-orthodontic anterior crowding
- Obstruction of orthodontic treatment
  - Obstruction of molar uprighting / distalization
- Interference with orthognathic surgery
  - **Mandibular:** recommended to extract 3rd molar 6 – 9 months prior to BSSO as extraction results in reduced quantity of bone at the proximal aspect of the distal segment, impacting rigid fixation when placing fixation screws (Balaji, 2011)
  - **Maxillary:** In a Lefort I osteotomy, after down fracture of the maxilla, maxillary wisdom teeth are often easily approached from above through the maxillary sinus and may safely be removed at this time without compromising the vascular pedicle of maxilla (Balaji, 2011)

PREVENTION OF ODONTOGENIC CYSTS & TUMORS

- Follicular sac (responsible for the formation of the crown) may undergo cystic degeneration and form a dentigerous cyst
  - Follicular sac may develop into an odontogenic tumor and in rare cases, a malignancy (exceedingly rare)
- The general incidence of neoplastic changes around impacted molars has been estimated to be approximately 3%
  - These pathologic entities are usually seen in patients young than 40, suggesting the risk of neoplastic changes may decrease with age
- In retrospective survey of large numbers of patients, between 1-2% of all third molars are extracted because of the presence of an odontogenic cyst/tumor

ROOT RESORPTION OF ADJACENT TEETH

- Misaligned third molars in the process of eruption may cause root resorption of adjacent teeth
- The actual occurrence of significant root resorption of adjacent teeth is not clear, although it may be as high as 7%
- In most cases, the adjacent tooth repairs itself with the deposition of a layer of cementum over the resorbed area and the formation of secondary dentin. However, if resorption is severe, both teeth may require removal.



TEETH UNDER DENTAL PROSTHESES

- The general recommendation is that if a removable/fixed tissue-borne prosthesis is to be constructed on a ridge where an impacted tooth is covered by only soft tissue or 1 or 2 mm of bone, it is highly likely that in time the overlying bone will be resorbed, the mucosa will perforate, and the area will become painful and often inflamed, so this tooth should be removed prior to prosthesis fabrication.

- Teeth that are completely covered with bone (>2mm in thickness), that show no pathologic changes, and that are in patients older than 40 years are unlikely to develop problems on their own.

JAW FRACTURE PREVENTION

- The presence of third molars in the mandible have been proven to increase susceptibility to angle fractures
- Patients who engage in contact sports, such as football, boxing or rugby should consider having their impacted third molars removed to prevent jaw fracture
- An impacted third molar disrupts continuity of external oblique ridge, producing an area of low resistance
- Additionally, the presence of an impacted third molar in the line of a fracture may cause increased complications in the treatment of the fracture.

Increases risk of jaw fracture (angle) by 3x but decreases the risk of condylar fractures

Does the Presence or Position of Lower Third Molars Alter the Risk of Mandibular Angle or Condylar Fractures?

Saba Naghipur, BSc, Adnan Shah, BDS, MDS, and Reda Fouad Elgazzar, BDS, MSc, PhD

Purpose: The purpose of this study was to determine whether a relation exists between the presence of mandibular third molars (M3s) and mandibular angle and condylar fractures and whether the risk of these fractures varies with M3 position.

Materials and Methods: A retrospective cohort study was conducted in patients with mandibular fractures presenting to the oral and maxillofacial surgery service from April 2007 to March 2012. Data sources were patients' hospital charts and panoramic radiographs. Predictor variables were the presence and position of M3s. M3 position was based on the Pell and Gregory classification and angulation was determined by measuring the angle between the long axis of the M3 and the mandibular occlusal plane. Outcome variables were the presence of angle and condylar fractures. Other study variables included age, gender, and fracture etiology. Data were analyzed using the χ^2 test and Student t test.

Results: The study sample consisted of 446 patients with 731 mandibular fractures. Results showed that the risk of mandibular angle fracture was significantly higher in patients and mandible sides with impacted M3s ($P < .001$), whereas the risk of condylar fracture was significantly higher in patients and mandible sides lacking impacted M3s ($P < .001$). A relation between the position of M3s to angle or condylar fractures could not be found ($P > .05$).

Conclusion: The presence of impacted M3s increased the risk of angle fracture and simultaneously decreased the risk of condylar fracture. However, no relation appeared to exist between M3 position and fracture pattern.

J Oral Maxillofac Surg 72:1766-1772, 2014

FIGURE 1 – Fracture lines were visible on the panoramic radiograph from the 38 and 48 to the mandibular angle of both sides. The patient could not remove his earring.

MANAGEMENT OF UNEXPLAINED PAIN

- Occasionally, patients complain of jaw pain in the area of an impacted third molar that has neither clinical nor radiographic signs of pathology, and other sources of pain are ruled out (myofascial pain dysfunction, TMD)
- In these situations, removal of the impacted third molar frequently results in resolution of this pain
  - Difficult to ascertain as definitive management
  - Approximately 1% to 2% of mandibular third molars that are extracted are removed for this reason and patient must be informed that removal of the third molar may not relieve the pain completely

CONTRAINDICATION TO REMOVAL
THE DECISION TO REMOVE SHOULD BE BASED ON A CAREFUL EVALUATION OF THE POTENTIAL BENEFITS VERSUS RISKS.

- Extreme ages.
- Compromised medical status
- Surgical damage to adjacent structures.

PROPHYLACTIC OR THERAPEUTIC

INDICATIONS FOR ELECTIVE THIRD MOLAR REMOVAL IS THERAPEUTIC : EMERGING EVIDENCE IS THERE.

- It eliminates disease which is often present.
- Risk avoidance
- Economic cost of long-time surveillance
- Does it really make sense to wait for the acute infections, trismus and pain etc.

NATIONAL INSTITUTE OF CLINICAL EXCELLENCE.

- The practice of prophylactic removal of pathology free impacted third molars should be discontinued in NHS.
- They further defined pathology as :

Non restorable caries, non treatable pulpal and periapical pathology , cellulitis , abcess , osteomyelitis, internal/external resorption of teeth, fracture of tooth, disease of a follicle leading to tumor or cysts, tooth or teeth impeding surgery, reconstructive and tumor surgery.

AAOMS : CONCLUSIONS FROM RECENT EVIDENCE-BASED RESEARCH

- All third molars should be considered for removal in young adults in order to mitigate the risk of systemic inflammation and local progression of emergent complications.
- Patients who elect to retain their third molars need to be monitored for life.
- Patients with retained third molars should be in formed of research regarding increased risks of systemic disease.

RATIONALE FOR REMOVAL OF ASYMPTOMATIC THIRD MOLARS.

AAOMS CLINICAL TRIALS VS NATIONAL INSTITUTE OF CLINICAL EXCELENCE UK

- Periodontal disease
- Systemic inflammation.
- Mandibular fractures.
- Cysts
- Tumors
- Incisor crowding
- Complications of advancing age
- Odontogenic infections.(0.8%)
- Nerve injuries (<21 yrs old as roots not completely formed)
- TMJ (internal derangement)(no increased risk after 3rd molar Sx)

Systemic inflammation can cause coronary artery disease, strokes, renal vascular disease, diabetes, and obstetric complications like preterm deliveries due to increase markers like c- reactive protein. Advancing age on bisphosphonates, anti coagulants, chemotherapy, immune compromised status like diabetic, asthmatics.

COMPOSITE DIFFICULTY SCORE

COMPOSITE DIFFICULTY SCORE

- Parameter Score
- Winter's classification (Wi)
- Distoangular 4
- Vertical 3
- Horizontal/Transverse 2
- Mesioangular 1
- Pell-Gregory classification
- Ramus (Ri)
- Class 3 3
- Class 2 2
- Class 1 1
- Occlusal (Oi)
- Level C 3
- Level B 2
- Level A 1
- Composite mandibular position score
- Ci Wi Ri Oi Range, 3–10

Difficulty index 7-10 Very difficult. 5-7 Moderately difficult. 3-4 Minimally difficult.(Data from Pederson)

PATIENT RELATED RISK FACTORS(INCREASING DIFFICULTY INDEX)

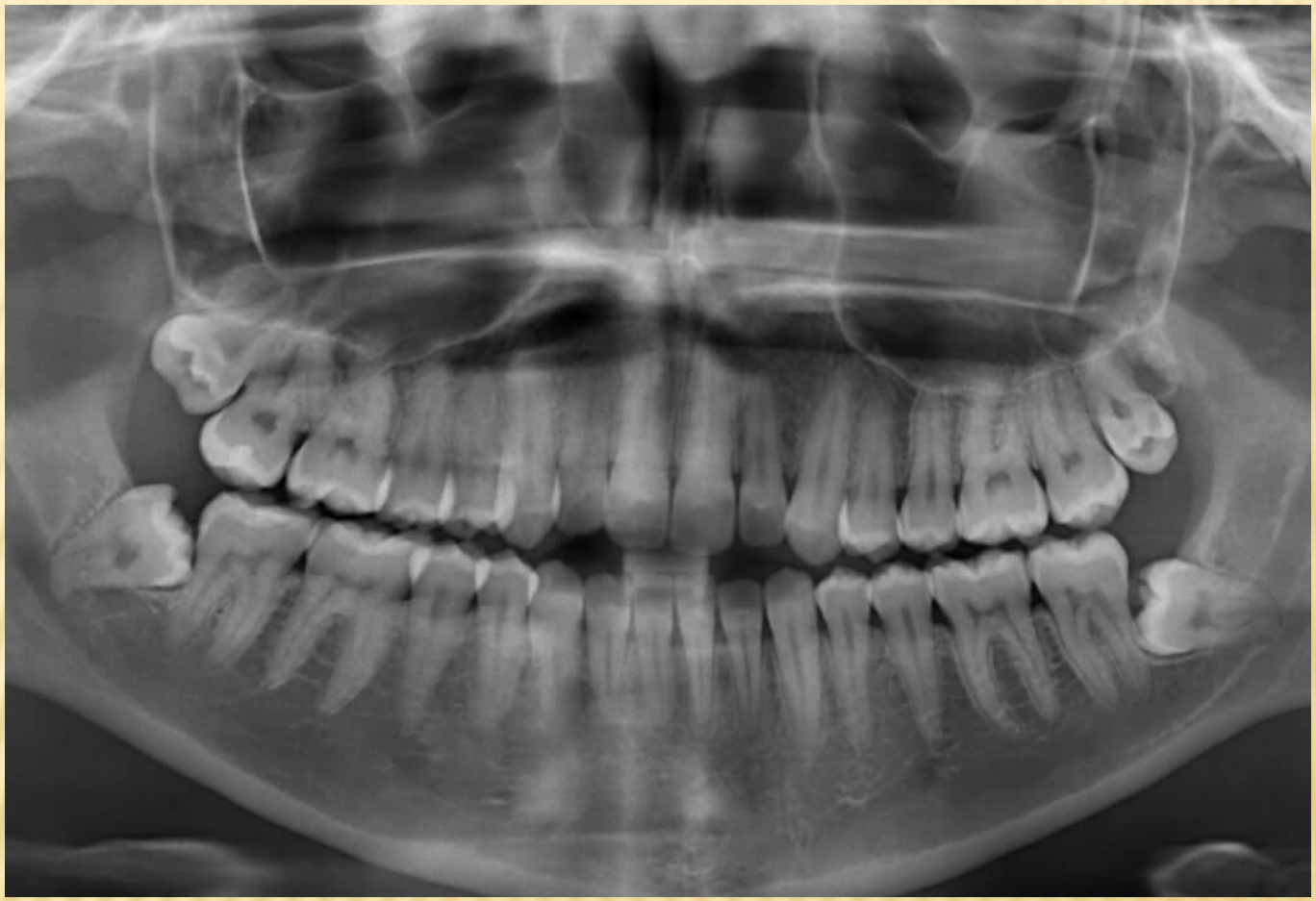
- Obesity
- Dense bone
- Large tongue
- Dilacerated roots
- Strong gag reflex
- Position of the inferior alveolar canal
- Advanced age
- Superiorly positioned maxillary third molar
- Fractious patient
- Apical root of lower third molar in cortical bone
- Uneven anesthetic
- Atrophic mandible
- Limited surgical access
- Location of maxillary sinus
- Systemic condition
- Anesthesia history
- Check flexibility
- Drug History

DIFFICULTY INDEX VS ANGULATION

- Mesioangular Impactons 45% . Least difficult
- Vertical 40% and horizontal 10% are intermediate difficult
- Distoangular 5% are most difficult.

RADIOGRAPHY AND IMAGING

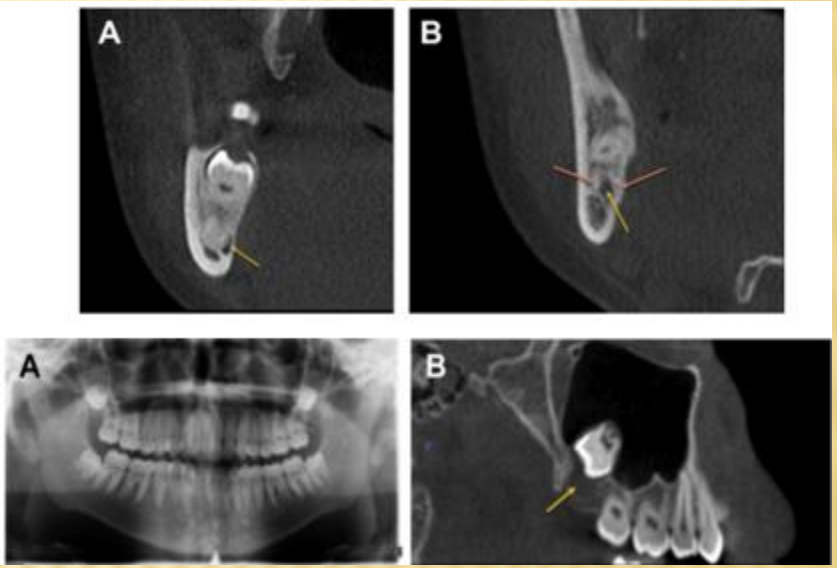
RADIOGRAPHIC EVALUATION



It is readily available, inexpensive, and provides visualization of the upper and lower jaw with minimal discomfort at a low radiation dose

CBCT

- CBCT (cone beam computer tomography) has become advantageous in gaining three-dimension view of molar positioning
  - Accurate determination of shape and anatomic position of IAC
  - Superior assessment of the relationship between molar root apices and the maxillary sinus
  - Ideal in detecting multiple roots of mandibular third molars



RADIATION EXPOSURE

TABLE 3.2

Typical Effective Dose From Radiographic Examinations

Examination	Median Effective Dose	Equivalent Background Exposure[a]
Intraoral[b]		
Rectangular collimation		
Posterior bite-wings: PSP or F-speed film	5 µSv	0.6 day
Full-mouth: PSP or F-speed film	40 µSv	5 days
Full-mouth: CCD sensor (estimated)	20 µSv	2.5 days
Round collimation		
Full-mouth: D-speed film	400 µSv	48 days
Full-mouth: PSP or F-speed film	200 µSv	24 days
Full-mouth: CCD sensor (estimated)	100 µSv	12 days
Extraoral		
Panoramic[b]	20 µSv	2.5 days
Cephalometric[b]	5 µSv	0.6 day
Chest[c]	100 µSv	12 days
Cone beam CT[b]		
Small field of view (<6 cm)	50 µSv	6 days
Medium field of view (dentoalveolar, full arch)	100 µSv	12 days
Large field of view (craniofacial)	120 µSv	15 days
Multidetector CT		
Maxillofacial[b]	650 µSv	2 months
Head[c]	2 mSv	8 months
Chest[c]	7 mSv	2 years
Abdomen and pelvis, with and without contrast[c]	20 mSv	7 years

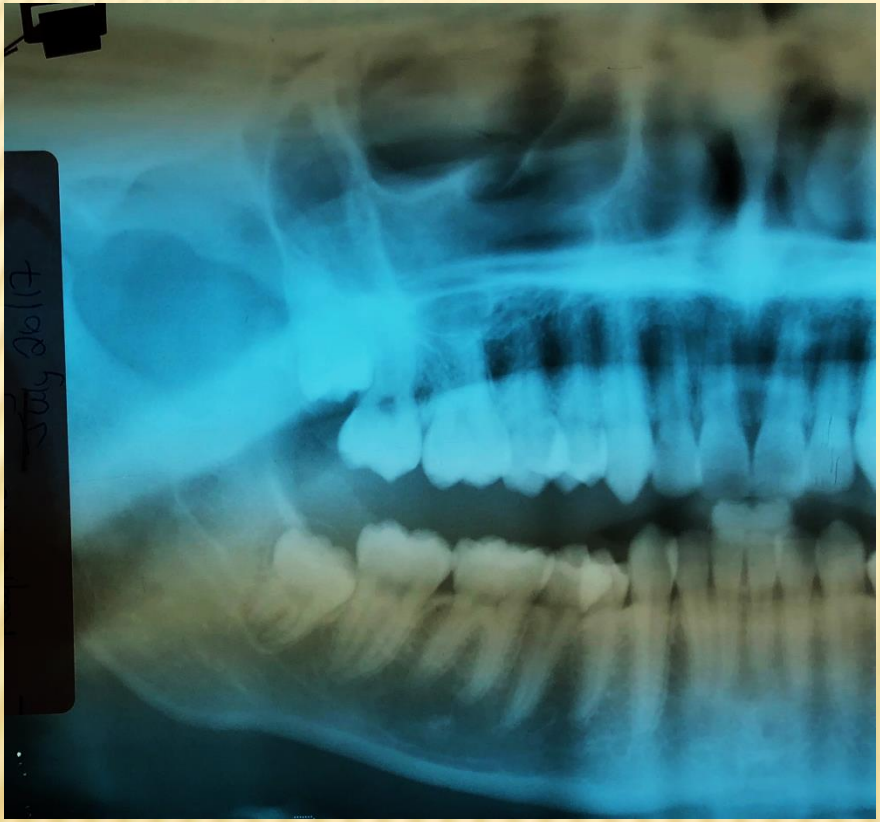
[a]Approximate equivalent background exposure is calculated based on an estimated background radiation dose of 3.1 mSv/year. Exposures more than the equivalent of 3 days are rounded off to the nearest day, month, or year.

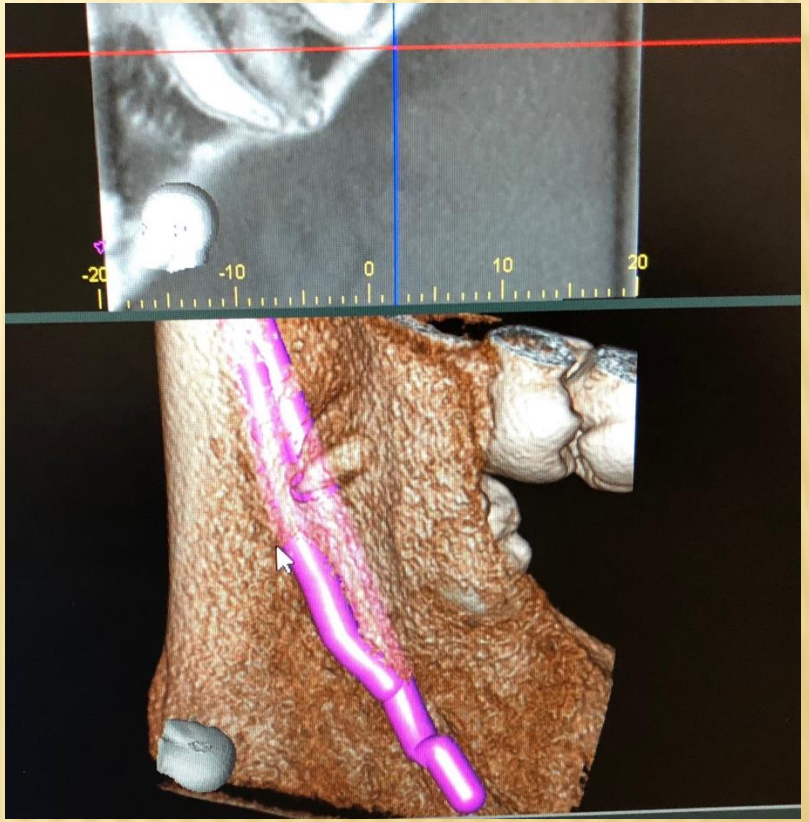
[b]Median dose from dentomaxillofacial radiography with typical exposure protocols is calculated from data collated from multiple published studies. Doses in the range of 10–1000 µSv are rounded off to the nearest multiple of 10.

[c]American College of Radiology, https://www.acr.org/~/media/ACR/Images/Quality-Safety/eNews/2015-September/Dose_chart.png?la=en

CCD, Charge-coupled device; *CT*, computed tomography; *PSP*, photostimulable phosphor.

IS THERE A ROLE OF COMPUTED TOMOGRAPHY IN THE MAMAGEMENT OF IMPACTED THIRD MOLARS




-20
-10
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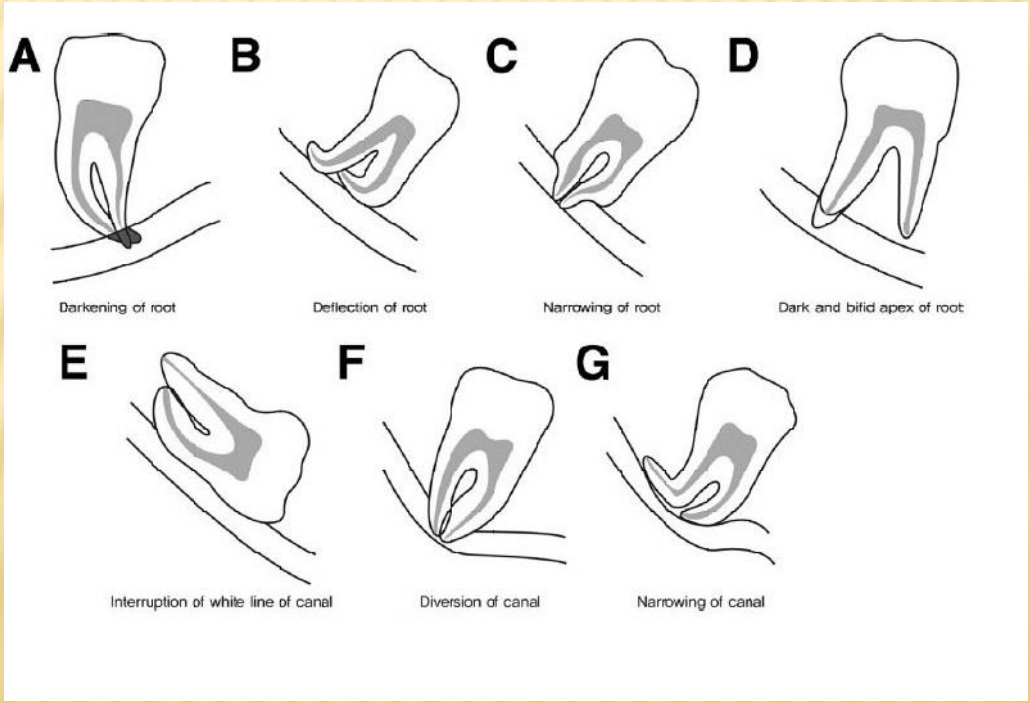
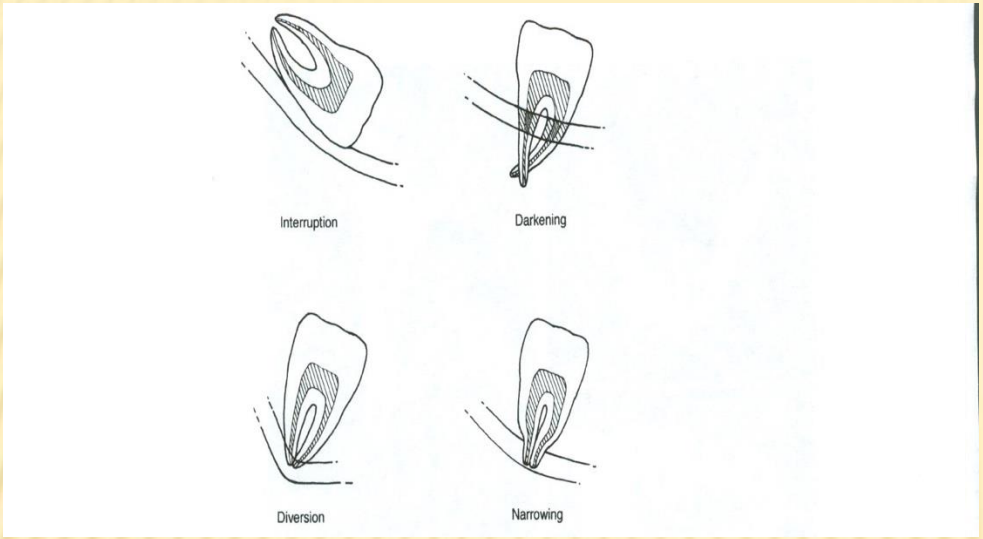
B
1 cm

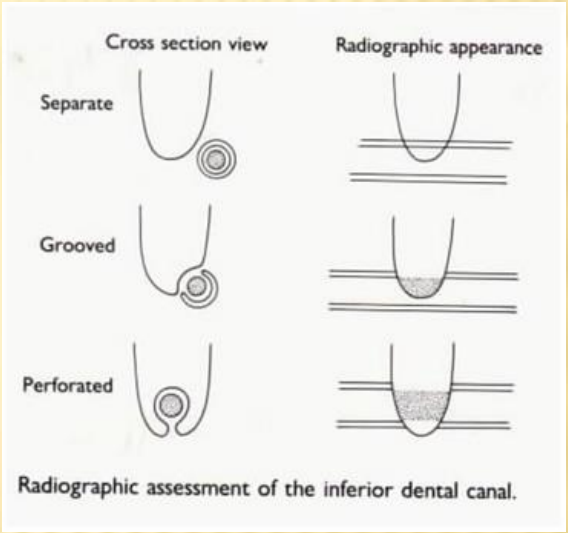
IAN INJURY MORE ASSOCIATED WITH THE FOLLOWING PANORAMIC VIEWS.

- Diversion of the IAN canal
- Darkening and Narrowing of the third molar roots
- Interruption of the cortical lines.



ROOD & SHEHAB:BJOMS:1990:28:20





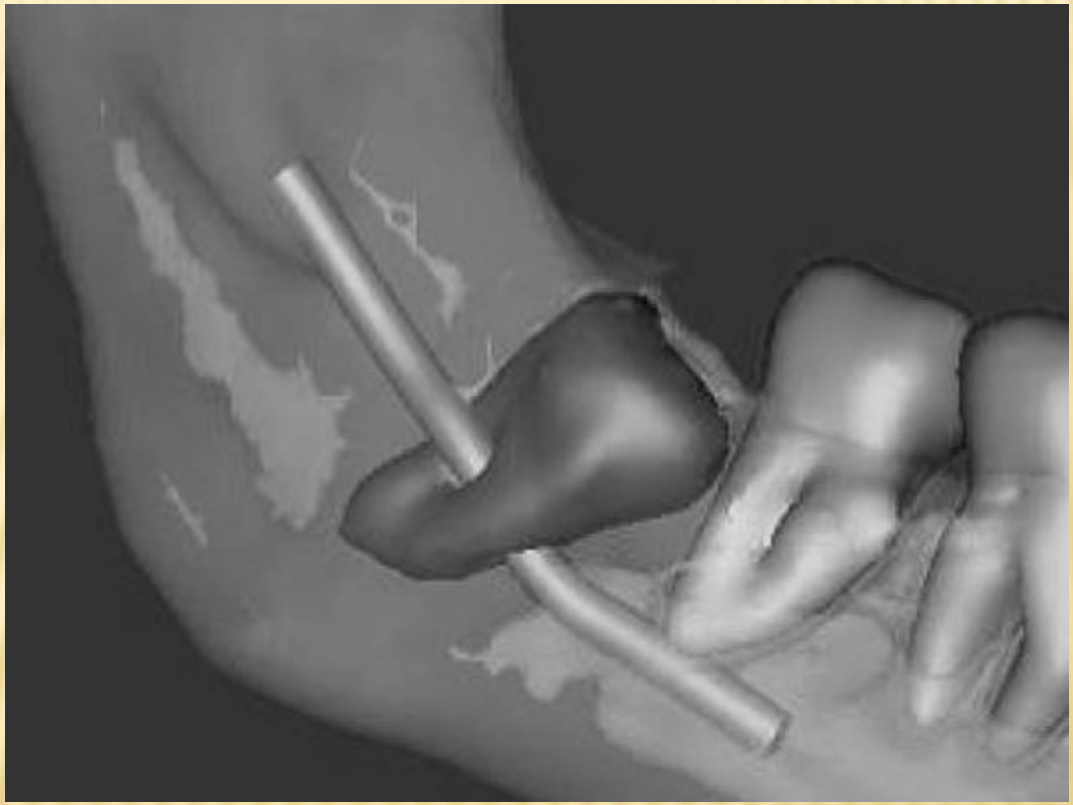
Radiographic assessment of the inferior dental canal.

When one or more of these findings are present the risk of IAN damage ranges from 1.4 to 12% with a base line risk of injury approximately 1%

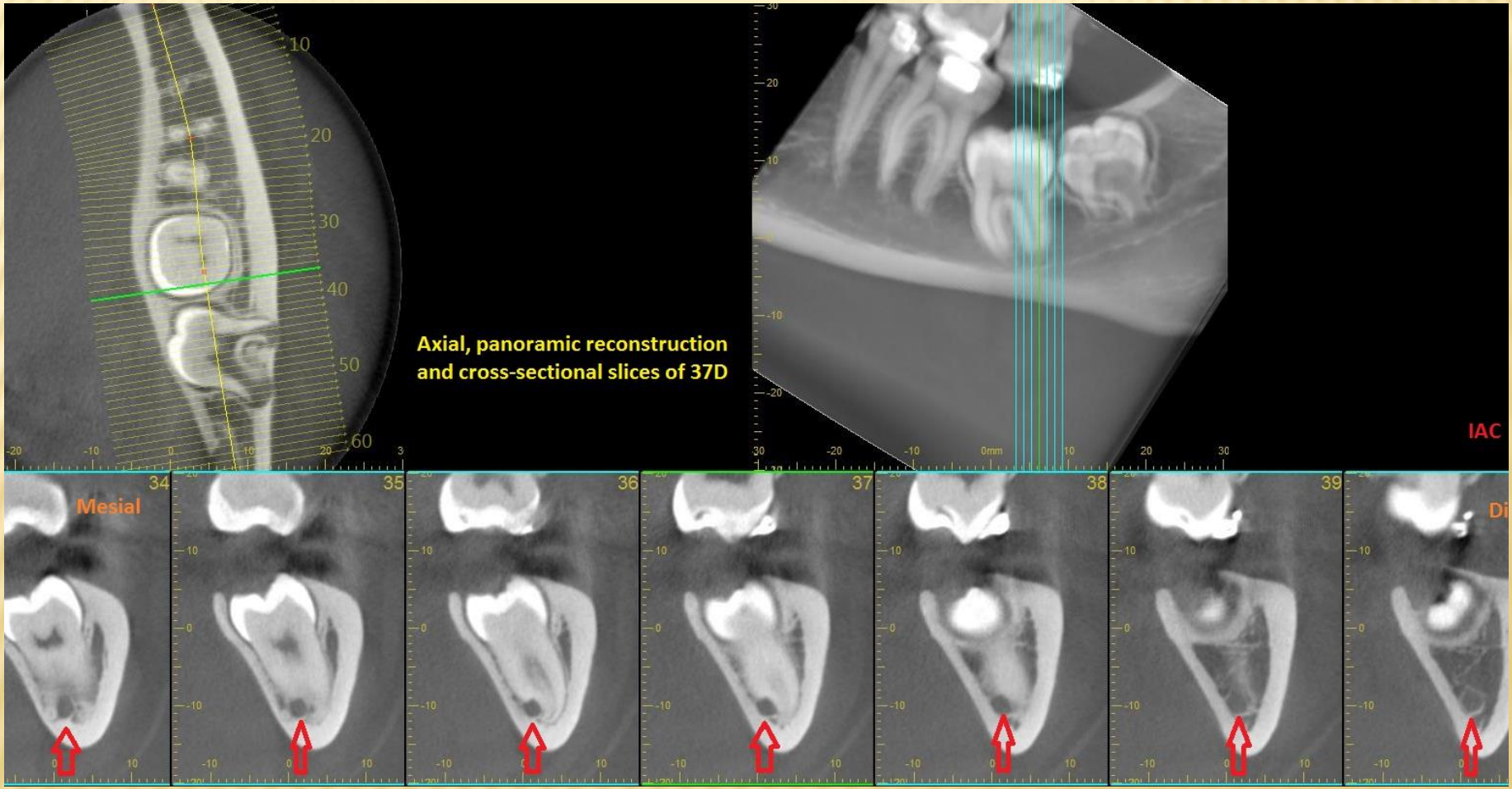
Narrowed IAN Canal

Roots appear dark

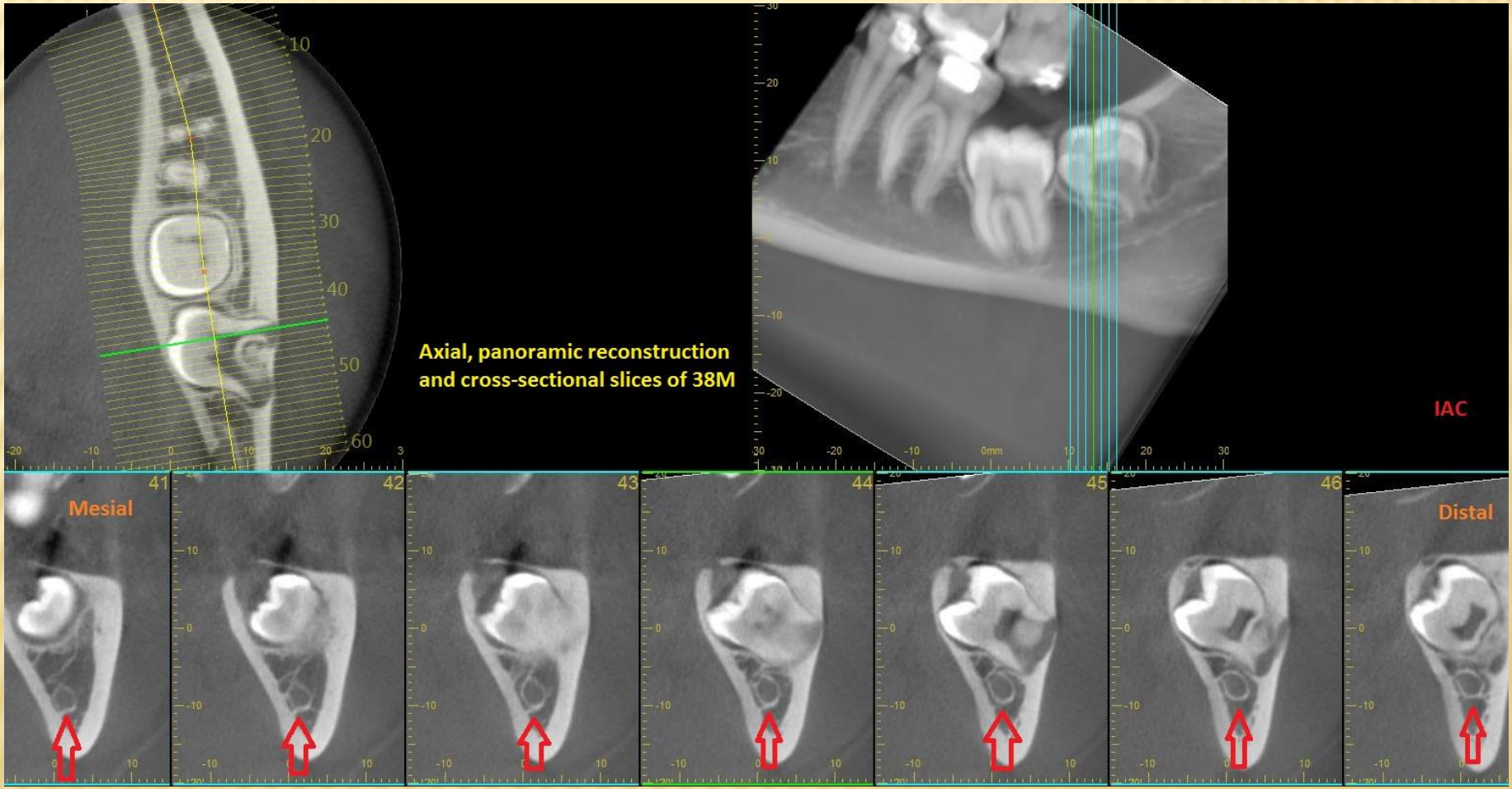
Loss of cortical outline

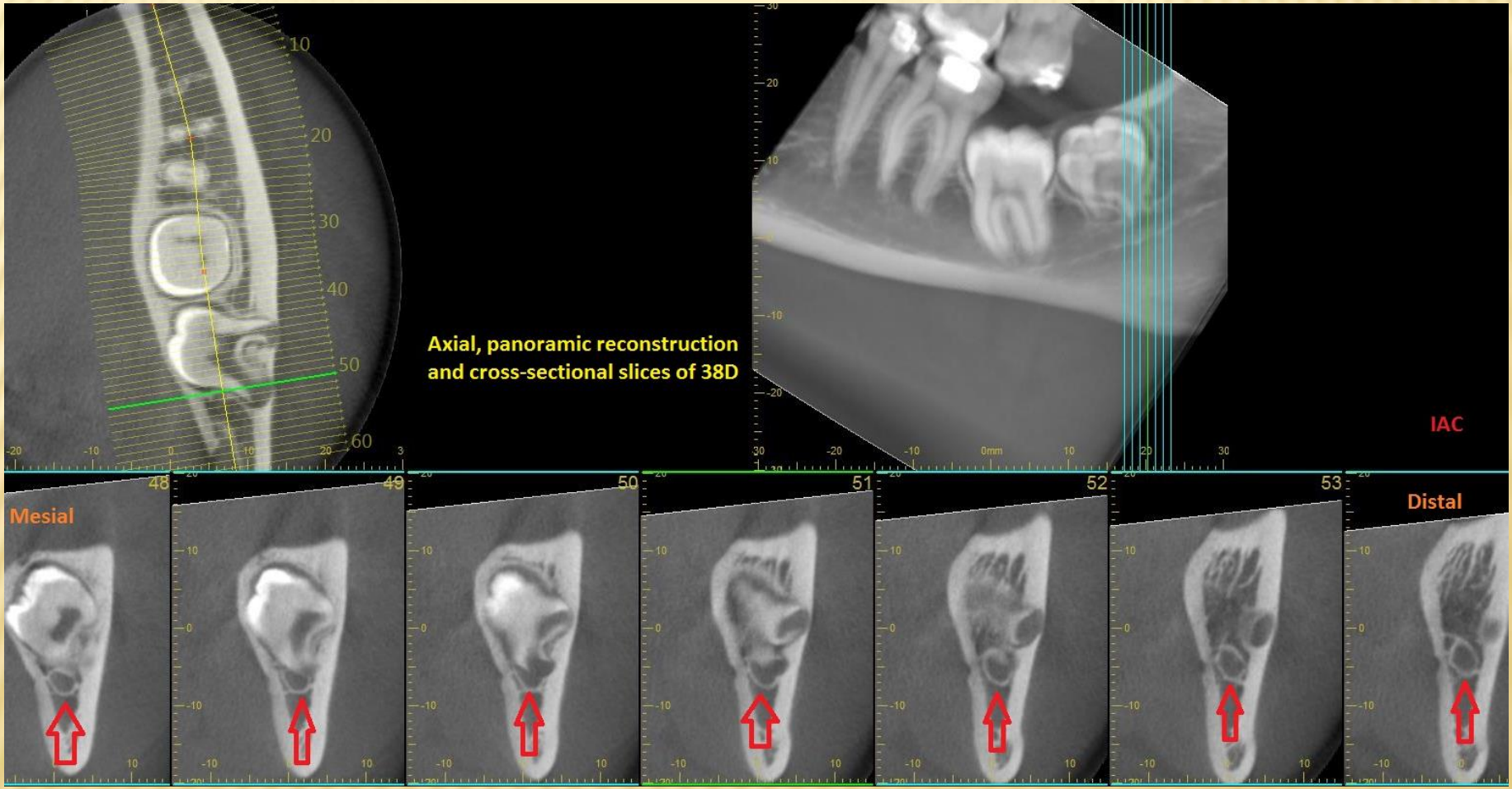


Reformatted 3D CBCT image


Axial, panoramic reconstruction
and cross-sectional slices of 37D
IAC
Mesial
34
35
36
37
38
39


Axial, panoramic reconstruction
and cross-sectional slices of 37M
IAC
Mesial
27
28
29
30
31
32


Axial, panoramic reconstruction
and cross-sectional slices of 38M
IAC
Mesial
Distal
41
42
43
44
45
46


Axial, panoramic reconstruction
and cross-sectional slices of 38D
IAC
Mesial
Distal
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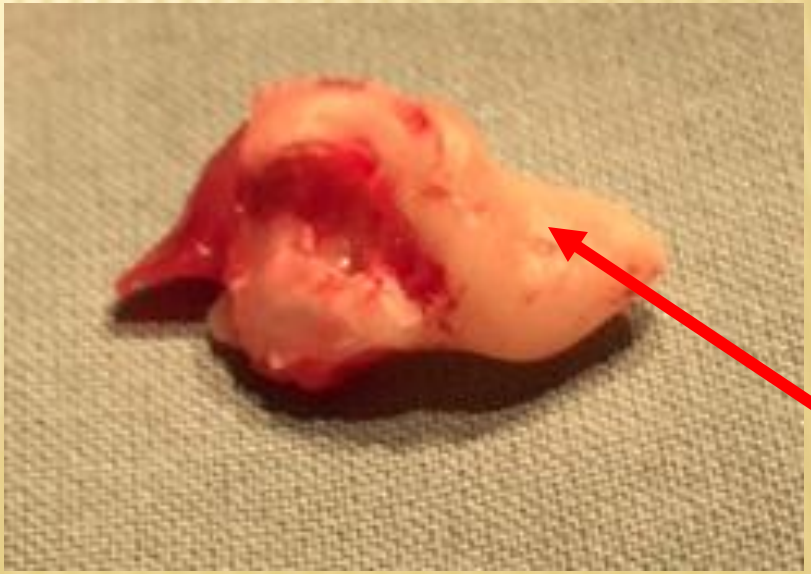
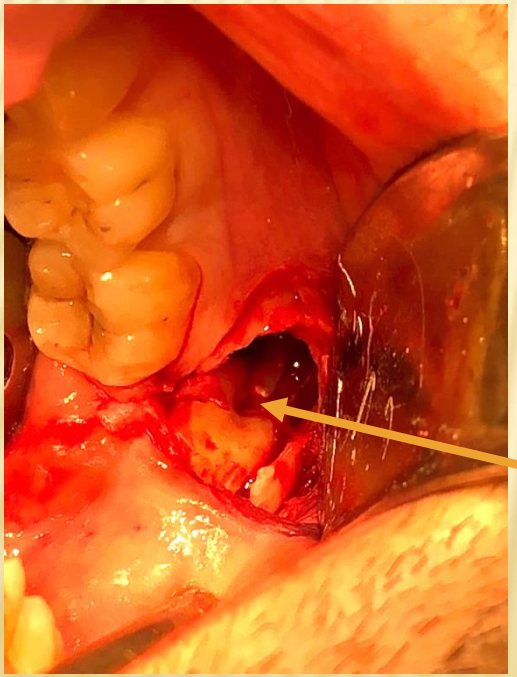
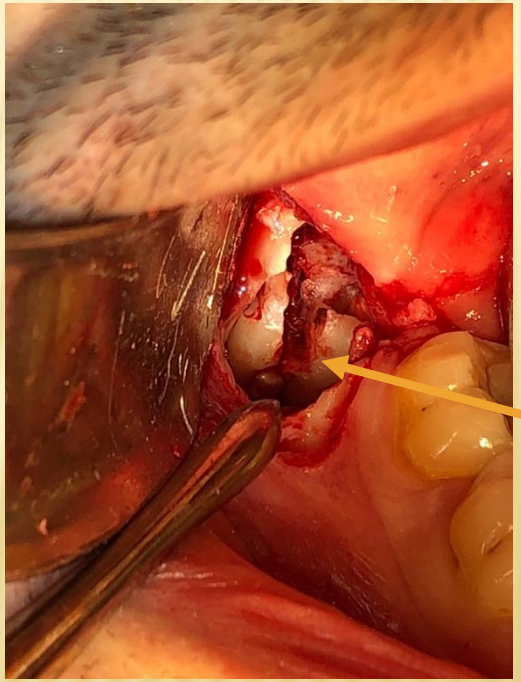
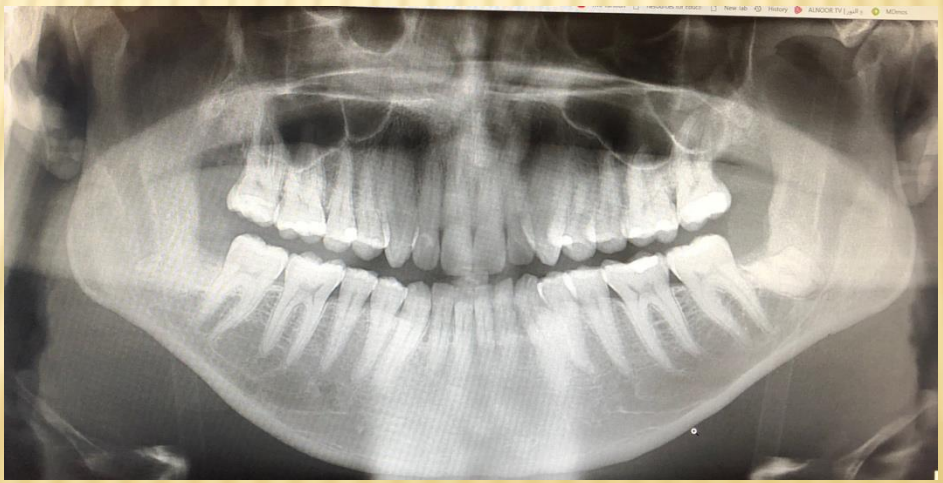
50
51
52
53

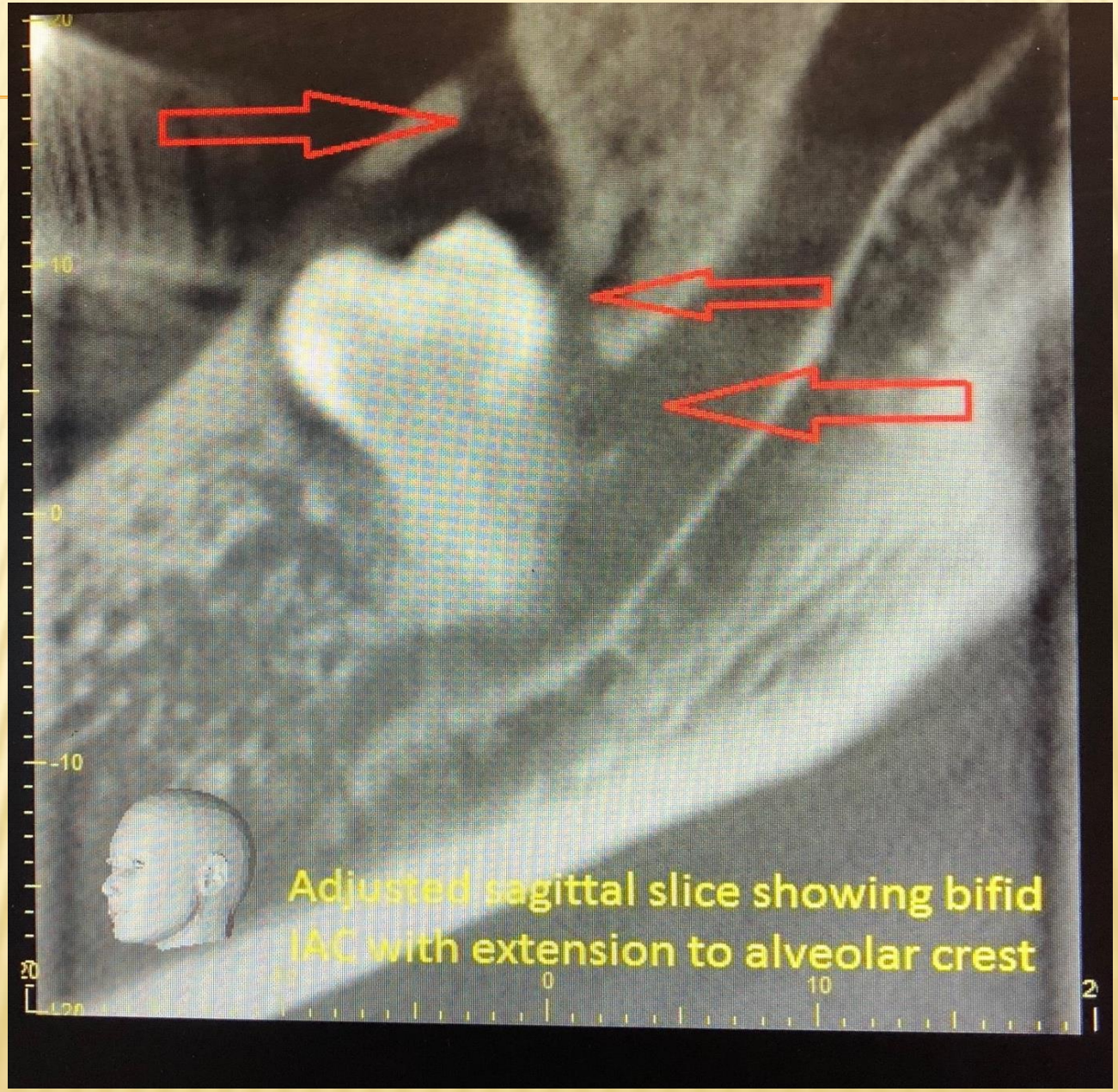



mic reconstruction, and
al slices of impacted tooth 48
IAC



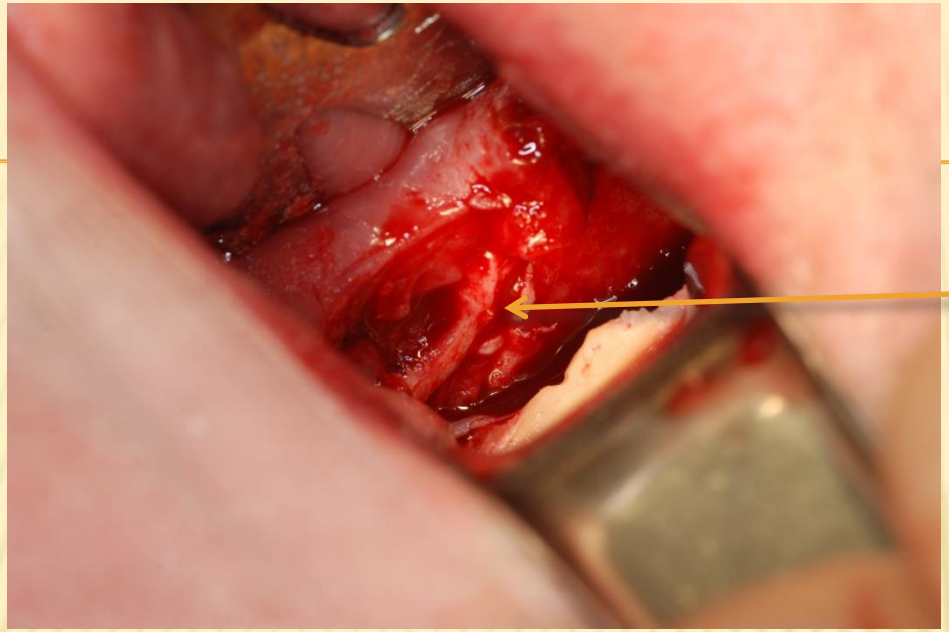


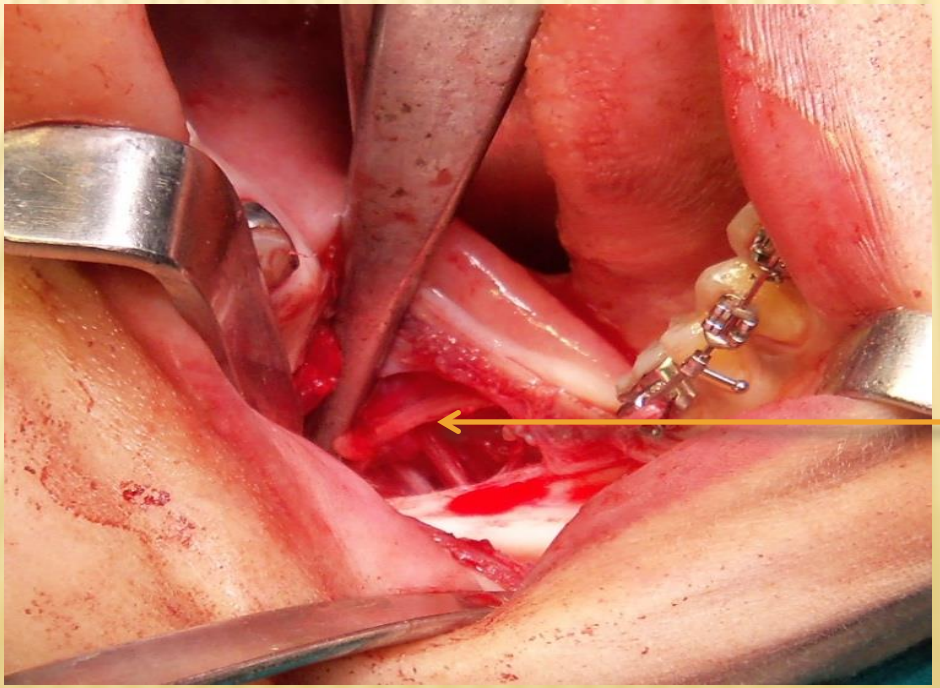



10
0
-10
0
10
Adjusted sagittal slice showing bifid
IAC with extension to alveolar crest

LINGUAL NERVE & MAGNETIC RESONANCE IMAGING(MRI)

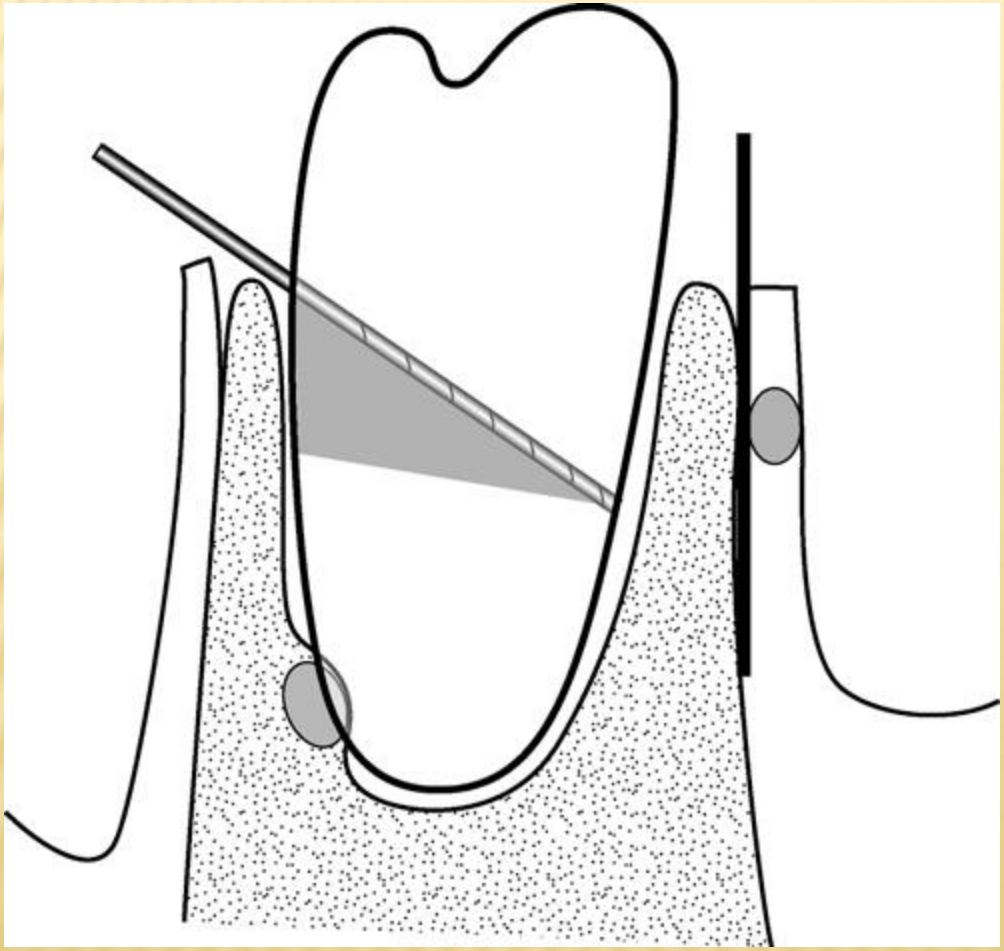
10% TIMES LN SUPERIOR TO THE LINGUAL CREST AND 25% IN DIRECT CONTACT WITH THE LINGUAL PLATE(Miloro et al:JOMS 1997:55:134-137.)
MEAN HORIZONTAL DISTANCE FROM LINGUAL PLATE IS 2.06 mm
AND VERTICAL 3.01 mm

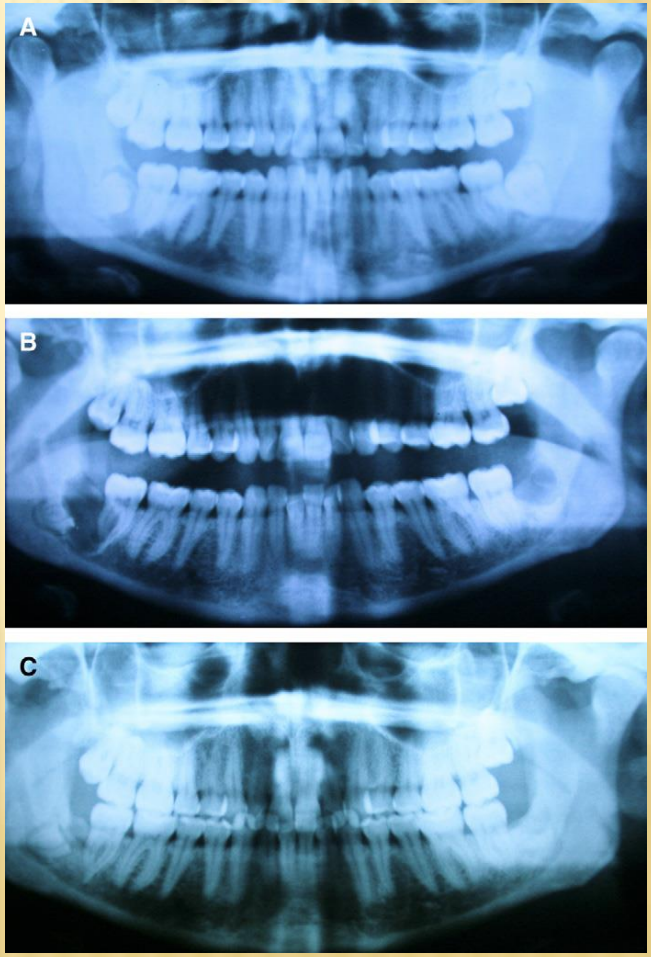

LN

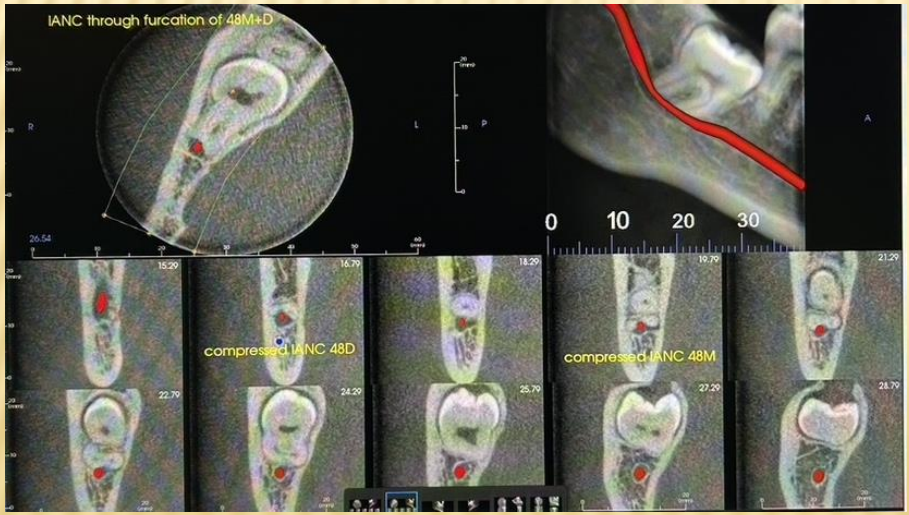

IAN

PARTIAL ODONTECTOMY.(ROOT INTIMATELY RELATED TO IAN)

CORONECTOMY






IANC through furcation of 48M+D
compressed IANC 48D
compressed IANC 48M
0
10
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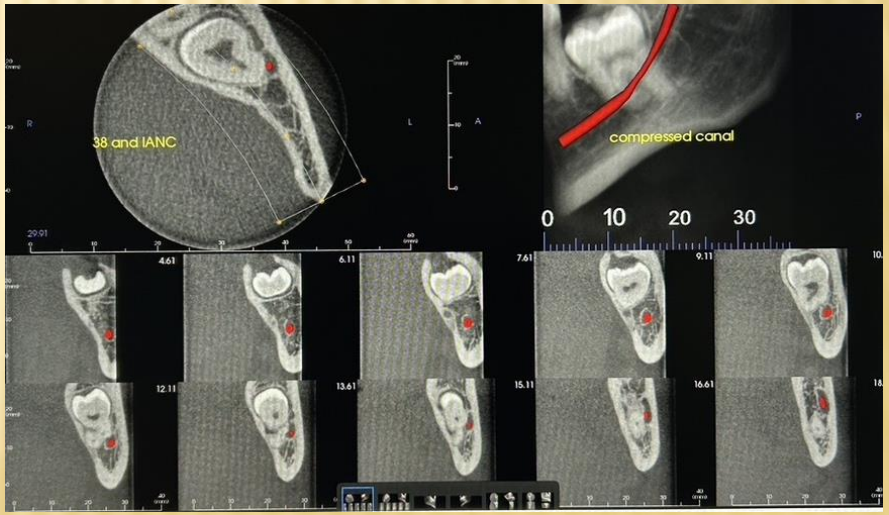
38 and IANC
compressed canal
0
10
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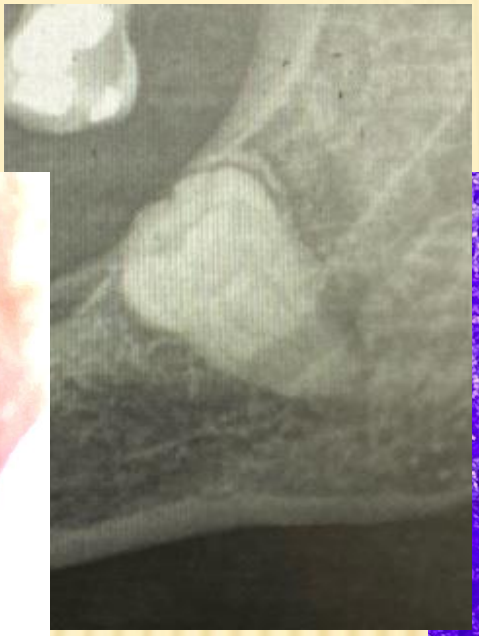
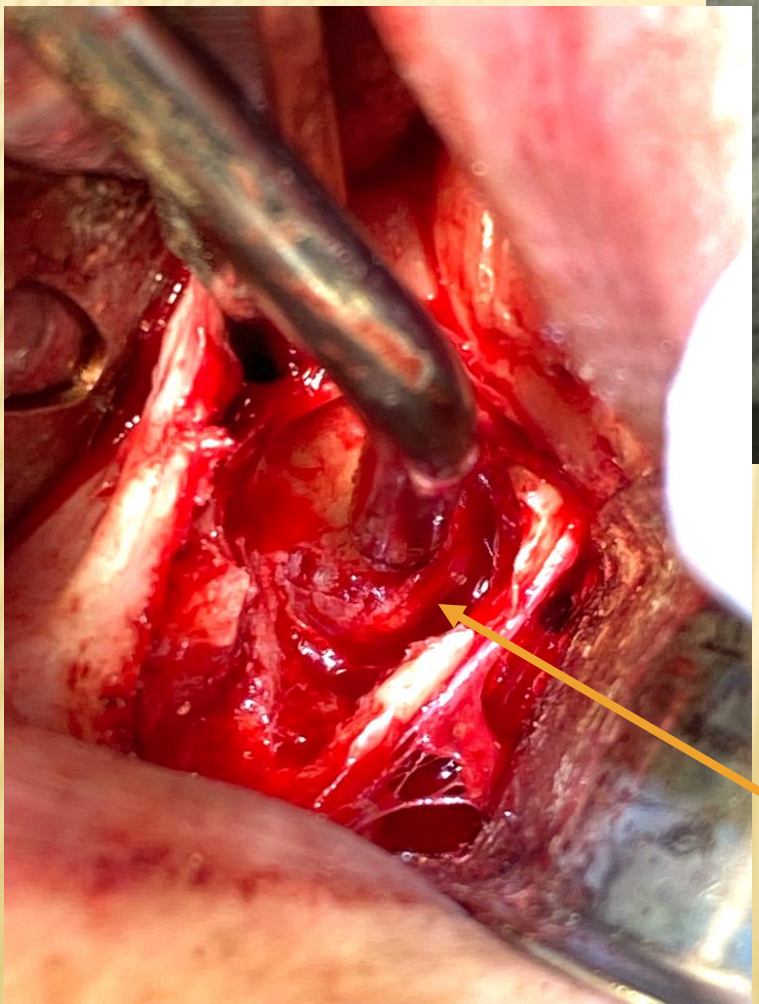
30

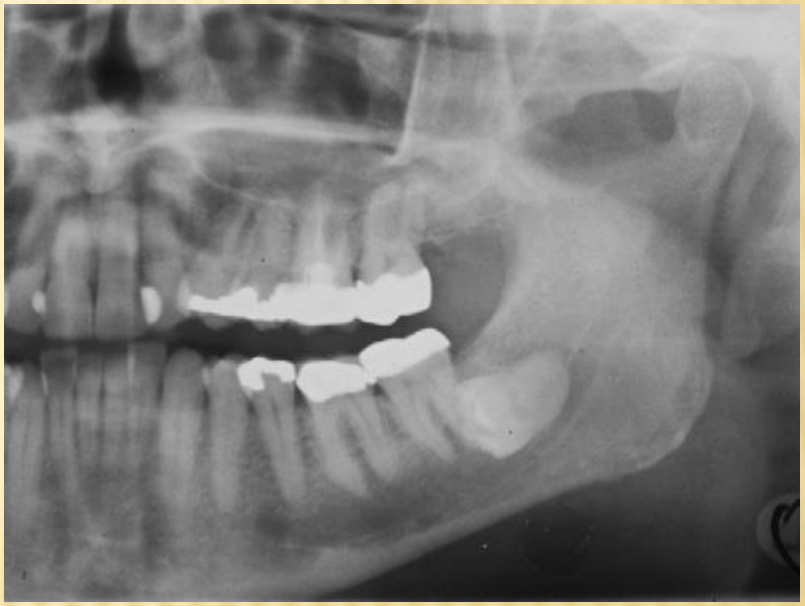
ROOTS MOVED WHILE SECTIONING THE CROWM





CONTRAINDICATIONS

- Active infection.
- Mobile teeth
- Horizontally impacted



INFORMED CONSENT

- Discusses the rational
- Discusses the risk factors
- Discusses the postoperative course
- Discusses the complications

PATH OF WITHDRAWAL SYSTEM OF ASSESMENT.

Path of withdrawal of the tooth
Obstacles to this:
Extrinsic to the tooth; bone , other teeth and IAN
Intrinsic to the tooth; crown, root morphology and angulation
Methods of overcoming the obstacles; removal, tooth division etc.
Point of elevation required to elevate the tooth or divided portions
Bone removal necessary to gain access and allow space for the elevation, division and exit of the tooth.
Flap design to allow access.

SURGICAL APPROACHES

SURGICAL APPROACH

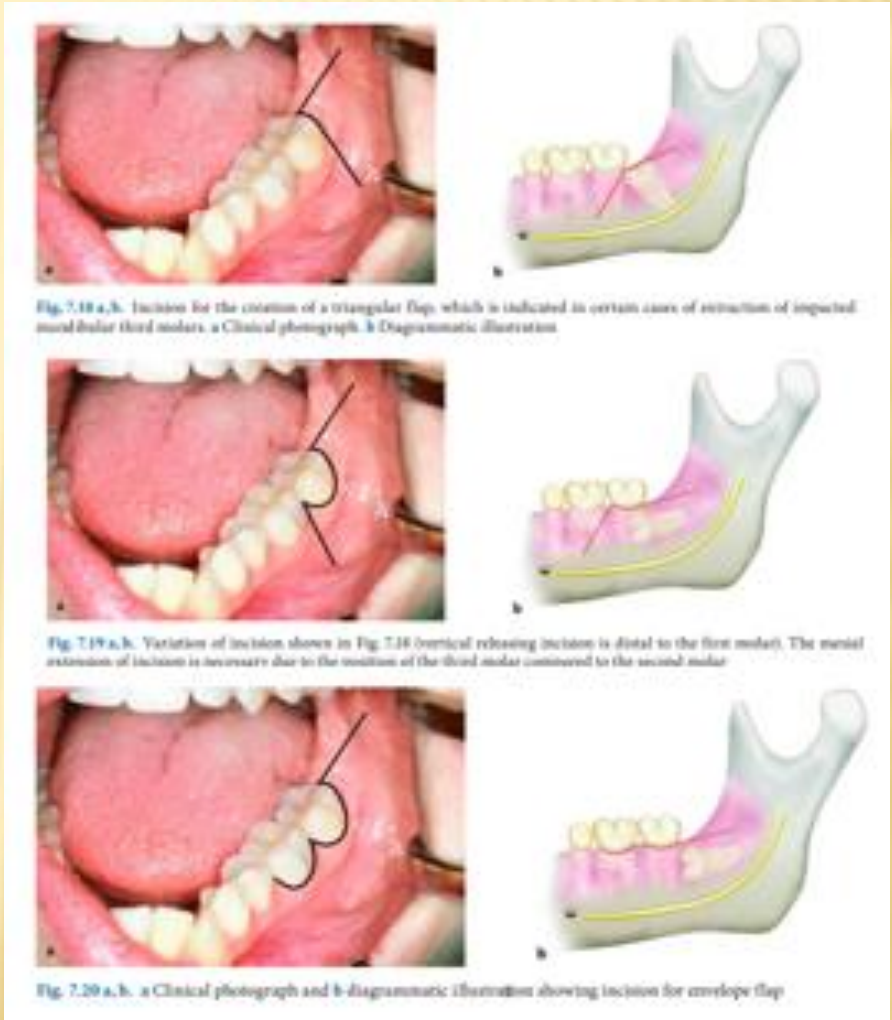
- The removal of an impacted third molar should proceed in an orderly, stepwise fashion
  - Obtain adequate exposure
  - Assess need for bone removal and remove sufficient bone to expose the tooth
  - Section tooth if necessary to avoid removing additional bone
  - Deliver tooth and socket curetted
  - Bone is smoothed with bone file; wound is irrigated and flap reapproximated

PRINCIPLES OF FLAP DESIGN

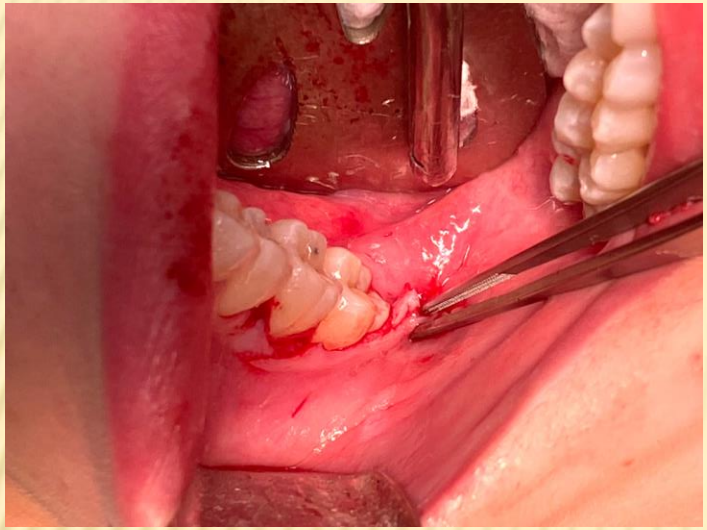
- Flap design principles
  - Avoid anatomical structures (major nerves and vessels)
  - Incision margins should always rest on sound bone
  - Base > apex to ensure adequate blood supply
  - Flap should be large enough to provide adequate visibility and accessibility for instrumentation
  - Envelope flap is preferred as it heals quicker than a three-cornered flap
  - If significant tension over the flap is suspected, a releasing incision should be made

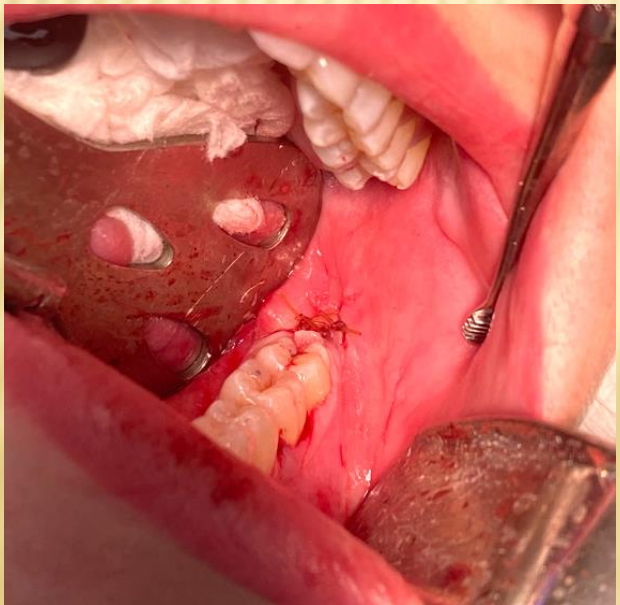
TYPES OF FLAPS

- **Triangular flap**
  - Incision begins at the external oblique ridge and continues to either the distal aspect of the second molar/first molar with vertical release made obliquely into vestibular fold
  - Extend to first molar if third molar is in close relation to second
- **Horizontal (Envelope) flap**
  - Incision begins at the anterior border of the ramus and extends to the distal of the second molar then into the sulcus ending at the mesial aspect of the first molar

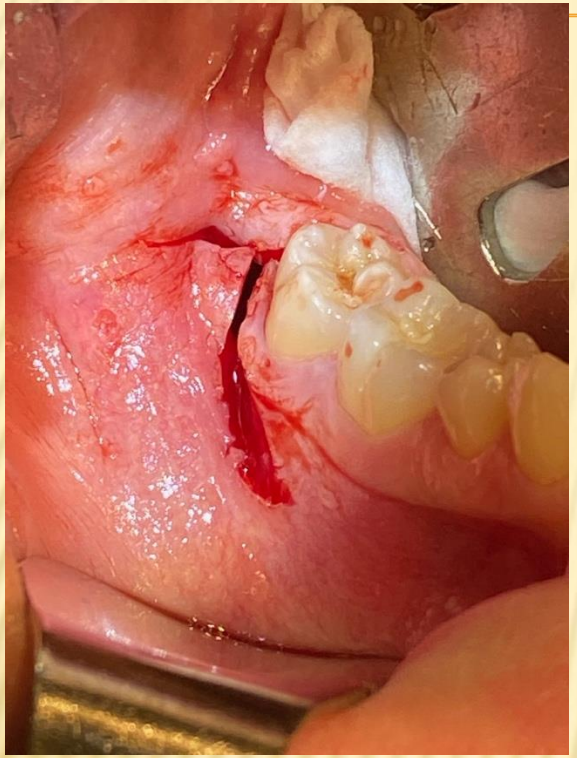


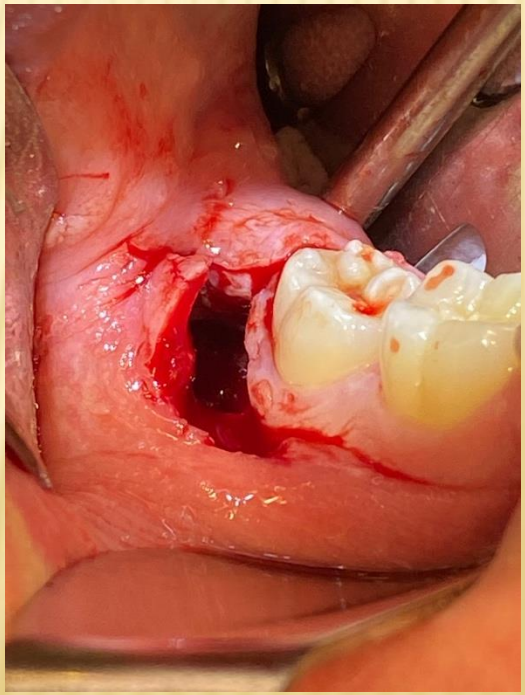
ENVELOPE FLAP

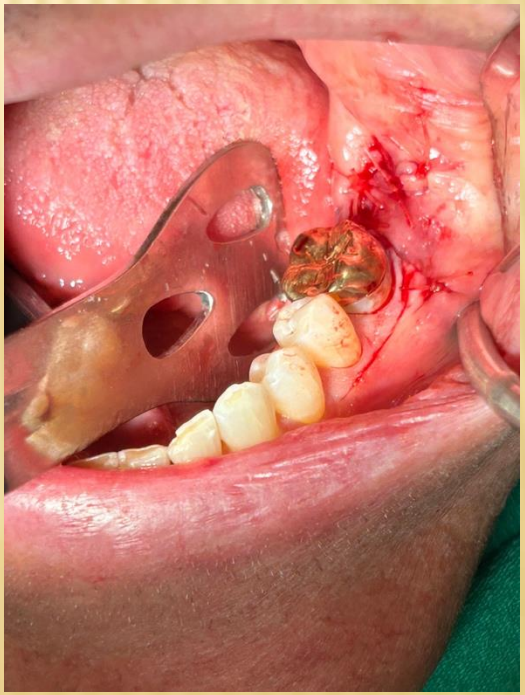




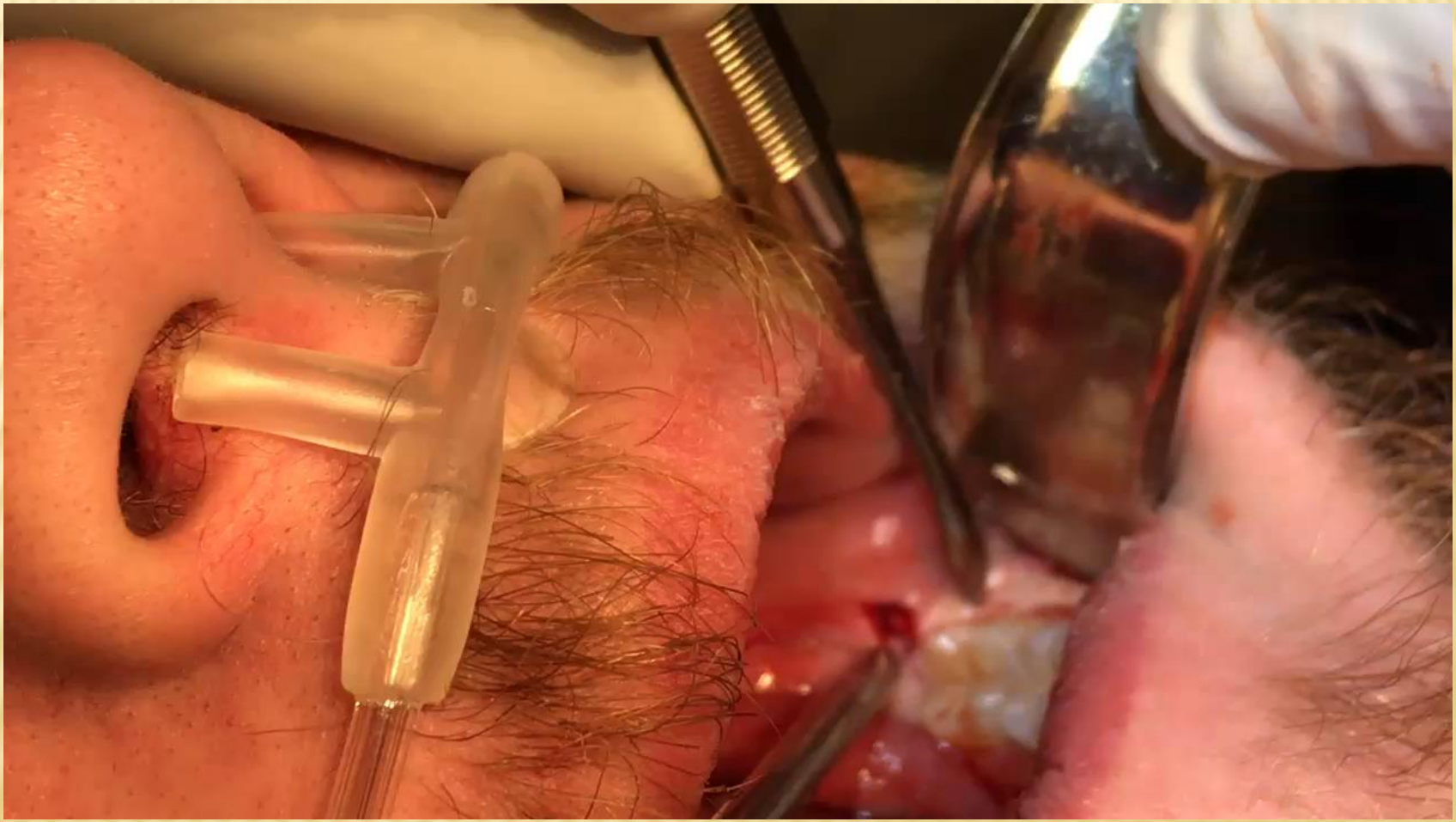
TRIANGULAR/WARDS INCISION

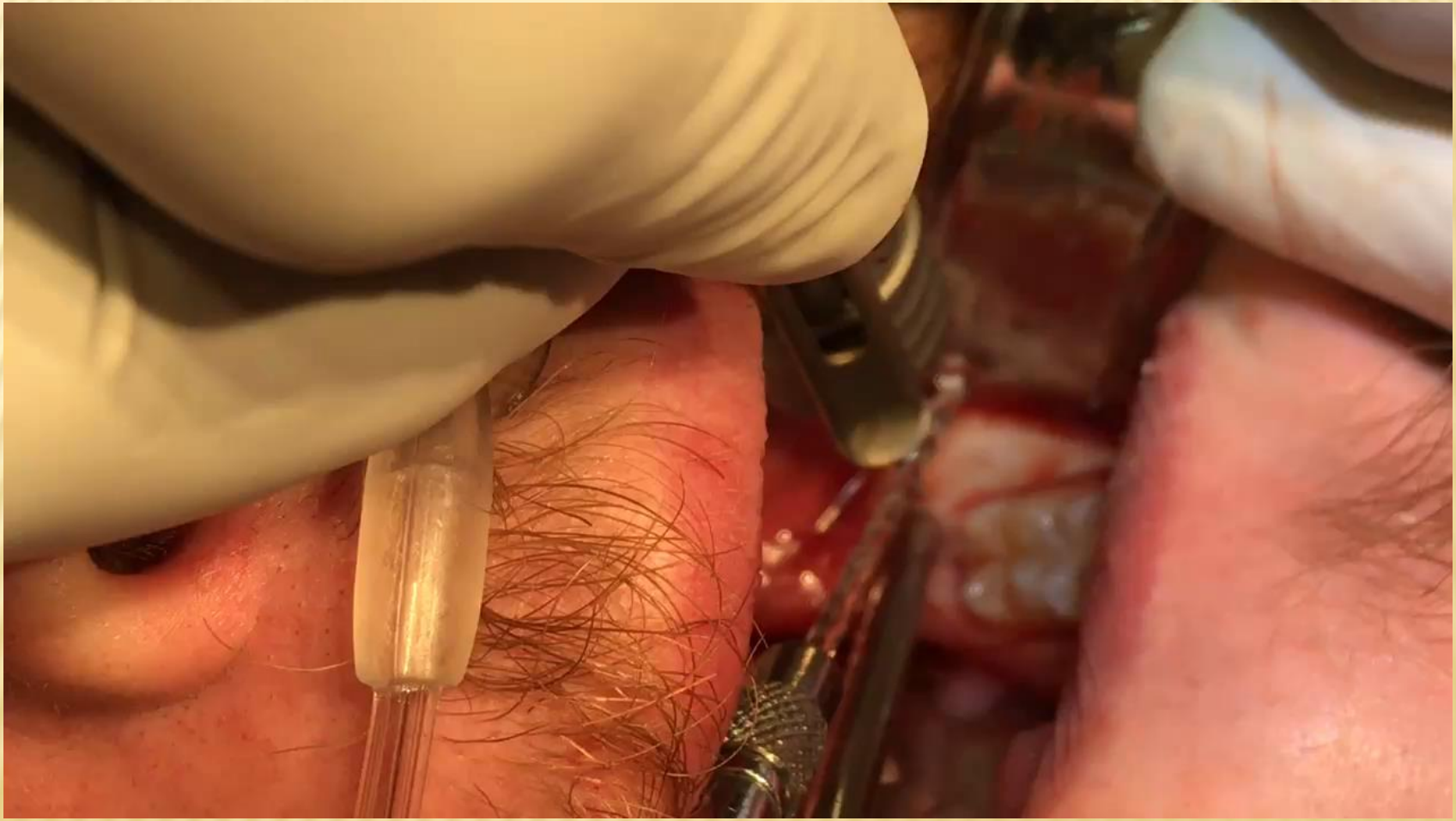


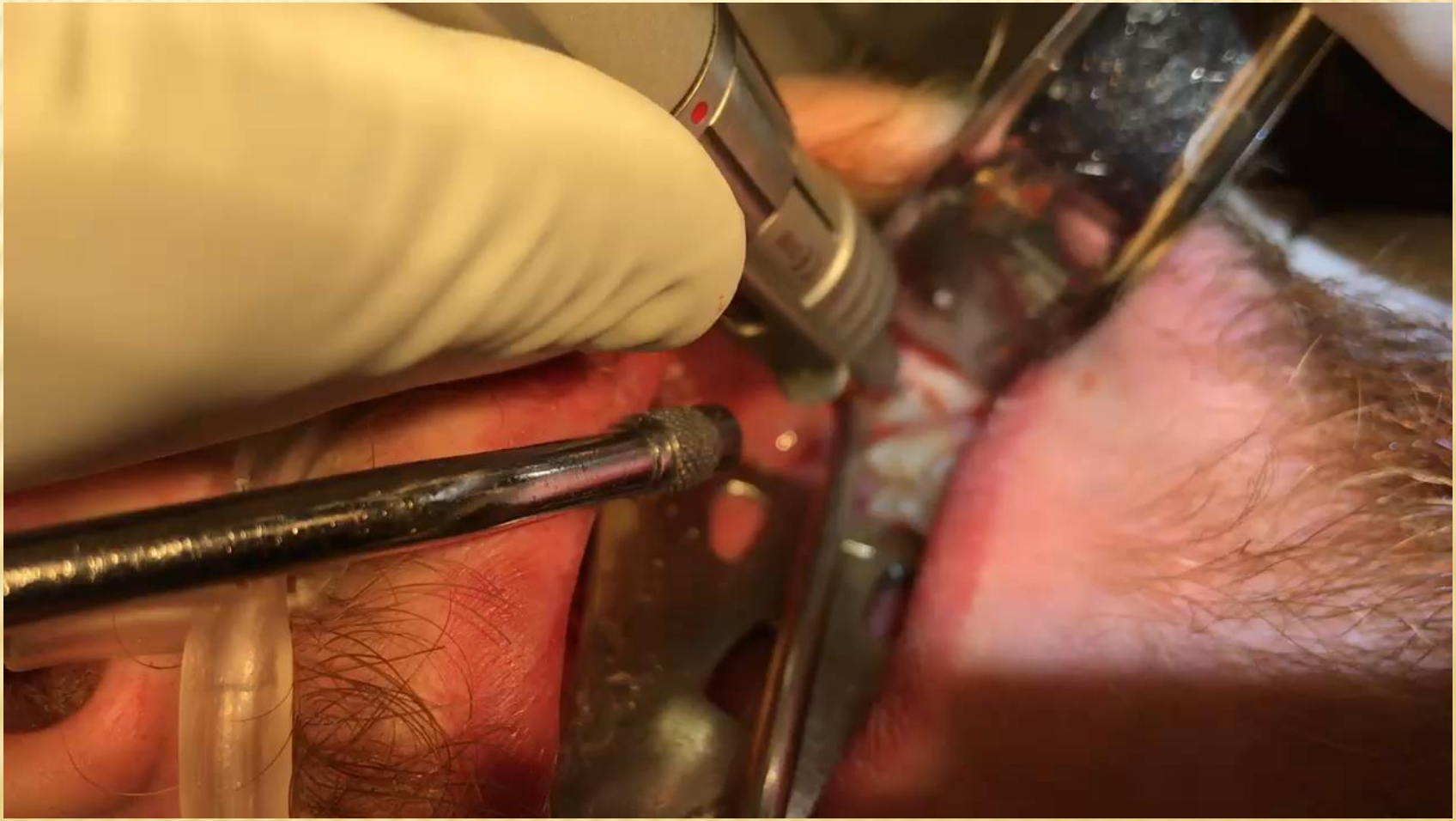


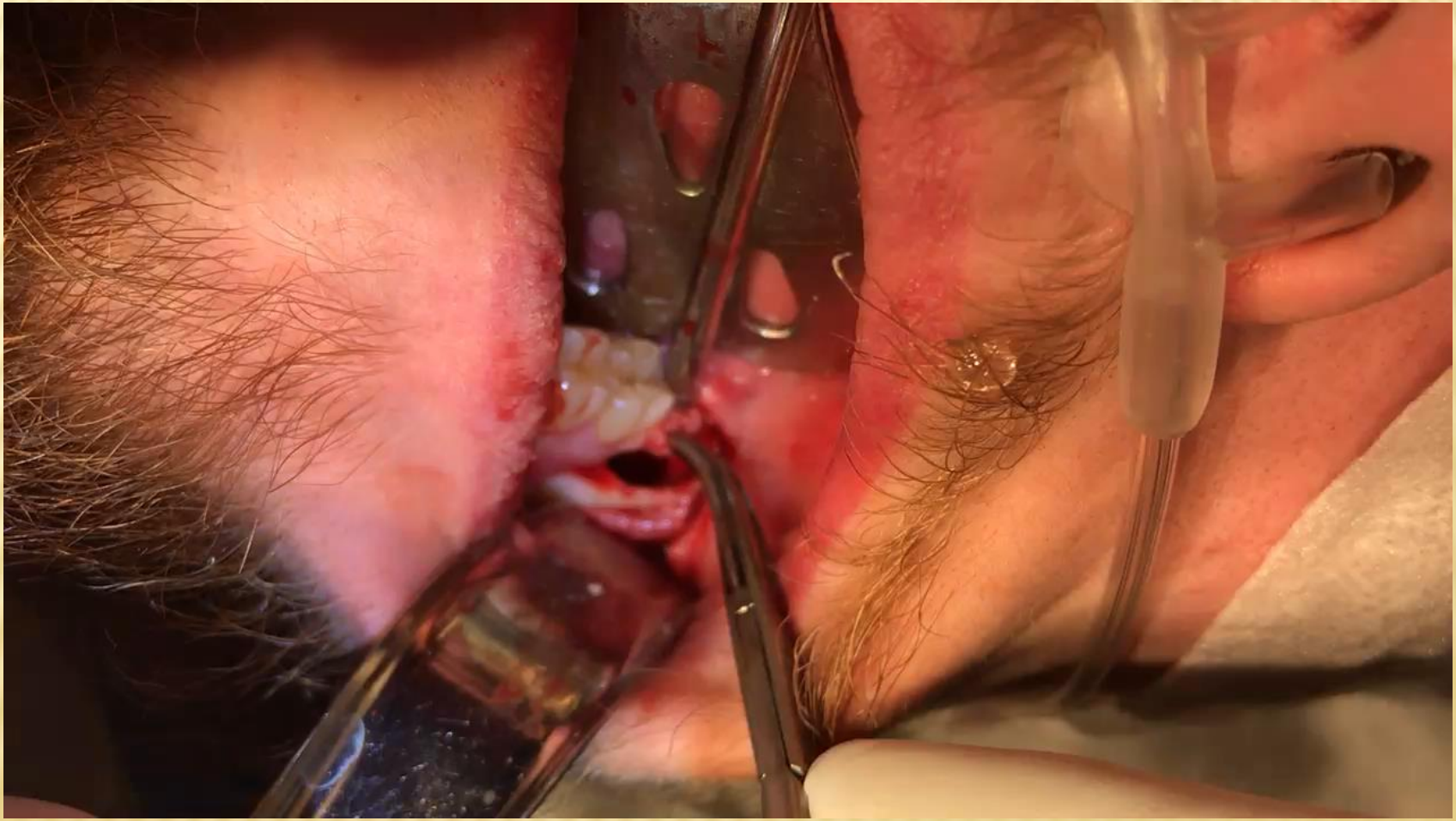


REMOVE THE FOLLICLE









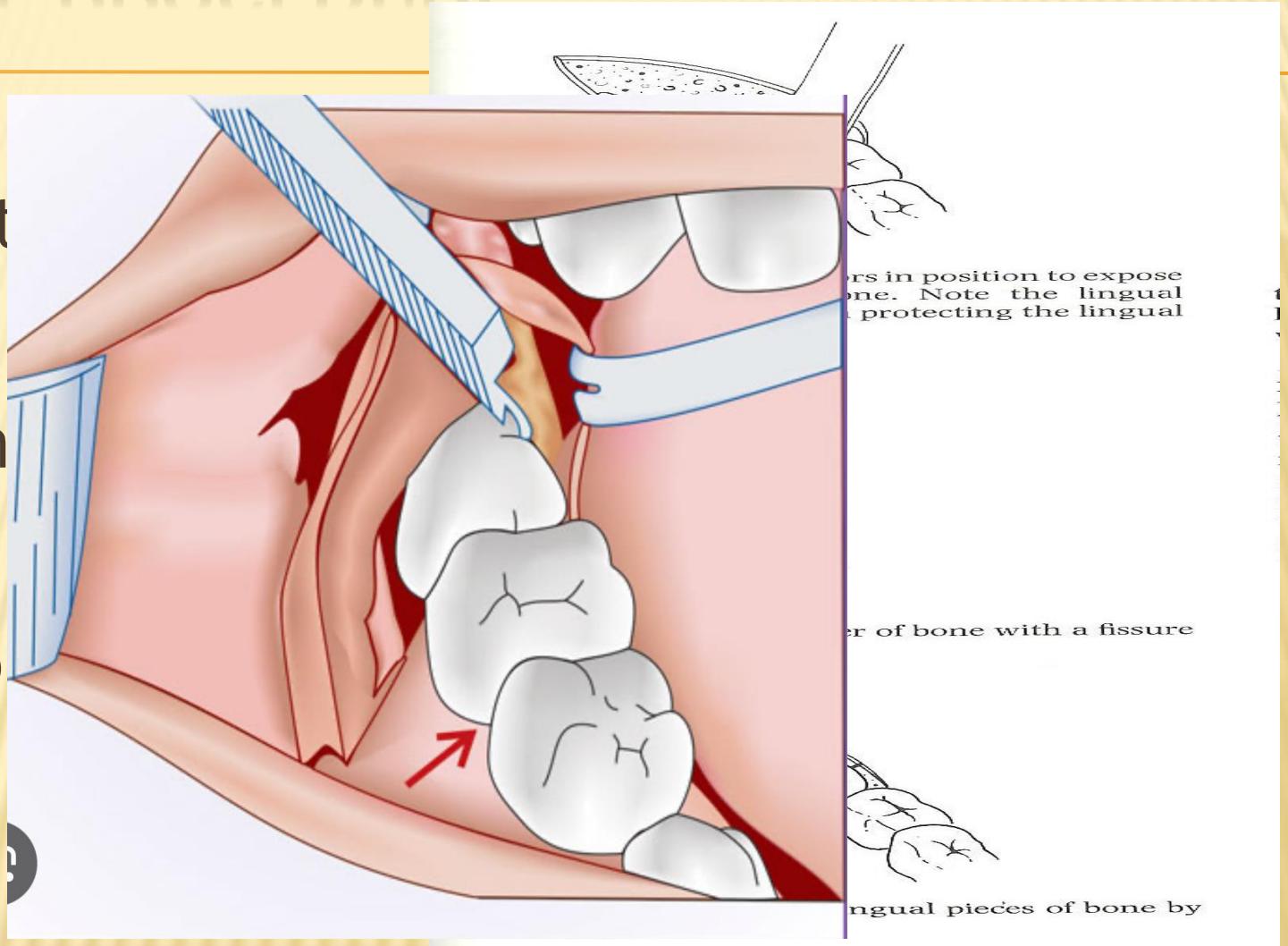

Germany Stainless
Pilling & Gruen Inc.

SURGICAL PROCEDURE.

- Bone Cut

Gutterin

Collar Bo



Lingual Split bone removal(Sir William Kelsey Fry)

SURGICAL PROCEDURE.

- Debridment removal of the follicle
- Irrigation
- Haemostasis
- Flap Closure

POST OPERATIVE MEDICATION AND INSTRUCTIONS.

- Analgesics.
- Antibiotics
- Apply ice packs.
- Do not rinse your mouth vigrously for 12 hours.
- Avoid hard and hot foods for 24 hours.
- No excessive exercise and effort for the first 24 hours.
- You may have blood taste in the mouth.

POST-OPERATIVE SEQUEL

- Pain
- Swelling
- Trismus
- Mild Bleeding

POST-OPERATIVE SEQUELAE

- Bleeding
  - Mild post-op bleeding common for 24 hrs
  - Gauze / tea bags can be helpful
- Edema
  - Peaks at 3-4 days post-operatively
  - Resolution often by post-operative day 5-7
- Pain
  - Peak in 12hrs post-op
  - Some soreness for up to 2-3 weeks is not uncommon
- Trismus
  - Normal ROM within 7-10 days
- If pain, edema, range of motion not greatly improved in 7-10 days, patient should be evaluated clinically for infection*


Bard-Parker
RIB-BACK
CARBON STEEL
Surgical Blade
15
BP

INCIDENCE & MOST COMMON COMPLICATIONS RELATED TO THIRD MOLARS.

- Complications range from 4.6% to 30%(intraoperatively /postoperative period)
- 80% of the population have four third molars and 5% have no third molars
- (Swedish population studies by Hogoson A.et al: The prevalence of third molars in Swedish population:Comm Dental Health:1988:5:121-38.)

Common complications :

1.Localized alveolar osteitis,

2.Infections.

3.Bleeding,

4.Paresthesia(injury to inferior alveolar nerve/lingual nerve)

5.Iatrogenic displacement of third molars.

6.Fractures(mandibular angle/maxillary tuberosity)

ELSEVIER
SAUNDERS

Oral Maxillofacial Surg Clin N Am 19 (2007) 117–128

ORAL AND
MAXILLOFACIAL
SURGERY CLINICS
of North America

Complications of Third Molar Surgery

Gary F. Bouloux, MD, BDS, MDSc, FRACDS, FRACDS(OMS),
Martin B. Steed, DDS, Vincent J. Perciaccante, DDS*

Division of Oral and Maxillofacial Surgery, Emory University School of Medicine, 1365-B Clifton Road NE, Suite 2300-B, Atlanta, GA 30322, USA

In 1994, the American Association of Oral and Maxillofacial Surgeons Third Molar Clinical Trial research group began an ambitious longitudinal study that has added an immense amount of scientific data to our understanding of third molar surgery outcomes. Concurrently, the American Association of Oral and Maxillofacial Surgeons identified the need to characterize the clinical outcomes of procedures commonly performed by members of the specialty in the 1990s [1]. As a incidence of complications. Third molar removal is no different, yet such a common procedure sometimes results in what are relatively rare complications. The possibility of these events should be discussed with patients before the procedure and handled in a timely and corrective manner by the surgeon. Complications related to third molar removal range from 4.6% to 30.9% [2,3]. They may occur intraoperatively or develop in the postoperative period.

ALVEOLAR OSTEITIS(DRY SOCKET)

- Incidence ranges from 1 – 30%
- Mandibular third molars suffer more AO(0.3-26%)
- Characterizes by sever throbbing pain usually begins 3 to 5 days postoperatively.
- Pain radiating to ear with foul taste and malodour.
- Malformation or disruption of blood clot /independent of fibrinolysis destruction of thrombus by bacteria
- Patients under the age of 20 years are considered low risk
- Patients on oral contraceptives , smokers , pericronitis and history of dry sockets seems to be high risk.

DRY SOCKET & POSTOPERATIVE INFECTION

- Early fibrinolysis of blood clot (2-3 days PO) leads to exposed socket wall
- Manifested by severe pain, bad smell, empty socket, no pus
- 2% in closed extraction & 20% in impaction surgery & excessive manipulation
- Prevention: careful surgery, cooling during drilling
- Treatment: local measures & pain management

0.3 to 26% Incidence of Dry Socket in third molar surgery

ALVEOLAR OSTEITIS(DRY SOCKET) PREVENTION

- Remove third molars when pre-existing pericronitis has been treated adequately.
- Surgery should be as atraumatic as possible.
- Copious irrigation of saline while cutting bone and sectioning tooth.
- Chlorhexidine 0.12% should be used on the day before surgery and for several days after.

(No role of pre or post operative antibiotics found in reducing the incidence of AO except in patients with immune compromised status.Poeschl et al:JOMS:2004.62.3)

ALVEOLAR OSTEITIS(DRY SOCKET) MANAGEMENT.

- A combination of antibacterial dressings , obtundant dressings and topical anesthetics are used.
- Copious irrigation of the socket with saline.
- Dressing of Alvogyl containing butamben, eugenol, idoform.
- Repeated dressings may be required.
- Systemic analgesics may be used as adjunct.

(do not use Alvogel when IAN is exposed as eugenol is neurotoxic)

INFECTIONS

- Incidence ranges from 0.8 to 4.2% after third removal.
- Degree of impaction, need for bone removal and tooth sectioning, exposure of IAN, presence of gingivitis and pericronitis, surgeons experience.
- Typically a mixed infection with predominatly anaerobic microorganisms(streptocci usually single largest)

MICROBIOLOGY

- The polymicrobial nature of these infections makes it important that the clinician understands the variety of bacteria that are likely to cause infection.

Aerobic gram-positive cocci.

Anaerobic gram-positive cocci.

Anaerobic gram-negative rods.

Role of bacteria in odontogenic infection

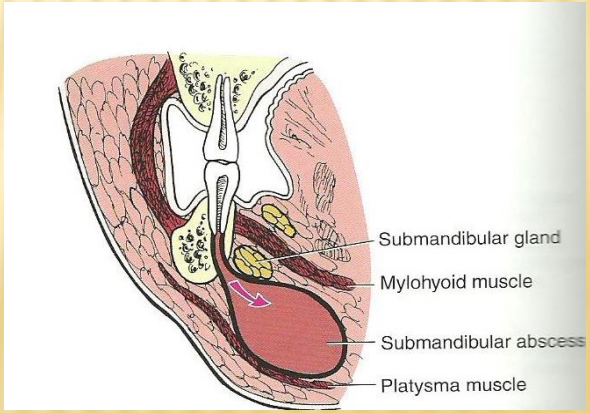
Anaerobic only	50%
Mixed anaerobic & aerobic	44%
Aerobic only	6%

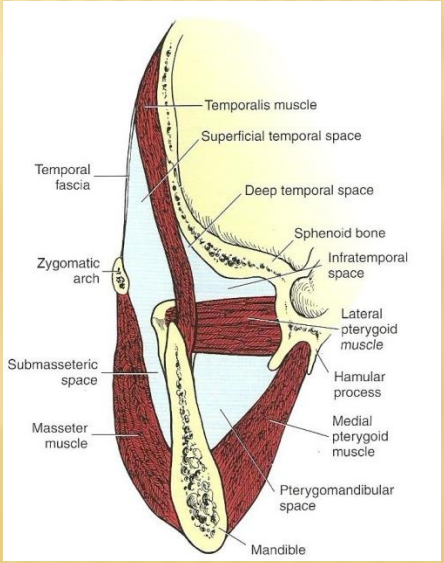
(Brook et al:Oral Microbiol Immunol 6 :123-125:1991)

FASCIAL SPACES – THE PATH OF LEAST RESISTANCE

- Primary Maxillary
  - Vestibule
  - Buccal
  - Infratemporal
- Primary Mandibular
  - Vestibule
  - Buccal
  - Submandibular
  - Sublingual
  - Pterygomandibular
  - Submasseteric.

- Cervical Fascial Spaces
  - Lateral pharyngeal
  - Retropharygeal
  - Prevertebral
  - Peritonsillar





COMMOMEST SITE INVOLVED

- Submandibular space infection was found in 60% of the cases , followed by pterygomandibular,
- buccal and lateral pharyngeal.

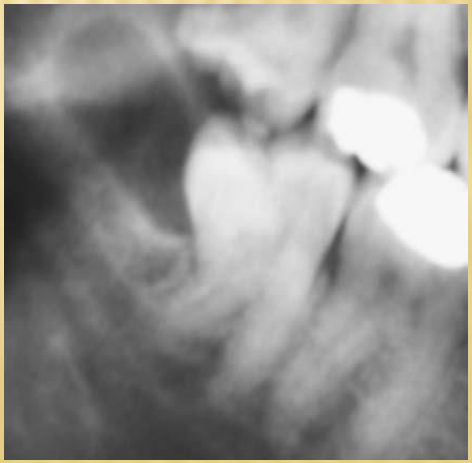
Thomas R Flynn.et al.JOMS:2006;1093-103

BLEEDING AND HEMORRHAGE

- Intraoperative incidence of 0.7% & 0.6% postoperative in mandibular third molars and 0.4% in Maxillary third molars..
  (Chiapasco M et al :0000:1993:76:412.)
- Distoangular impactions, deep impactions and elderly.
- Mandibular molars more common than maxillary(80 & 20% respectively)
- Local Causes
  Trauma to soft tissues, vessel injury,bony bleeders.
- Systemic Causes
  Hemophlia A & B ,von Willebrand disease
  Antithrombotic medication

DAMAGE TO ADJACENT TEETH

- Incidence of damage to adjacent restoration has been reported to be 0.3 -0.4%
  (Chiapasco M et al :OOOO:1993:76:412.)
- Maxillary mesioangular impactions with class B and vertical mandibular impactions may be slightly at risk.



MANDIBULAR & MAXILLARY FRACTURES.

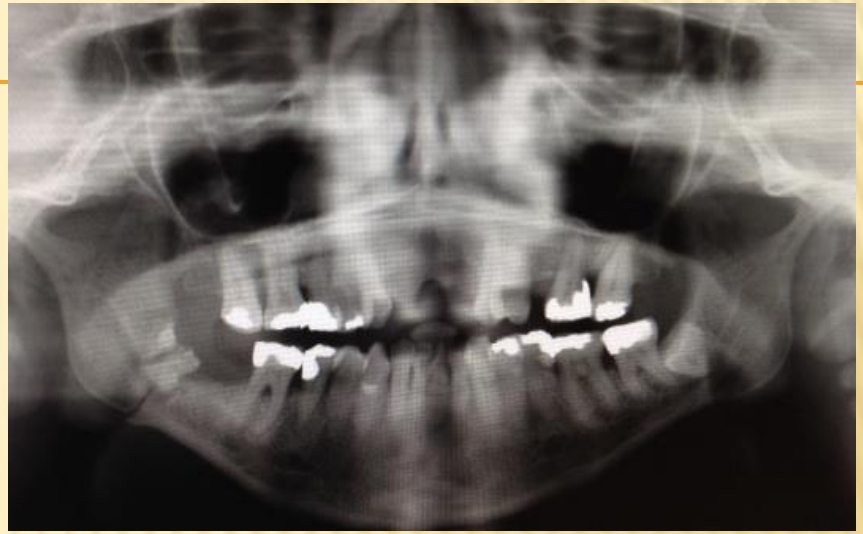
- Incidence of mandibular fractures is reported to be 0.049%

  (Libersa et al:JOMS:2002:60:163.

- Patients older than 40 years with roots adjacent to canal have increased risk for fractures.

- Intraoperative were few and late after 6.6 days exclusively upon mastication.
- (Iizuka et al:IJOMS:1997:26:338.)
- Incidence of Maxillary Tuberosity fractures was 0.6%

  (Chiapasco M et al :OOOO:1993:76:412.)

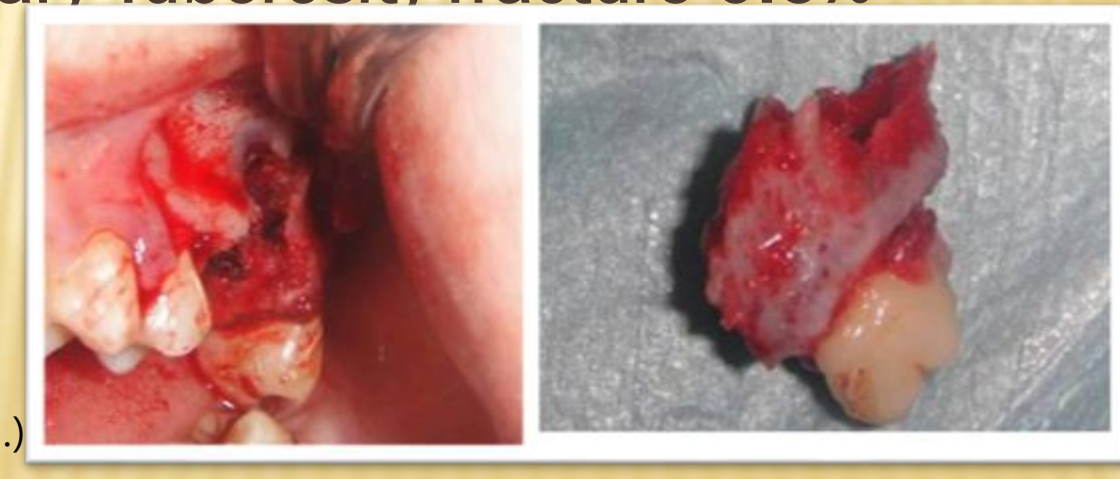


FRACTURE OF MAXILLARY TUBEROSITY

- Importance of Maxillary Tuberosity
- Management of fractured MT:
  - If MT still attached to periosteum & tooth
  - If MT is detached from mucosa
  - If it is accompanied with OA Communication

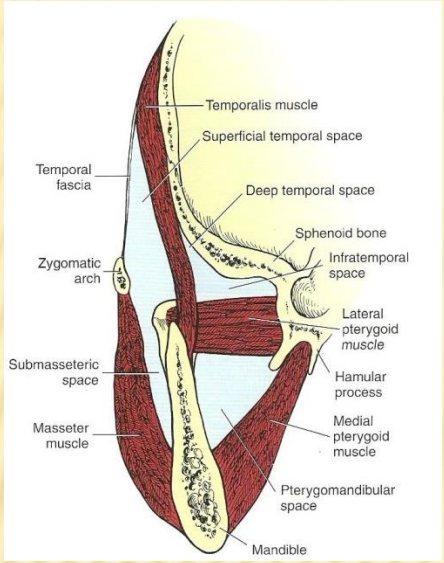
N.B. Fractured alveolar bone is treated similarly

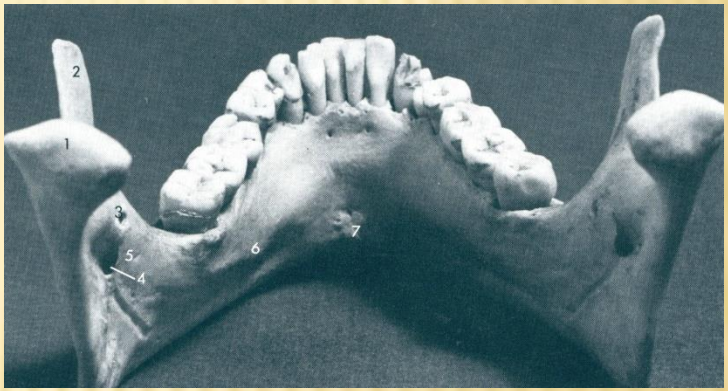
Incidence of Maxillary Tuberosity fracture 0.6%



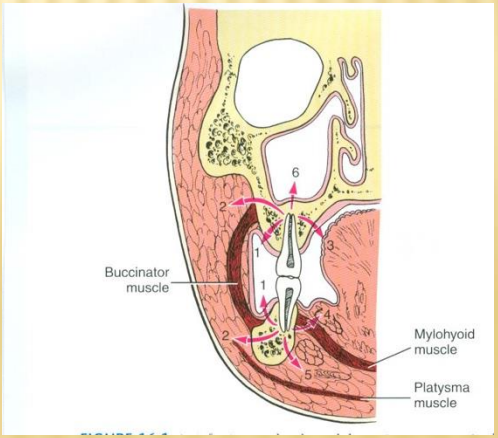
(Chiapasco M et al :OOOO:1993:76:412.)

DISPLACEMENT OF THIRD MOLARS. IATROGENIC (MANDIBULAR)





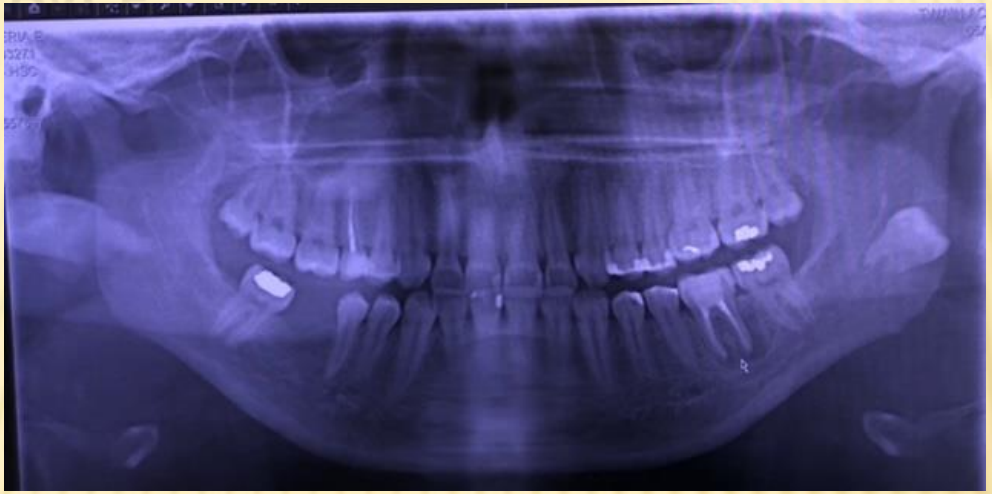
Sublingual space
Submandibular space.
Ptergomandibular space.
Lateral pharyngeal space.

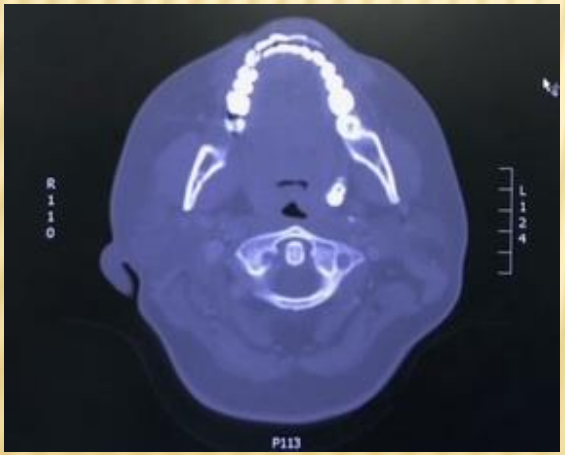


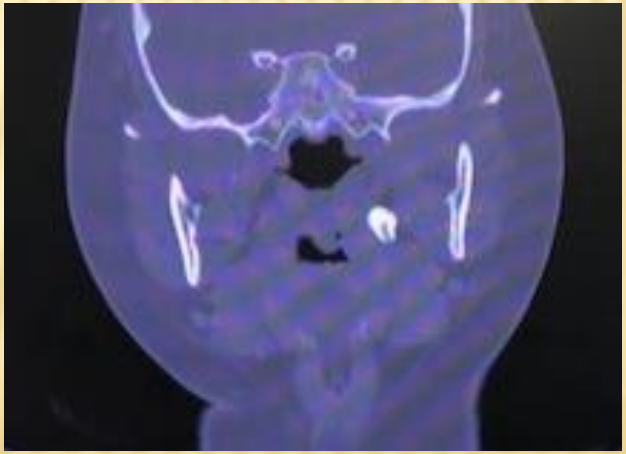

A


B

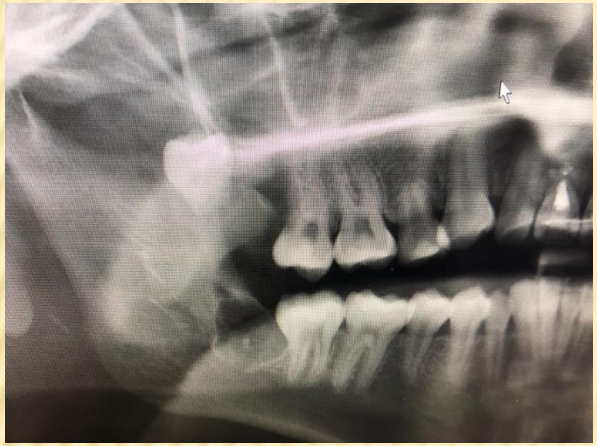
LEFT MANDIBULAR THIRD MOLAR DISPLACED INTO LATERAL PHARYNGEAL SPACE

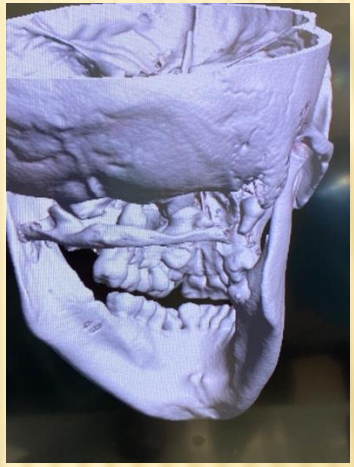


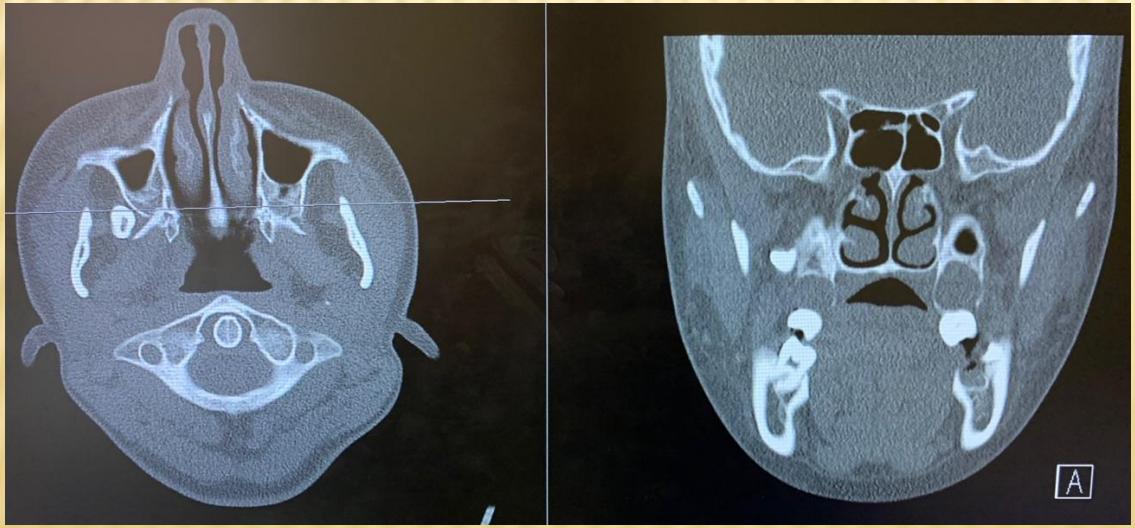




RIGHT UPPER WISDOM TOOTH DISPLACED INTO INFRATEMPORAL FOSSA/PTERYGOMAXILLARY FISSURE AREA.

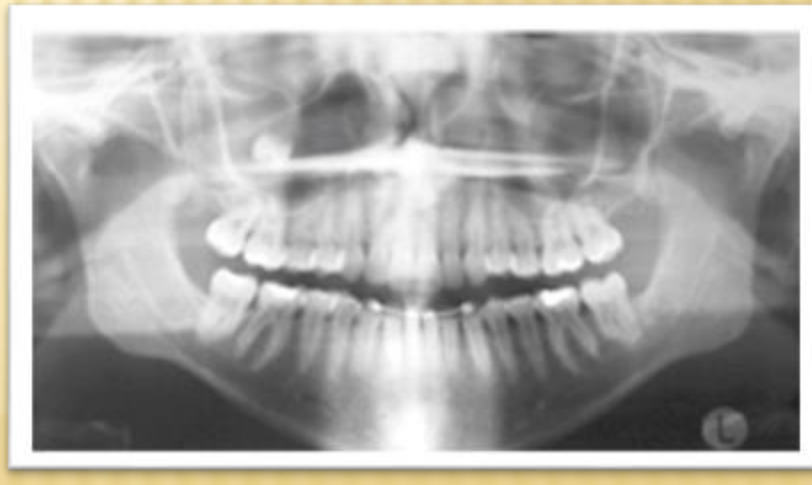






DISPLACEMENT INTO M. SINUS

- The point of elevator has to be between the bone and the root.
- Be careful with higher impacted upper third molar.



Management:

- Take a new X-ray (Occlusal, OPG, periapical)
- Try immediate removal through socket
- Leave root to fibrose for 3 weeks?
- Close wound & consider referral
- When in doubt, inform patient & make appropriate referral
- Sinus approach

DISPLACEMENT OF THIRD MOLARS. IATROGENIC (MAXILLARY SINUS)

- Management.

Retrival by placing the suction tip over the opening into the sinus.

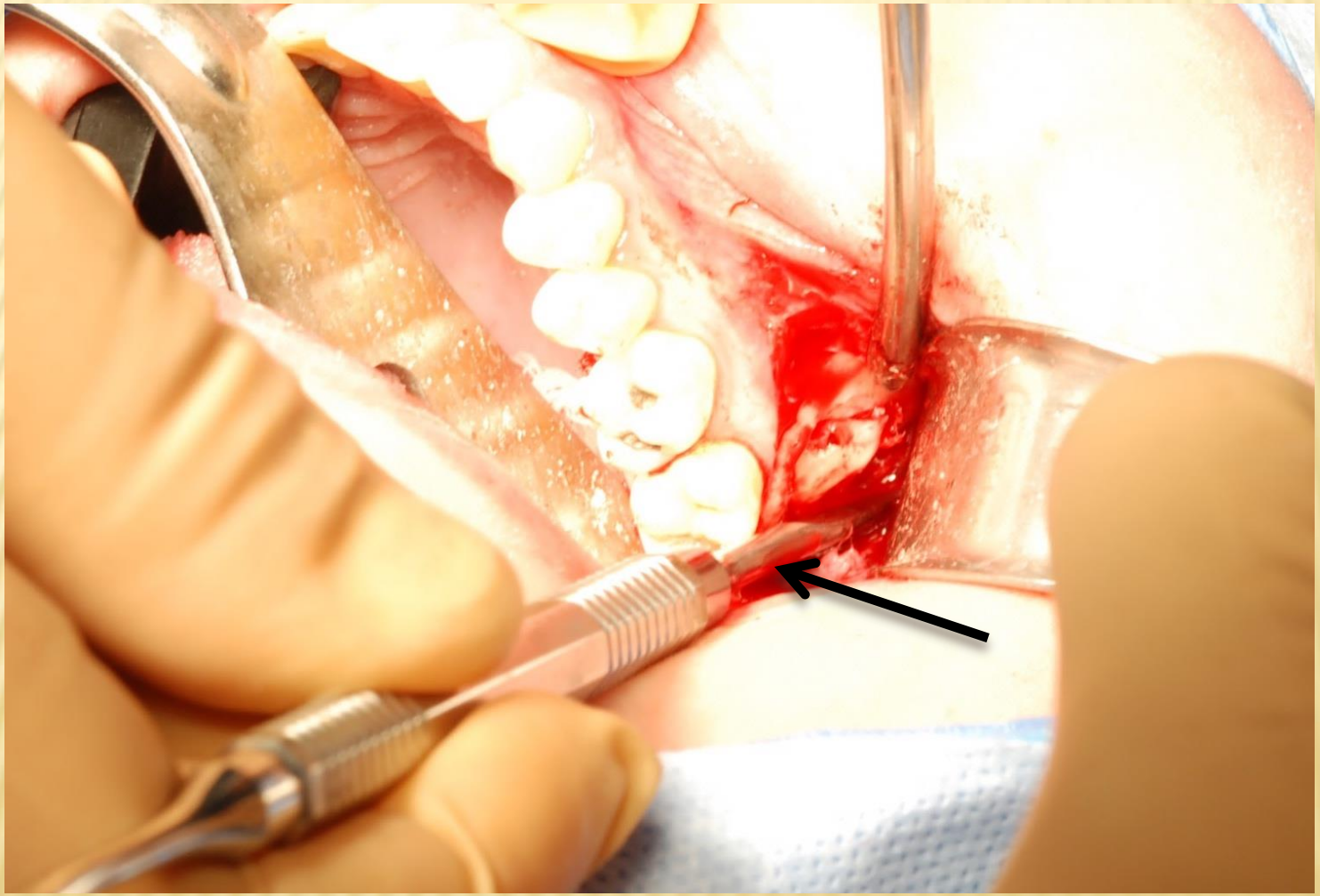
Irrigate the sinus and repeat the procedure.

Place the patient on antibiotics and nasal decongestant

. Imaging by CT or radiographs (PNS)

Through Caldwell-Luc approach under GA in the OR.

Pogral,M:Oral % Macfac Clin N Am:1990:2:441.



OROANTRAL COMMUNICATIONS/FISTULA

- OAC is a communication between the sinus and the oral cavity.

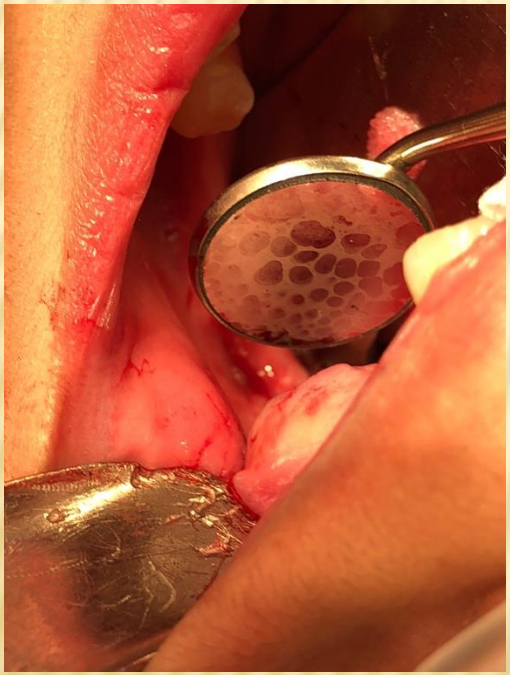
  If not diagnosed and treated may epithelialize and become a fistula.

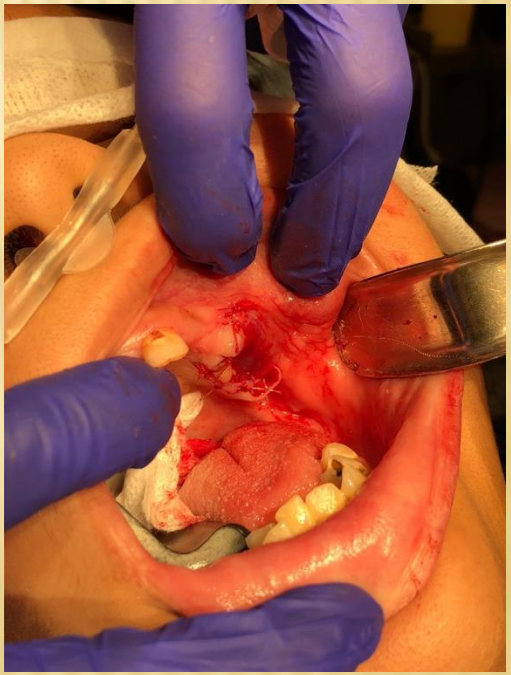
- Incidence of 0.08% to 0.25% OAC has been reported with maxillary third molar removal.

- OAC smaller than 2mm closes spontaneously with out any treatment.

- OAC most frequently occurs from extraction of first molars followed by second molar.

Punwutikorn J. et al:IJOMS:1994:23:19.

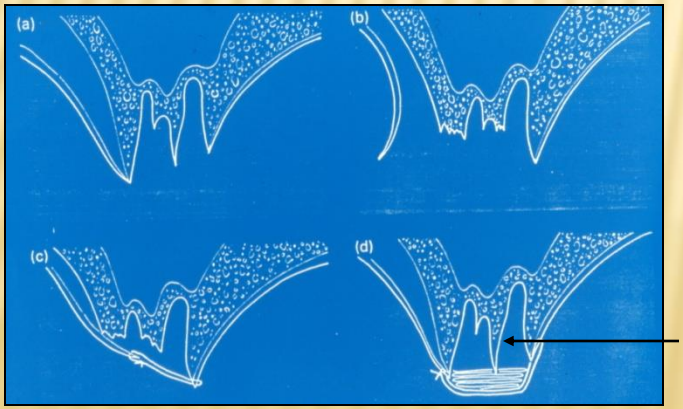




Management of OroAntral Communication

Our protocol

- Invisible defect
  - Sinus precautions
- Visible defect
  - Trimming of alveolar bone
  - Suturing of approximated buccal and palatal mucosae
  - Packing of socket with “Figure of 8” suture
  - Sinus precautions



Sinus precuations

Avoid negative pressure

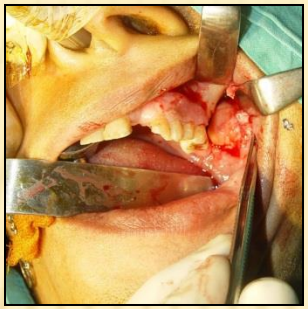
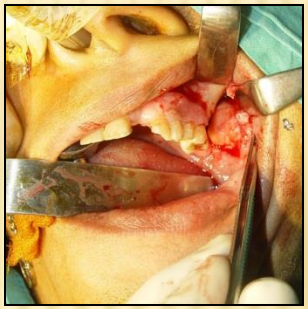
- Nose blowing
- Violent sneezing
- Use of straw
- Smoking
- Vigorous rinsing

OROANTRAL COMMUNICATIONS/FISTULA MANAGEMENT

- Buccal flaps.
- Palatal flaps.
- Bridge flap.
- Tongue flaps.
- Buccal fat pad(BFP)
- Gold foils.



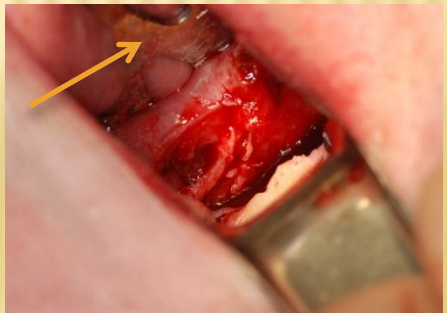


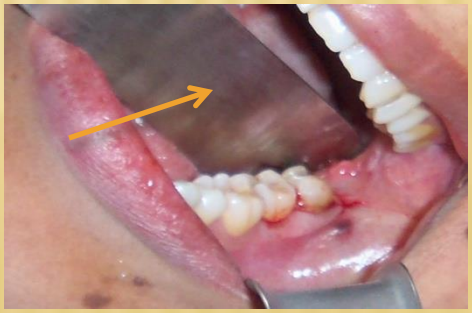





ASPIRATION OF THIRD MOLARS

- Due to patient gagging & swallowing , aspiration of a tooth may result
- The use of intravenous sedation further compromises the protective reflexes of airway
- No use of oropharyngeal gauze or sweet heart retractor to protect the airway/swallowing

It should be used.

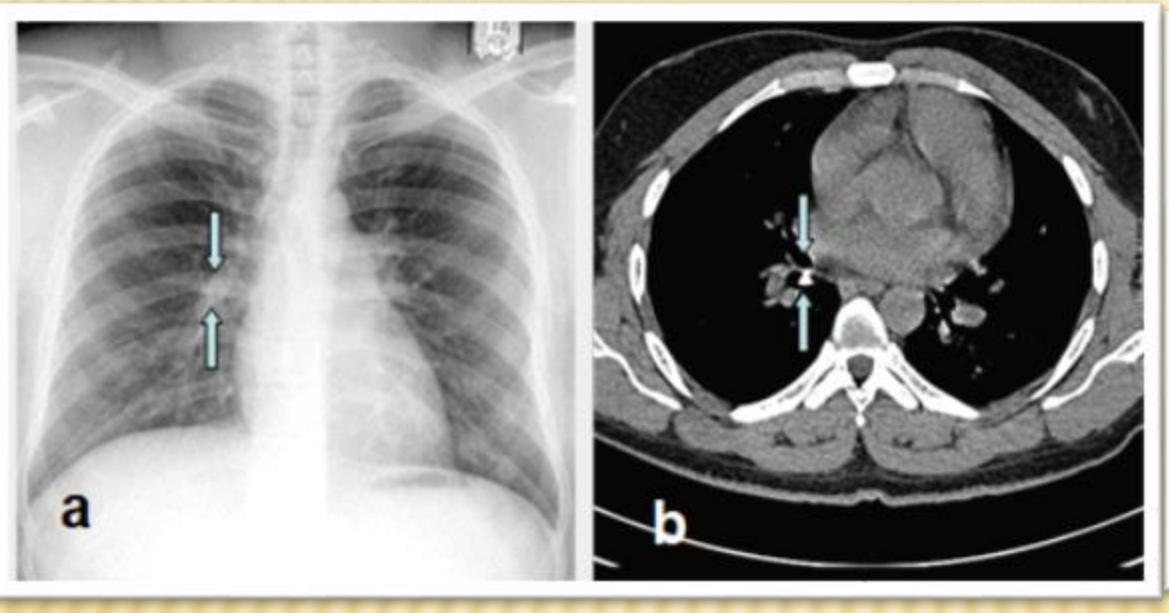


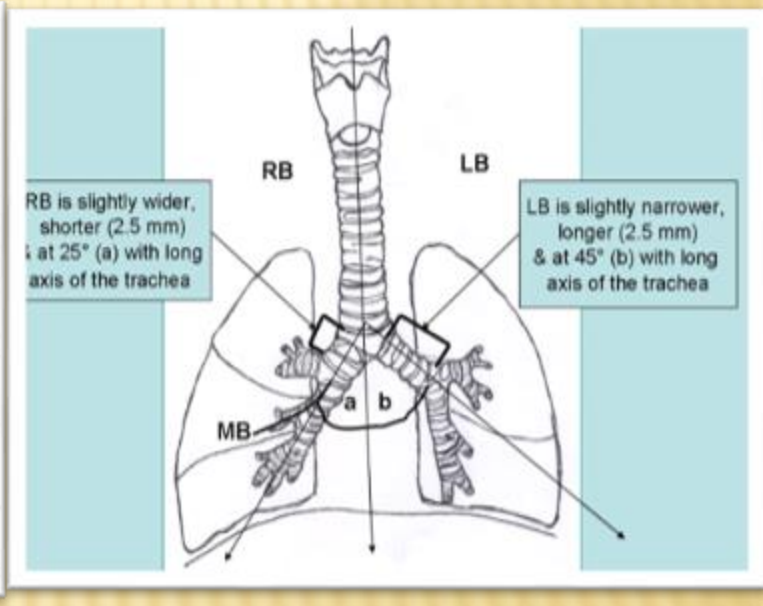


ROOT OR TOOTH LOSS

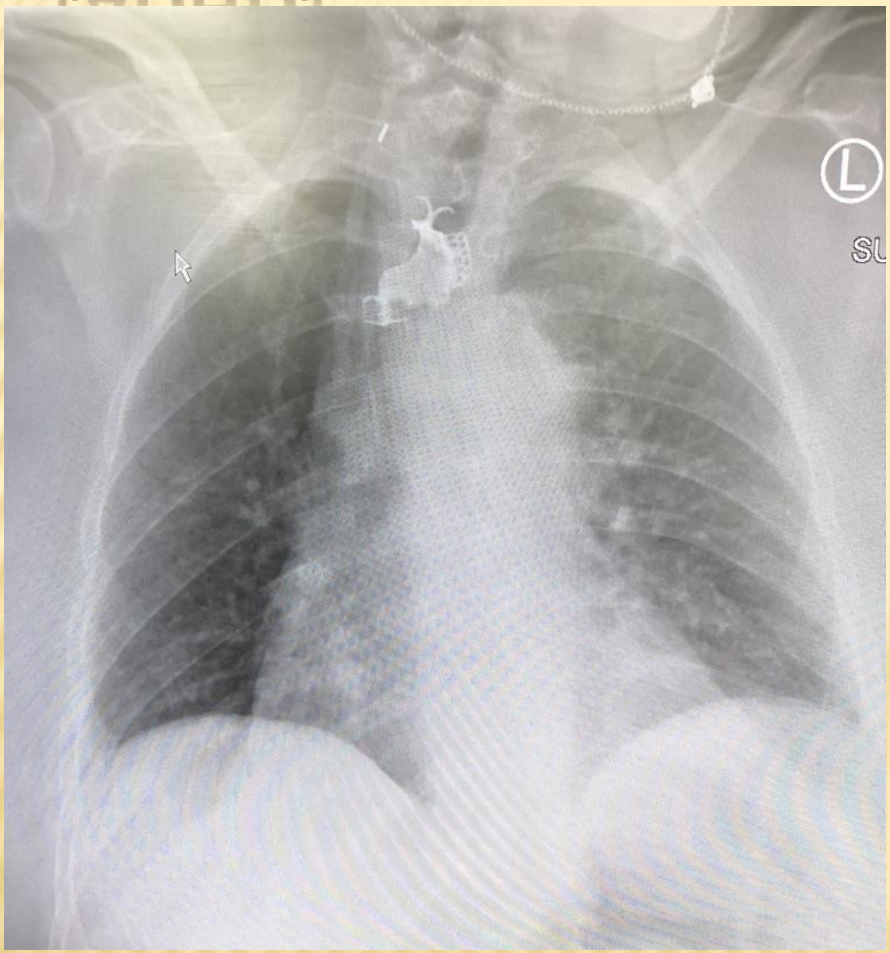
- The mouth
- Spittoon & suction apparatus
- Gauze swabs
- On the ground
- In patient's clothes
- **Ingestion or Aspiration**
- Maintain O2 saturation
- Referral to hospital
- Chest x-ray /CT
- Laryngobronchoscopy/GA
- Rarely Open Thorocotomy

TOOTH INGESTION OR ASPIRATION





DENTURE DISLOGED INTO RIGHT BRONCHUS (ADHD)



NERVE INJURIES

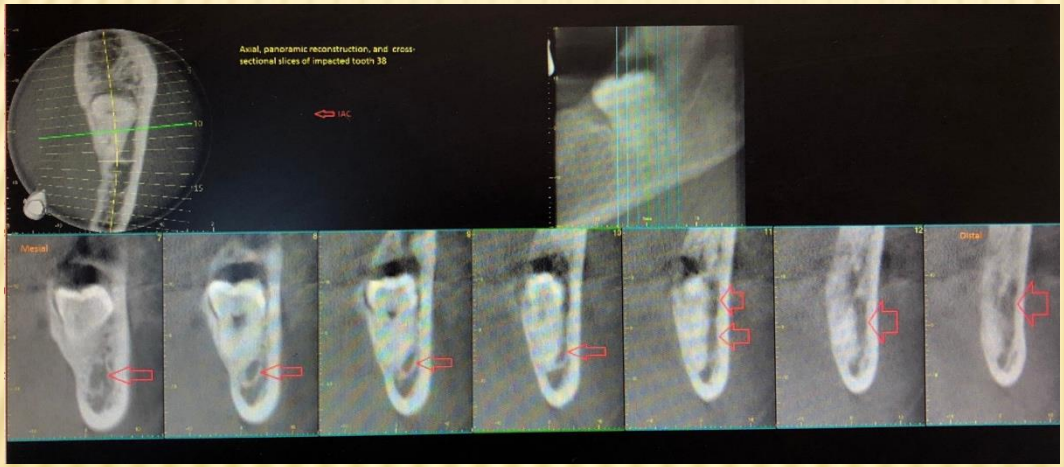
- Incidence of inferior alveolar nerve injuries for removal of third molars ranges from 0.5% to 5%.

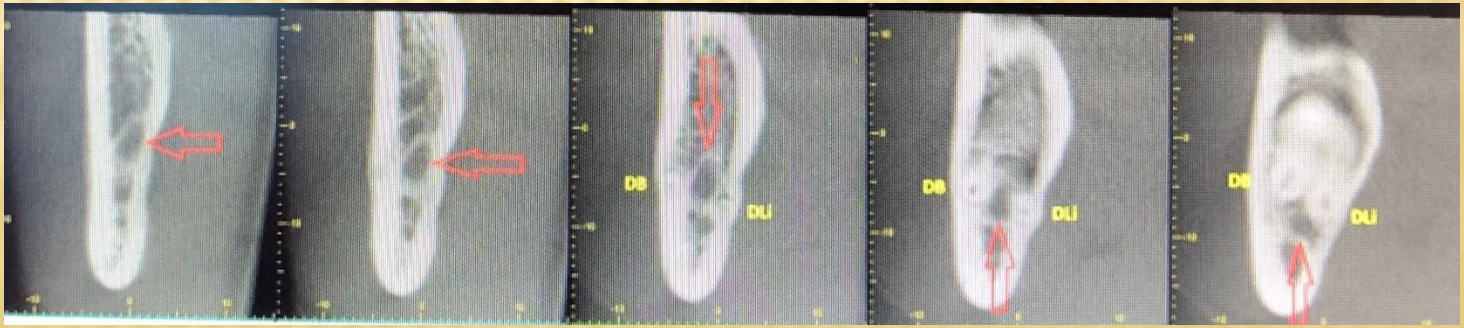
- Permanent nerve damage is < 1%.

- Incidence of lingual nerve injuries range from 0.02% to 0.06%

Renton T , McGurk M:BJOMS:2001:39:423-8.
Roger A Mayer, Shahrokh Bagheri:2011:Atlas OMF Surg Clin N Am:63-78.


Axial, panoramic reconstruction, and cross-sectional slices of impacted 38
IAC
Mesial
MLi
MB
DB
DLi
Distal
Axial, panoramic reconstruction, and cross-sectional slices of impacted 48 (mesial roots)
IMC
Distal
Mesial

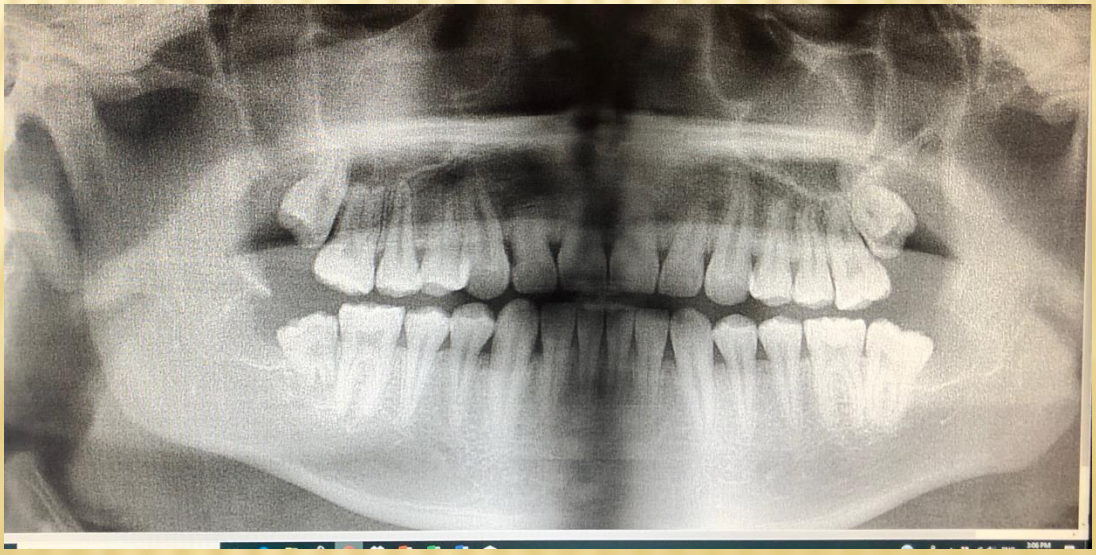

Axial, panoramic reconstruction, and cross-sectional slices of impacted tooth 38
IAC
Mesial
Distal


DB
DLi
DB
DLi
DB
DLi

LUXATION OR EXTRACTION OF THE WRONG TOOTH

- Management:
  - Carful examination and manipulation avoids this dilemma
  - Fixation of the luxated tooth
  - Immediate replantation if the wrong tooth is extracted
  - Incident has to be documented and pt has to be informed
  - Discuss the issue with the orthodontist if the extraction was for orthodontic purposes

INADVERTENT EXTRACTION



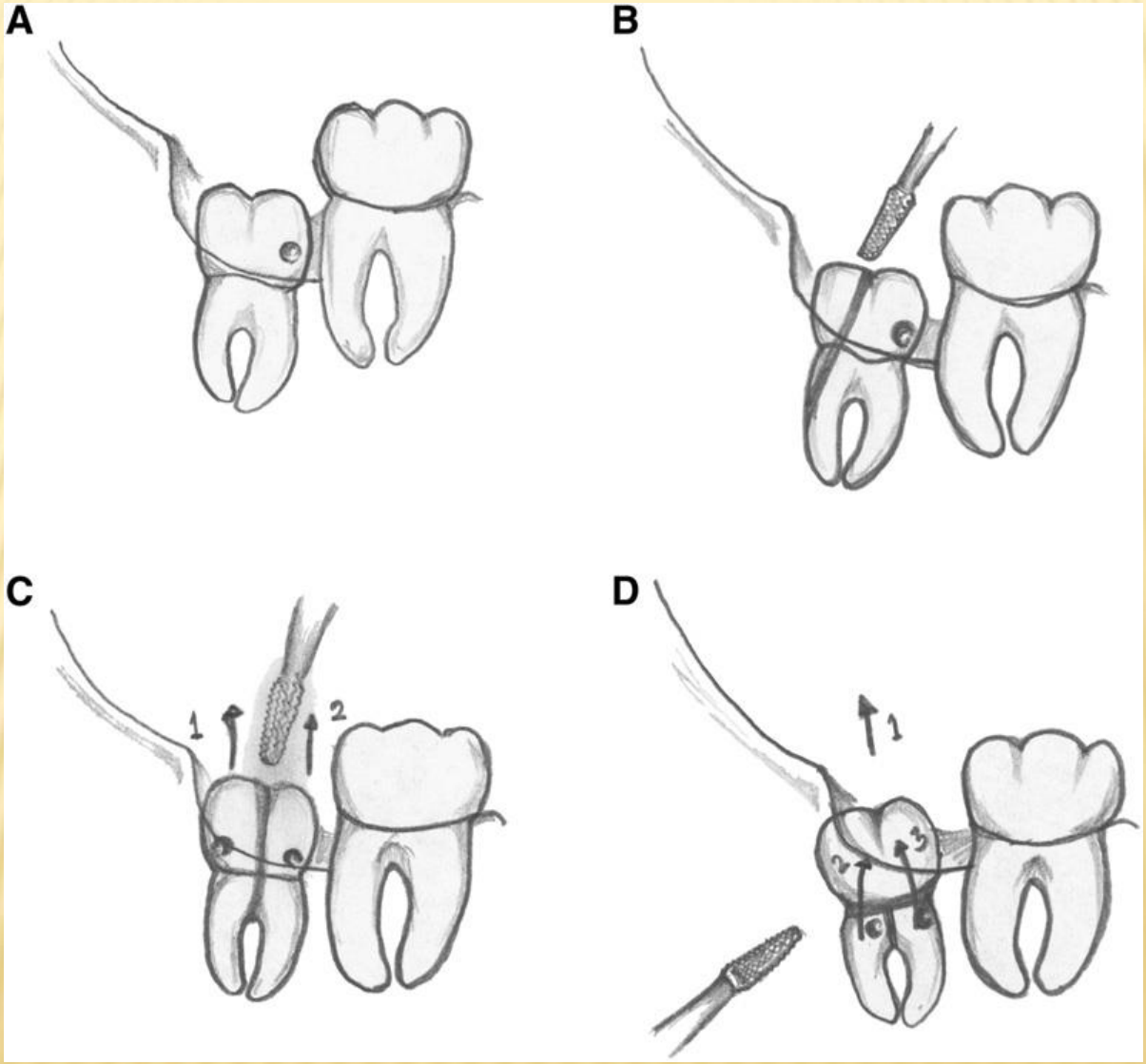
SUMMARY

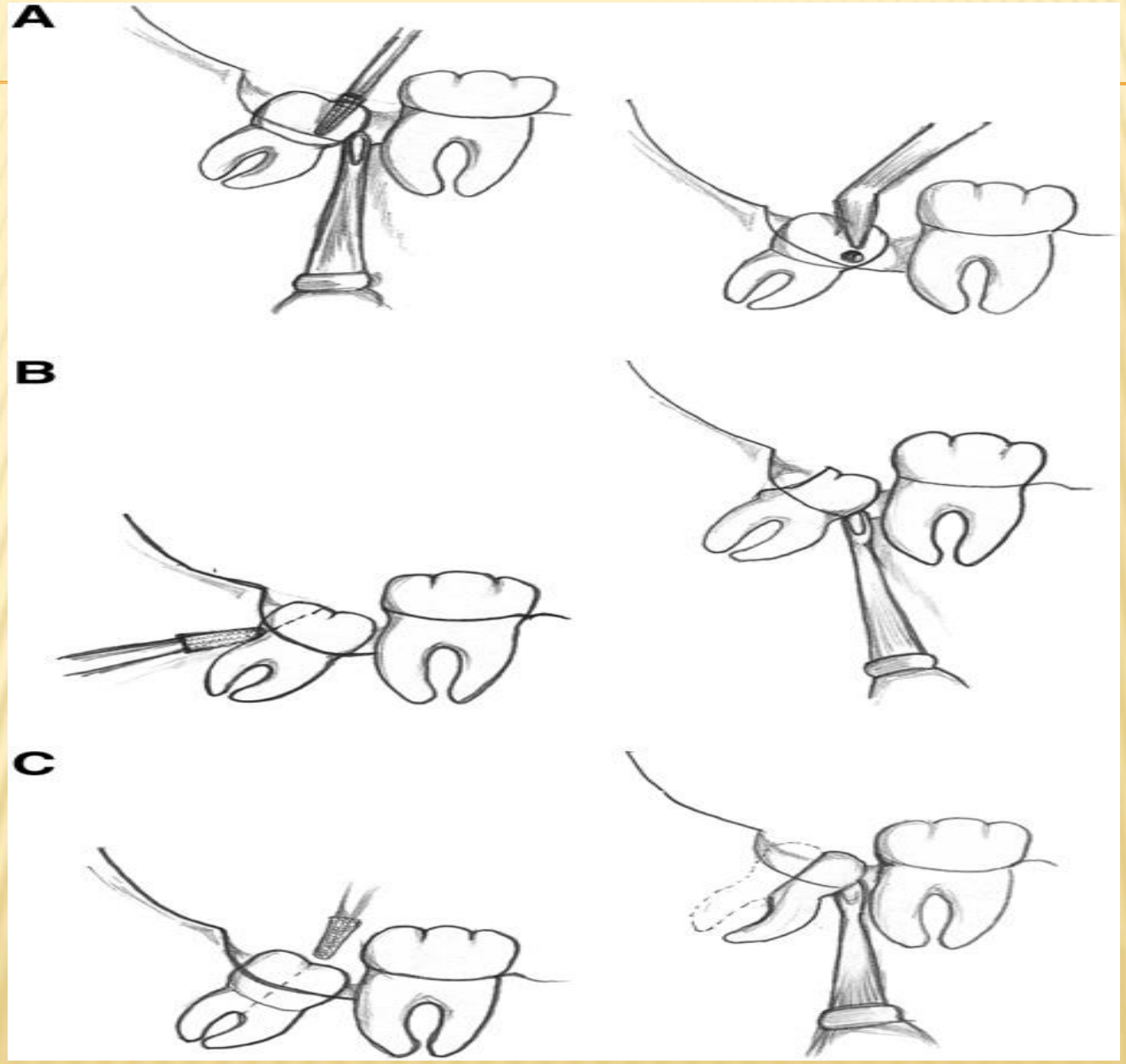
- Identify and assess the risk factors along with difficulty index.
- Minor surgical sequel
- Major complications
- Informed Consent
- Take appropriate treatment measures to prevent complications
- Identify the complications and manage accordingly.

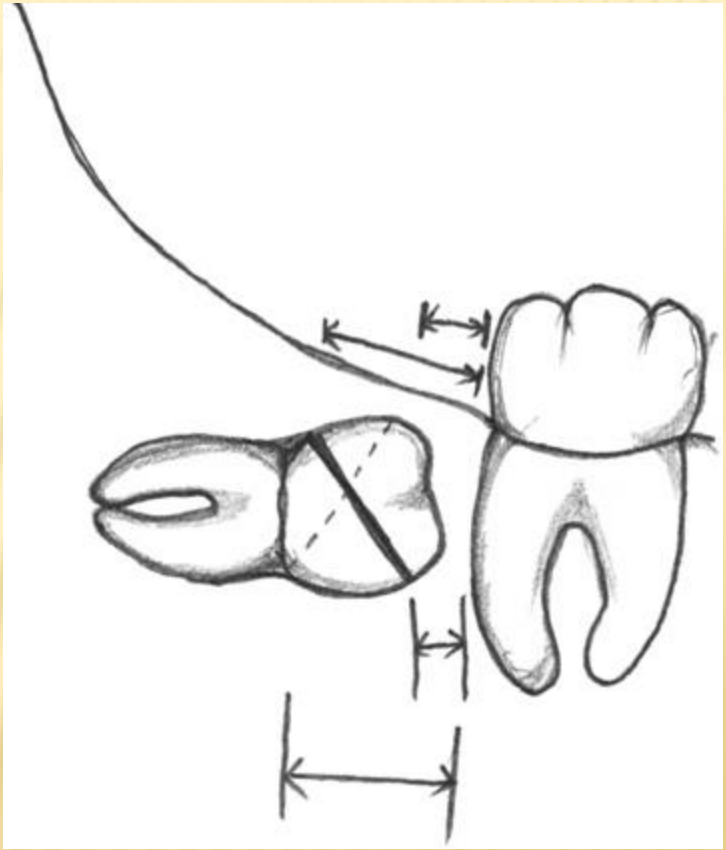
REFERENCES

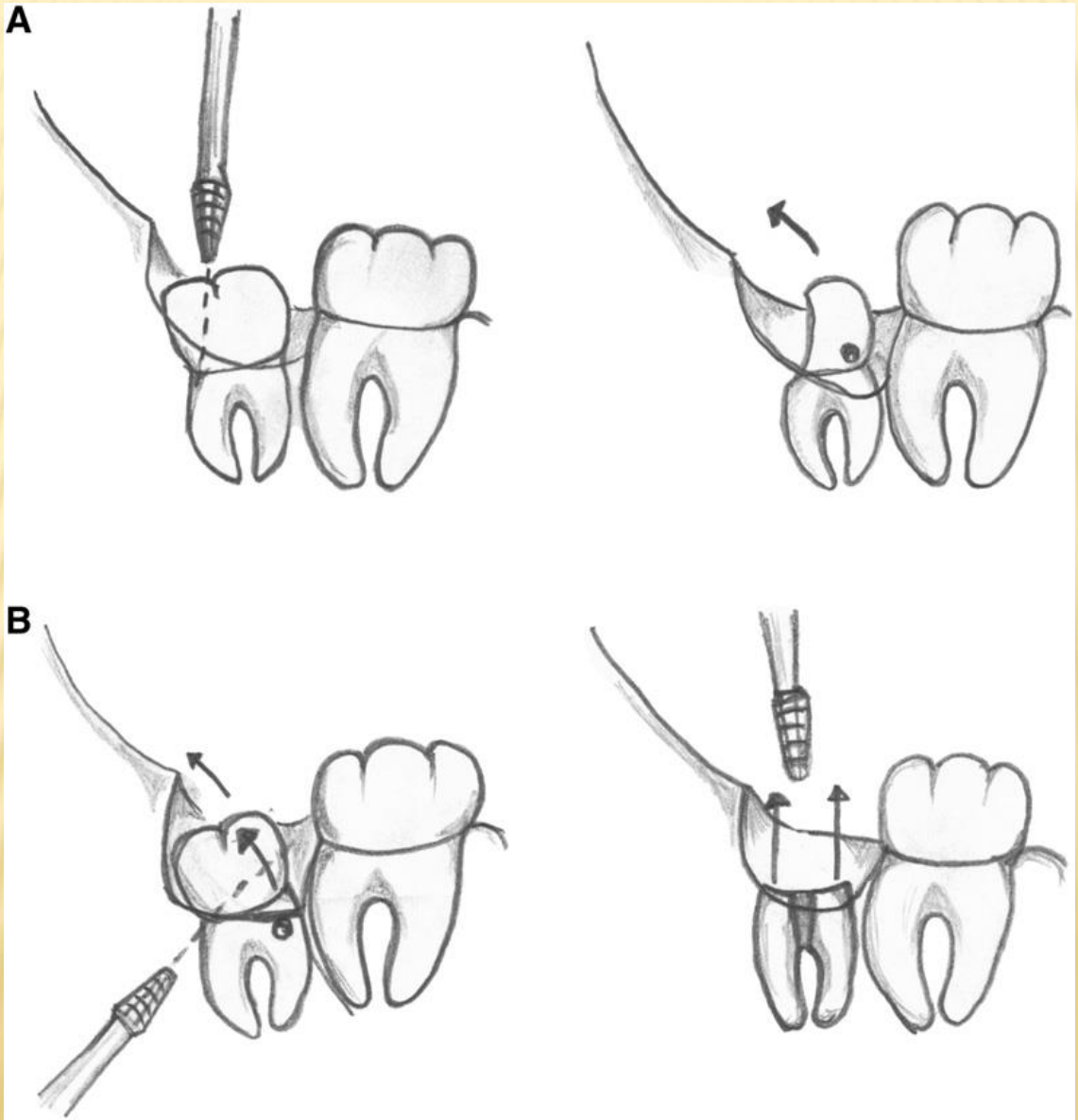
- Third molar Removal:An Overview of Indications ,Imaging , Evaluation and Assessment of Risk:Robert Marciacini:Oral Maxillofacial Surg Clin of North Am:2007
- Nerve Injuries from Madibular third Molar Removal:Roger. A. Meyer, Shahrukh Bagheri:Atlas of Oral Maxillofacial Surg Clin of North Am:2011
- Nerve Injuries after third Molar Removal:Vincent Ziccardi, John Zuniga:Oral Maxillofacail Clin of N Am;2007
- Third Molar Surgery and Associated Complications;Srinvas Susrala, Daniel Magalnick:Oral and Maxillofacial Surg Clin of N Am:2003
- Complications of Third Molar Surgery:Gary Bouloux,Martin Steed:Oral and Maxillfacial Surg N Am:2007

TOOTH SECTIONING




A
B
C




A
B