Tooth Impaction
"Distortion in Dental Anatomy: An Atlas"

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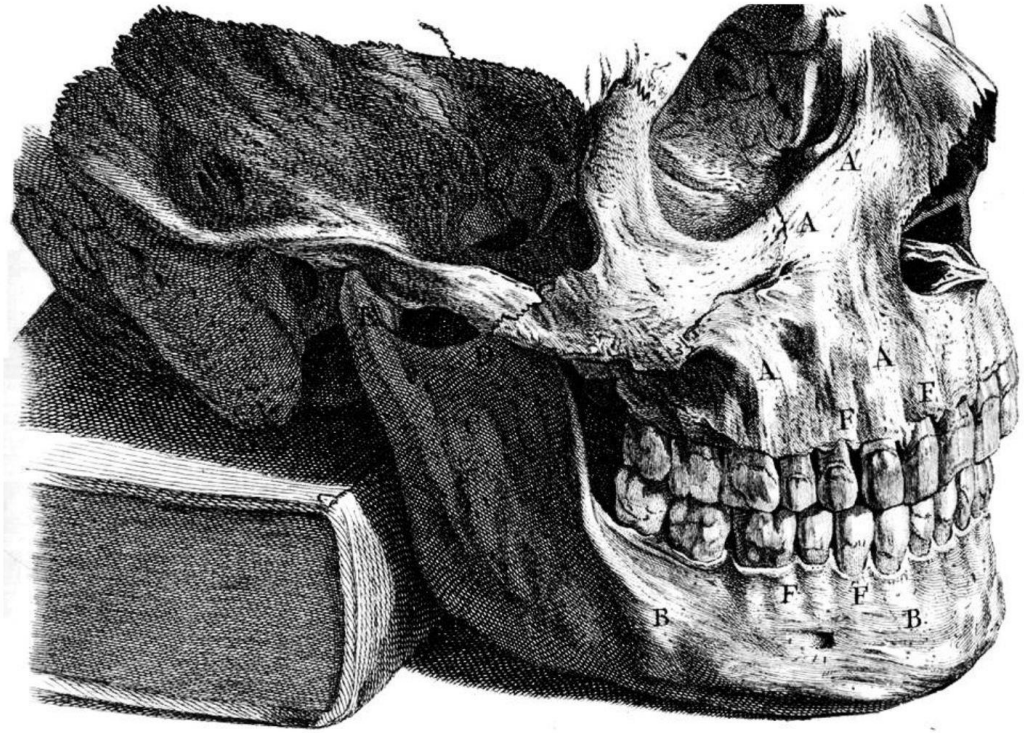
Vasilios K. Thomaidis



Editions Saint George Volos 2019

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To my family

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Preface

Tooth impaction is the condition in which a tooth has failed to erupt, partially or completely, to it's correct position in the dental arch. It is a very common condition. Impaction of the third molar (wisdom tooth) occurs in up to 73% of young adults in Europe[1]. It could be said that wisdom tooth impaction is the rule and not the exception.

While many theories (Mendelian, Phylogenic, Orthodontic, Insufficient Space Development) have been proposed to explain tooth impaction, the mechanism and causes are still not clearly understood.

Impacted teeth are often associated with clinical manifestations (e.g. facial pain and swelling, head and neck abscesses, lymphadenopathy) that concern not just dentists but many medical specialties as well.

The purpose of this atlas is to familiarize both dental and medical students with concepts that are frequent in clinical practice and yet not demonstrated enough in Anatomy.

I would like to thank my colleagues from the laboratory of Anatomy, Prof A. Fiska (Director) and Dr. G. Tsoukalas (Lecturer) for their unyielding aid in the completion of this manuscript. I would also like to thank my assistant A. Alexandrou, who assisted me in the operations presented in this book. Finally, I wish to thank E. Tsoukala and A. Vasilopoulos, medical students, for their help in the preparation of this book.

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Maxillofacial Surgeon

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[1] Elsey MJ, Rock WP. *Influence of orthodontic treatment on development of third molars*. Br J Oral Maxillofac Surg. 2000 Aug;38(4):350-3

Contents

CAUSES

A. LOCAL FACTORS

- Inadequate space to erupt
- Obstruction of the eruption path (e.g. cysts, odontomas, supernumerary teeth)
- Ankylosis of primary or permanent tooth
- Nonabsorbtion, over retained tooth
- Nonabsorbtion of a dense alveolar bone
- Ectopic position of the tooth bud
- Root dilacerations

B. SYSTEMIC FACTORS

- Heredity factors
- Systemic diseases (e.g. tuberculosis, anaemia)
- Endocrine disorders (i.e. thyroid, parathyroid, and pituitary gland
- Systemic conditions and syndromes (e.g. cleidocranial dysostosis, osteogenesis imperfecta)
- Cleft lip and palate deformities

CLINICAL MANIFESTATIONS

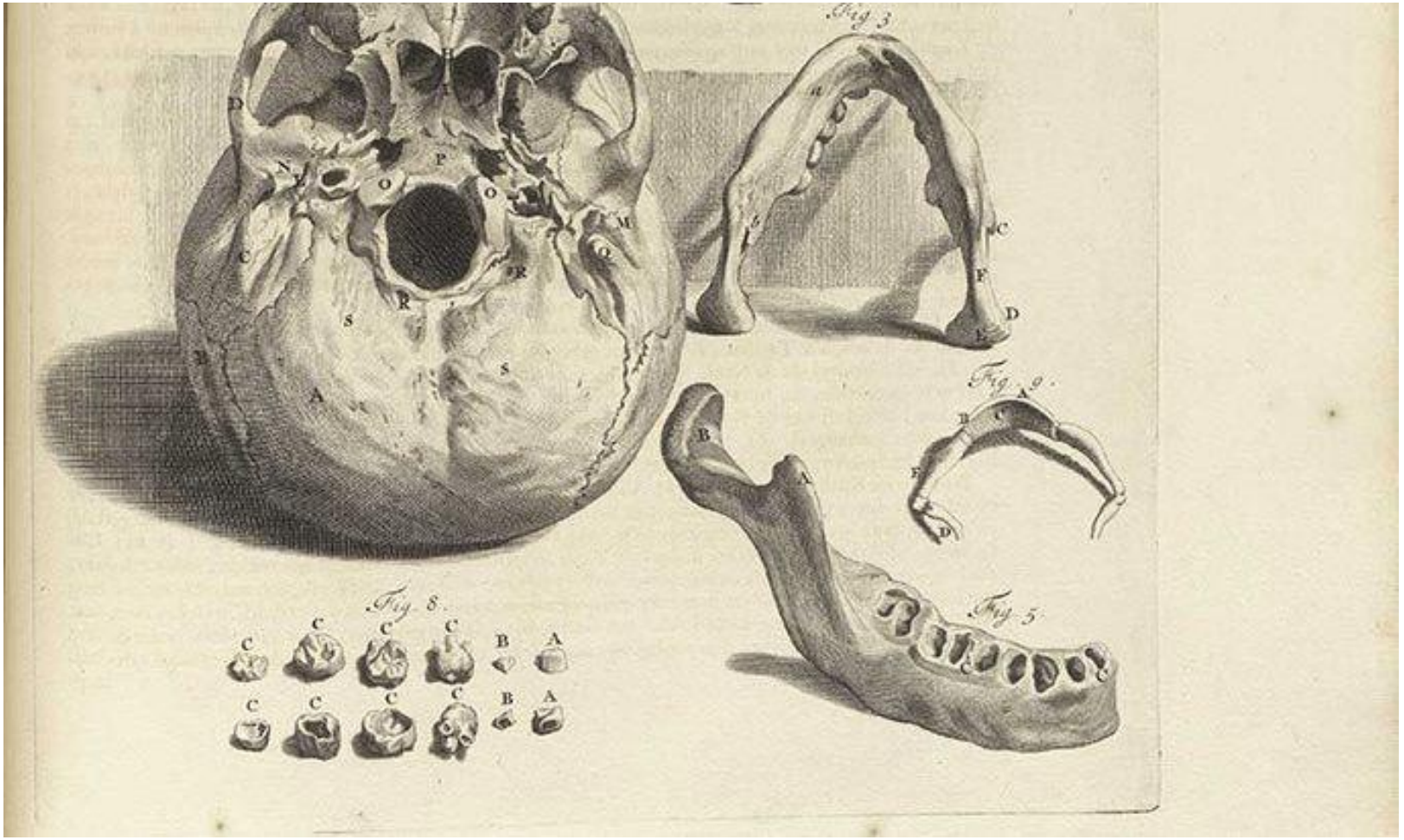
Pain
Headache
Fever
Abscess
Trismus
Paresthesia
Regional lymphadenopathy

COMMONLY IMPACTED TEETH IN ORDER OF FREQUENCY

Mandibular 3rd molar
Maxillary 3rd molar
Maxillary canine
Mandibular premolar
Maxillary premolar
Mandibular canine
Maxillary central incisor
Maxillary lateral incisor

Third molars (wisdom teeth) are most commonly impacted because they are the last teeth to erupt in the dental arch.

Impaction of Mandibular Teeth



Mandibular 3rd Molar Impaction

Classification

Impacted third molars are classified according to their inclination to the longitudinal anatomic axis (Winter's classification [1]) as:

1. Mesioangular Impacted
2. Distoangular Impacted
3. Horizontal/Transverse Impacted
4. Vertical/Inverted Impacted
5. Buccoangular Impacted
6. Linguoangular Impacted

1. Winter, GB. *Impacted Mandibular Third Molar*. St Louis, American Medical Book Co., 1926.

Mesioangular Impaction

The mandibular right impacted 3rd molar lies in a mesioangular position.

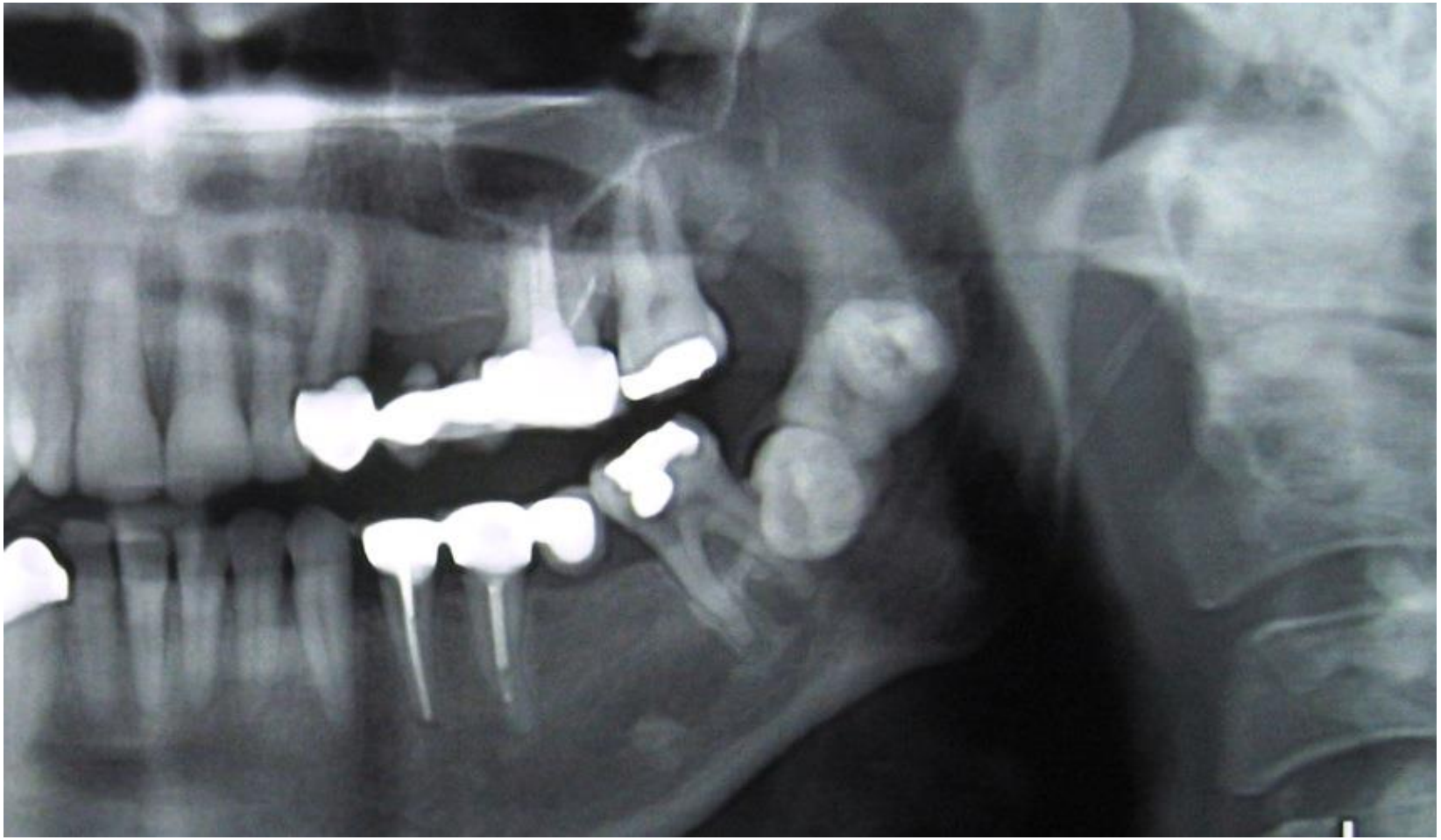
Distoangular Impaction

The mandibular left impacted 3rd molar is orientated in a distoangular position.

Horizontal Impaction

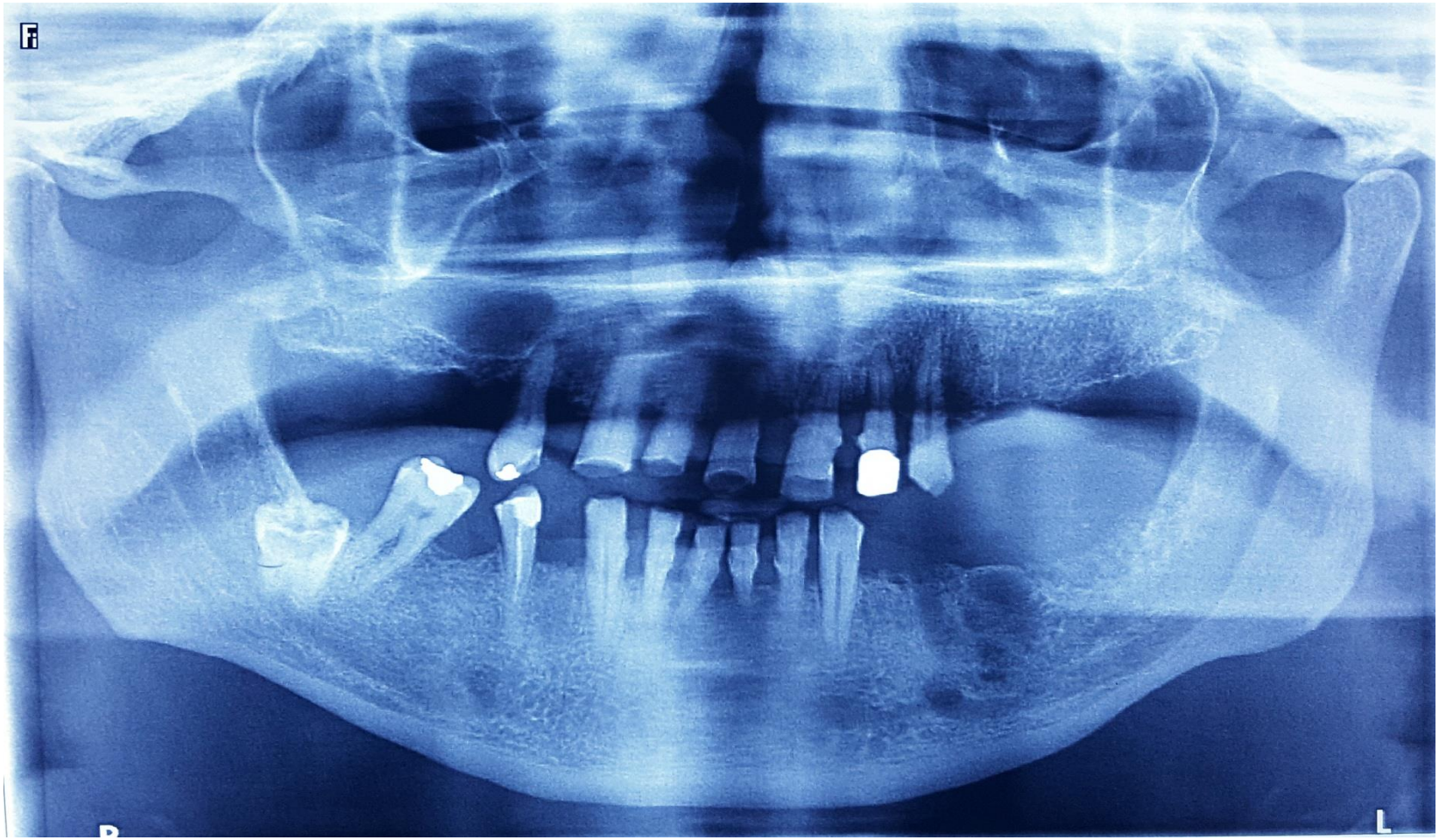
Both mandibular 3rd molars are impacted horizontally. According to the relation of the crowns between the 3rd and 2nd molars, the condition on the right side is known as *"crown to crown" impaction* whereas at the left side as *"crown to cervix" impaction.*

Transverse Impaction



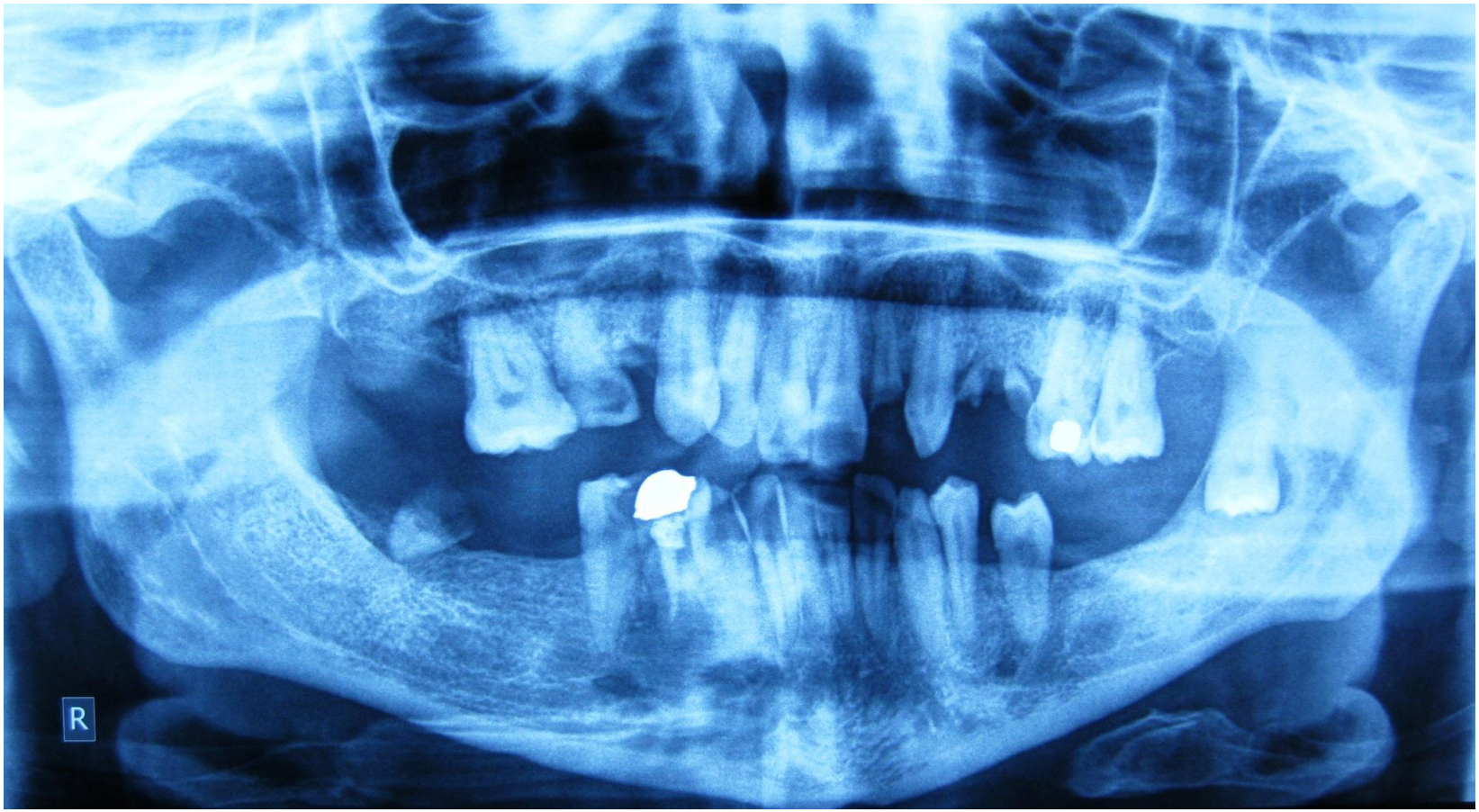
Transverse impaction of 3rd and 2nd left molars.

Vertical Impaction



The lower right 3rd molar is vertically impacted into the mandibular bone.

Inverted Impaction

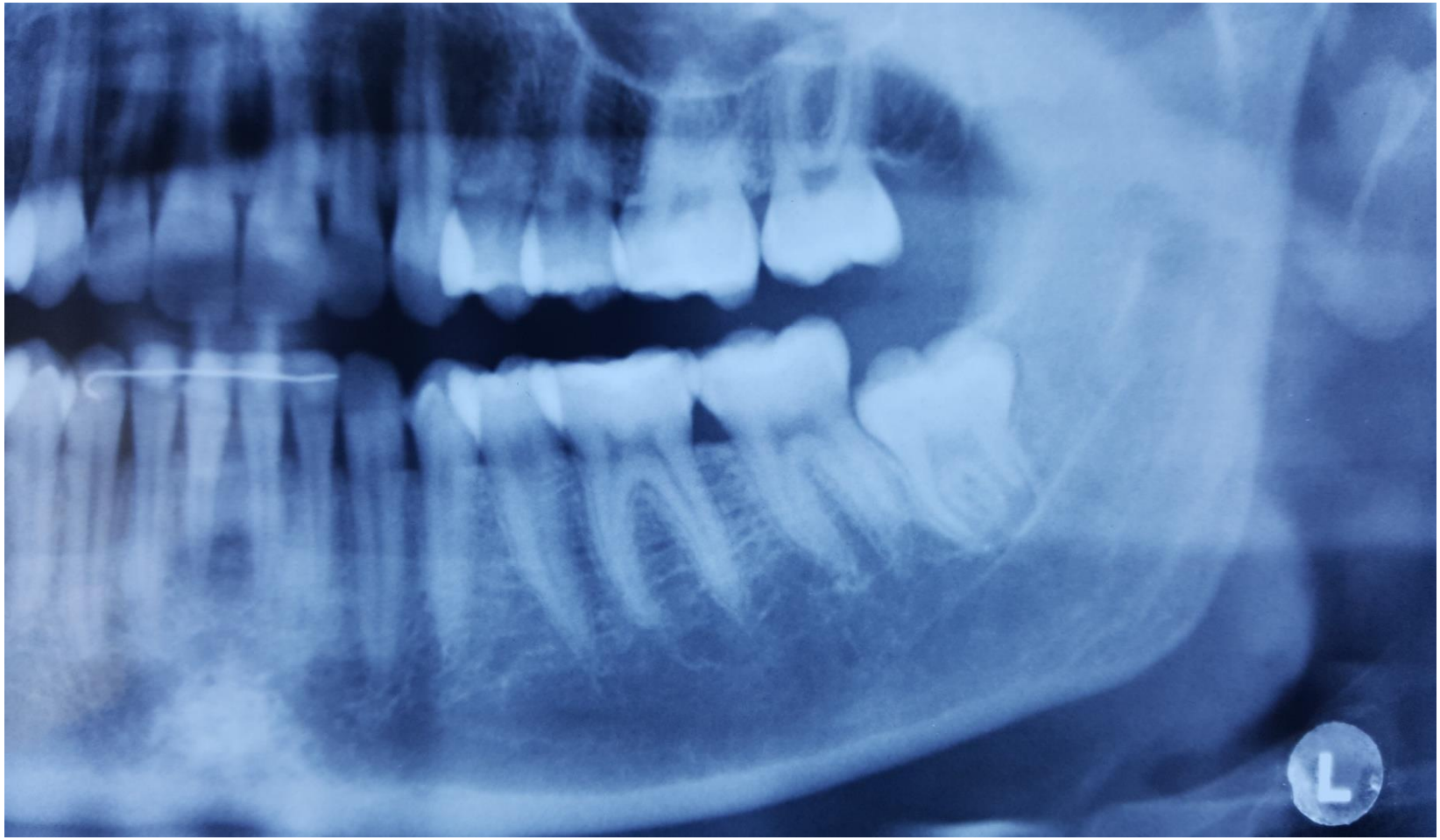


An inverted and impacted left mandibular 3rd molar.

Buccoangular Impaction

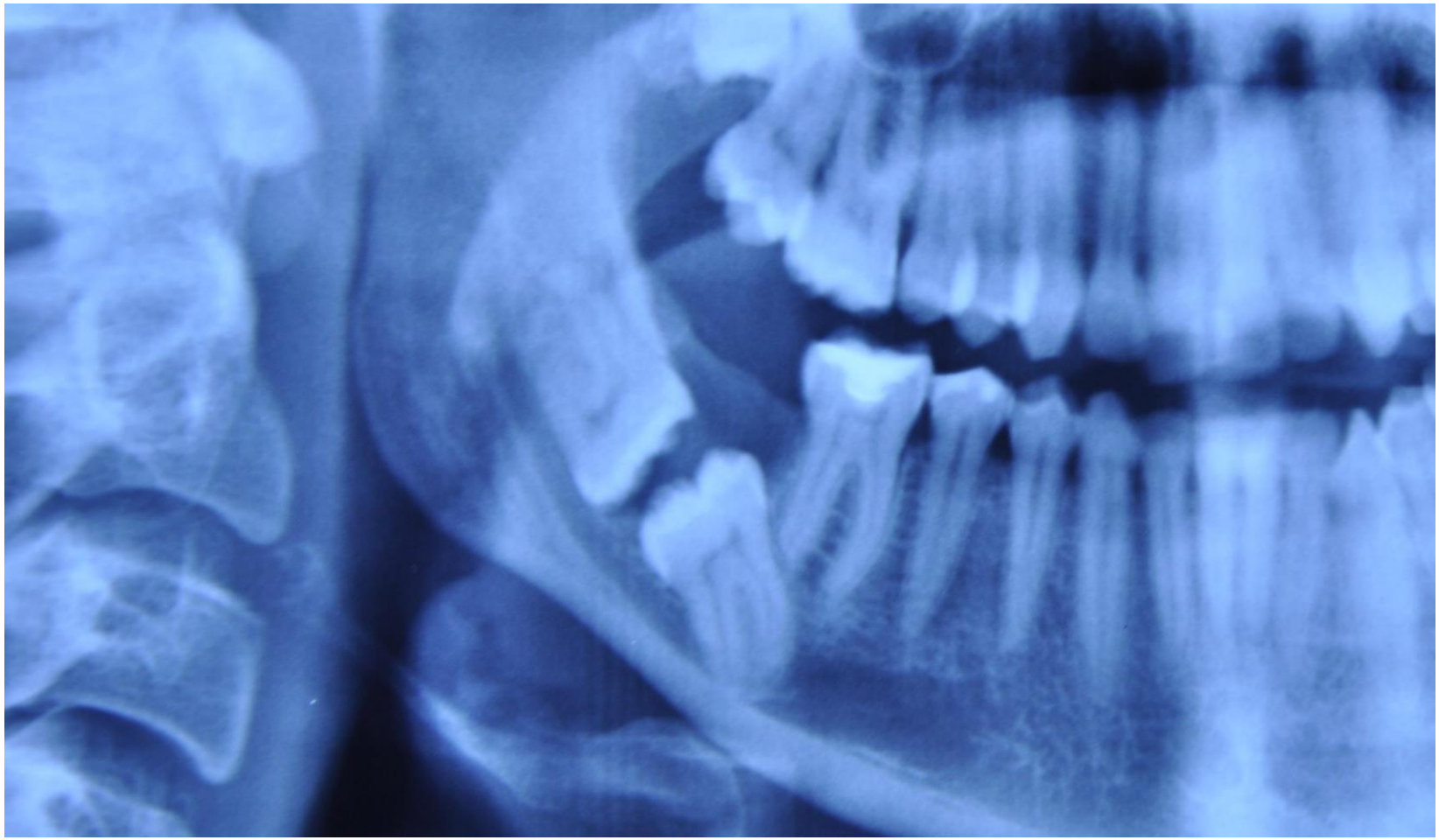
The impacted mandibular left 3rd molar lies in a position with it's crown facing buccally.

Linguoangular Impaction



The impacted mandibular left 3rd molar lies in a position with it's crown facing lingually.

"Kissing molars"

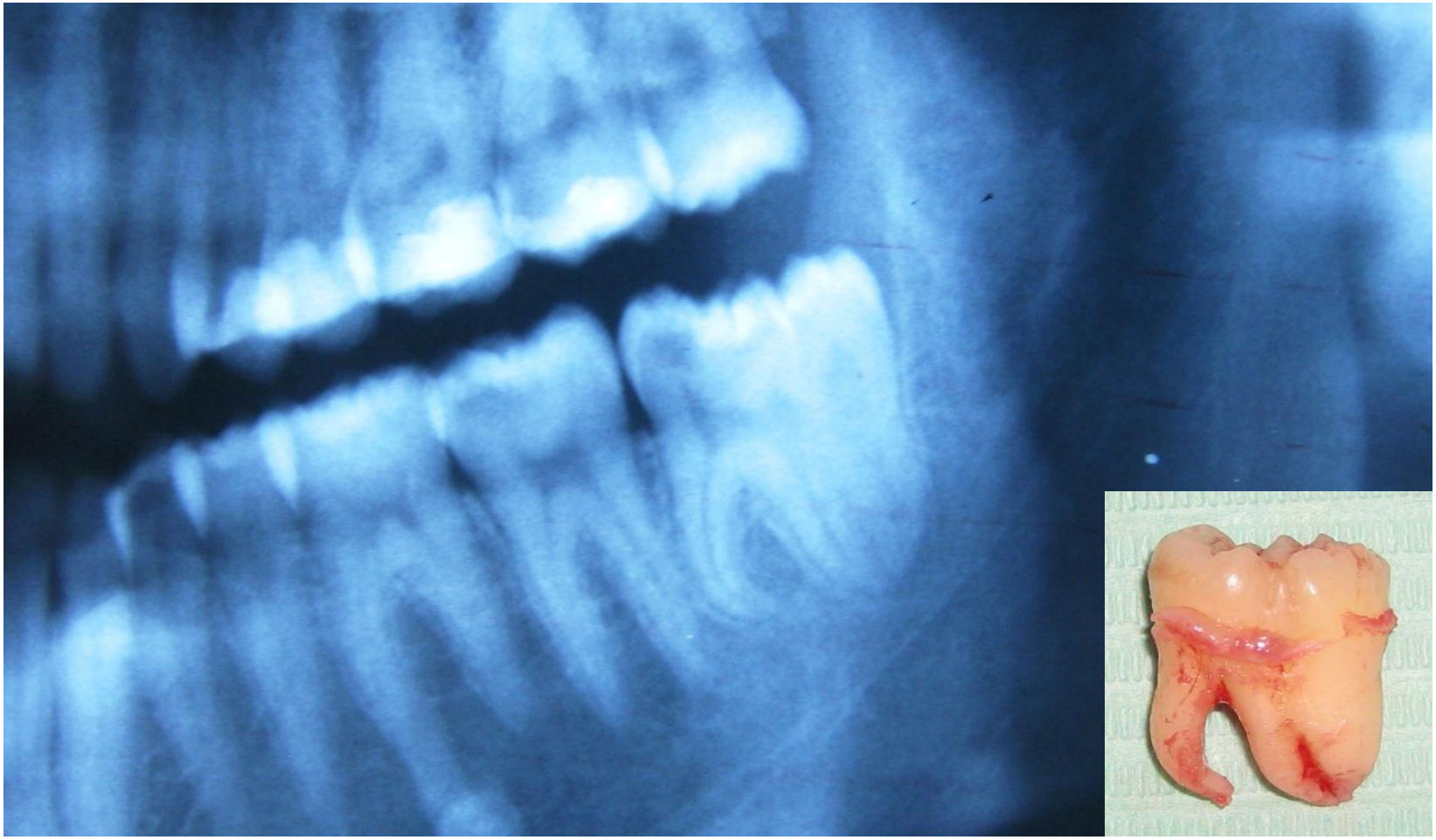


Kissing molars or rosette formation is a very rare form of impaction, where the 3rd and 2nd impacted molars are orientated with their occlusal surfaces contacting each other, within a single dental follicle, and roots pointing in opposite directions.

Underdeveloped Distal Root

A rare case of bilaterally impacted 3rd mandibular molars where the distal root is underdeveloped in both of them.

Molar Fusion



The impacted left 3rd mandibular molar is fused with the adjacent 2nd molar.

***Tooth fusion*:** a rare developmental anomaly of the shape of the tooth, characterized by the union of two adjacent teeth.

Distomolar

An impacted upper left distomolar.

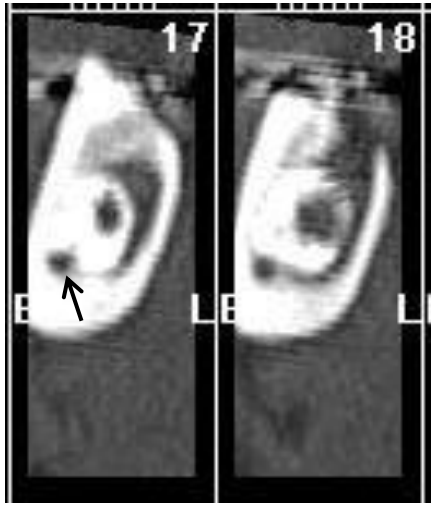
Distomolar: a supernumerary fourth molar distal to the third one.

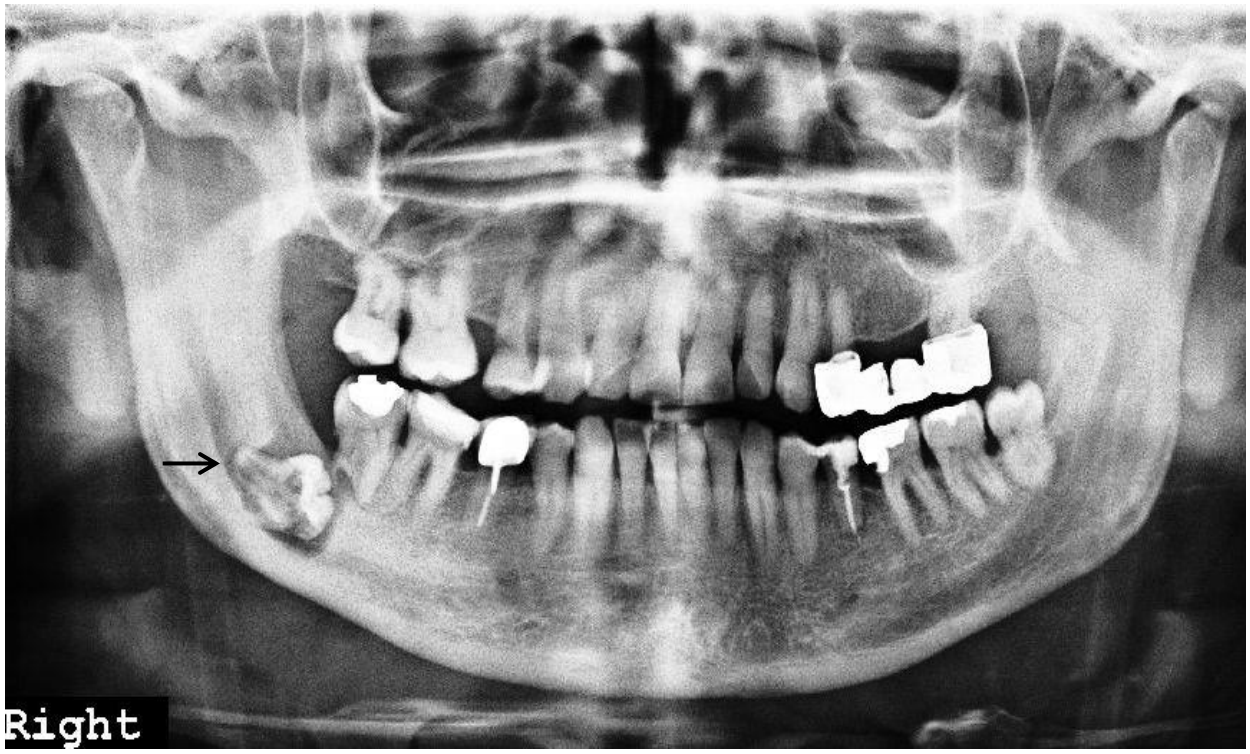
Anatomical relationship of impacted mandibular 3rd molars and the mandibular neurovascular bundle

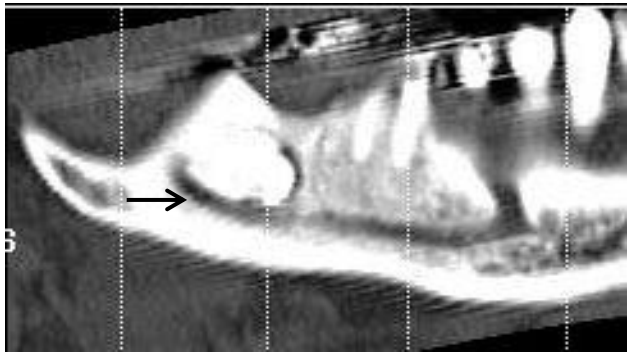
The roots of the third mandibular molars are in close proximity to the mandibular neurovascular bundle. In some cases, the roots of the third mandibular molars contact or penetrate into the mandibular canal. Other times, the roots overlap the mandibular canal or they are deflected over the roof of the canal. Pressure of the roots on the inferior alveolar nerve may cause pain which could radiate to the ear.

Assessment of the anatomical position of the impacted third molar in relation to the mandibular canal is mandatory in the event of surgical removal of third molars, so as to decrease the risk of nerve injury.

Relationship of the Mandibular Canal with Impacted 3rd Molars

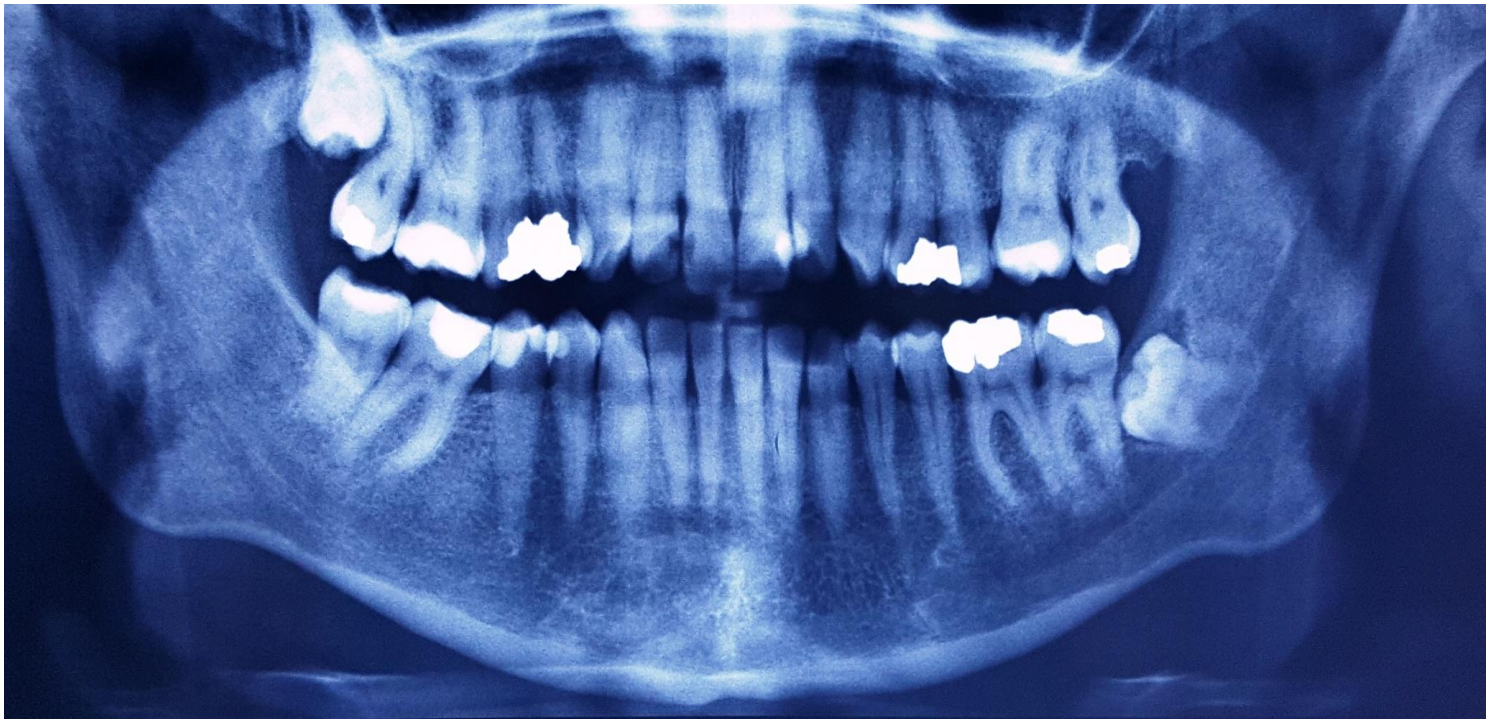


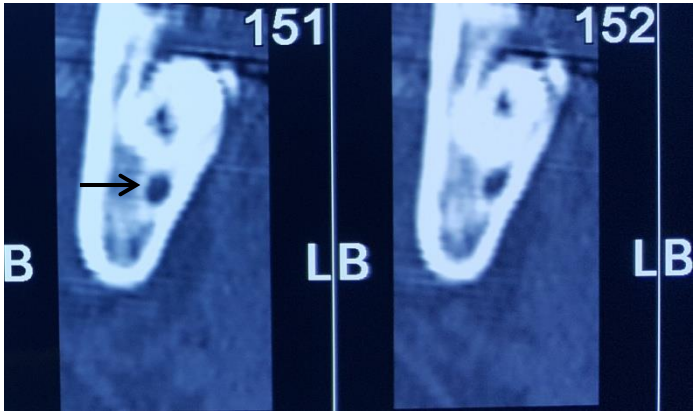




The entire impacted right 3rd molar lies on the mandibular canal (arrows).

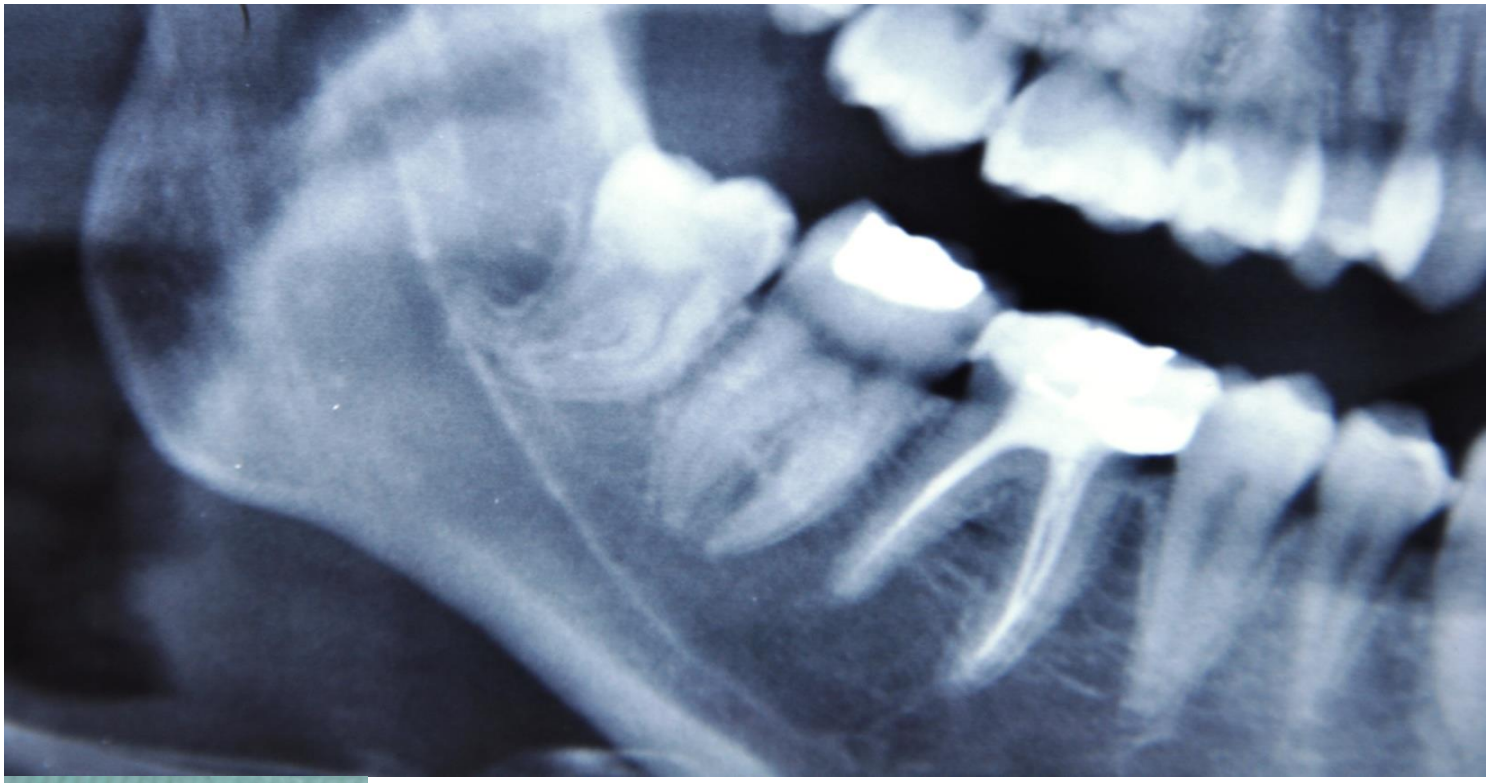
Relationship of the Mandibular Canal with Impacted 3rd Molars





The root of the left 3rd molar lies in direct contact with the mandibular canal (arrows).

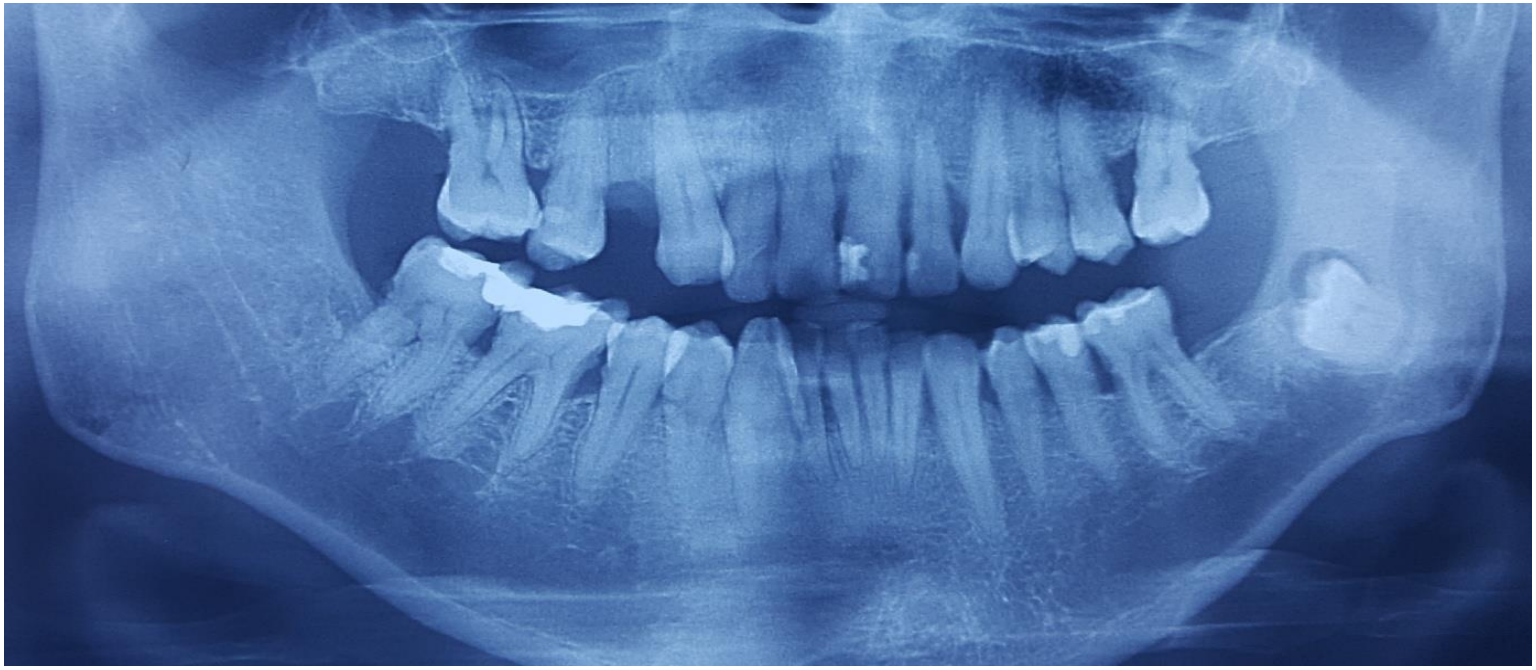
Relationship of the Mandibular Canal with Impacted 3rd Molars

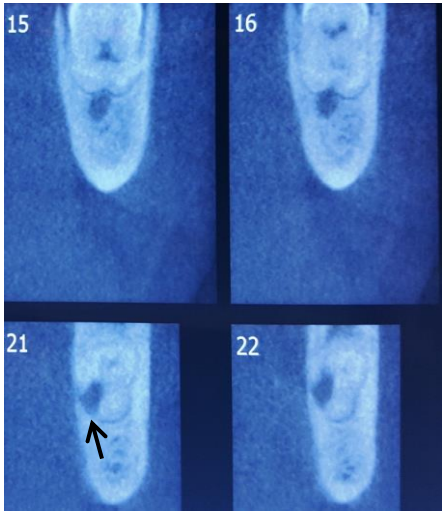


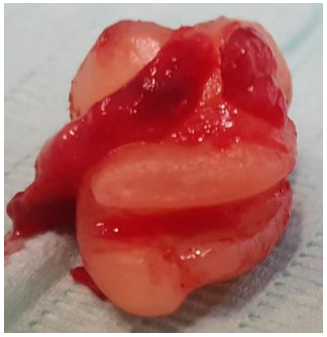
Dilaceration of the root of an impacted 3rd right molar, positioned in close contact with the mandibular canal.

Dilaceration: angulation or a sharp bent anywhere along the root portion of a tooth.

Relationship of the Mandibular Canal with Impacted 3rd Molars

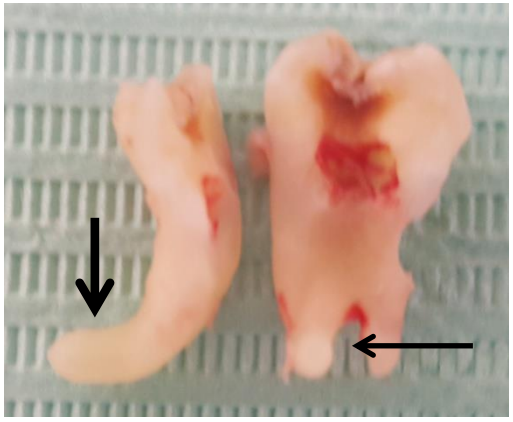






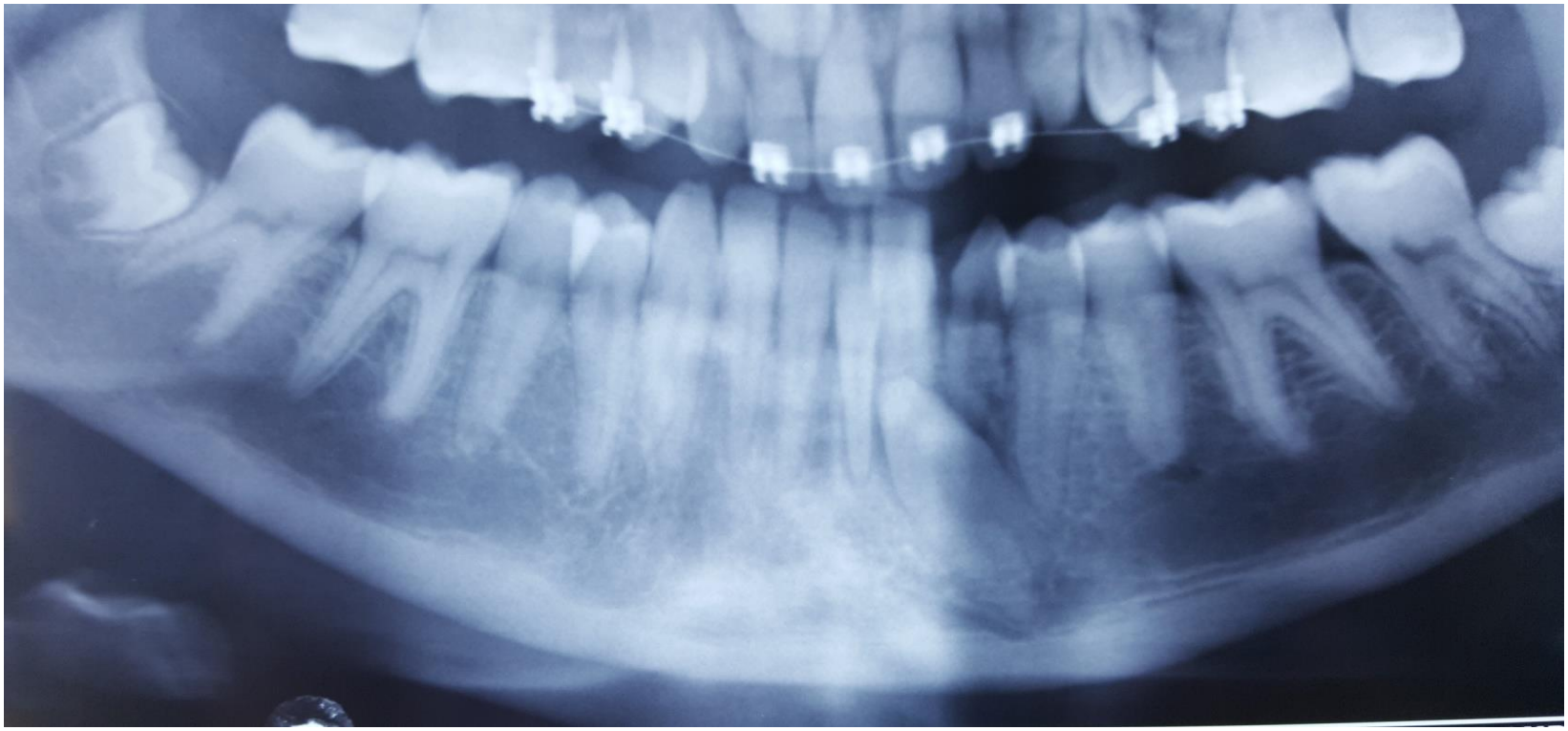
An impacted left 3rd molar where the inferior alveolar bundle runs between its root. The groove between the roots indicates the impression of the mandibular canal.

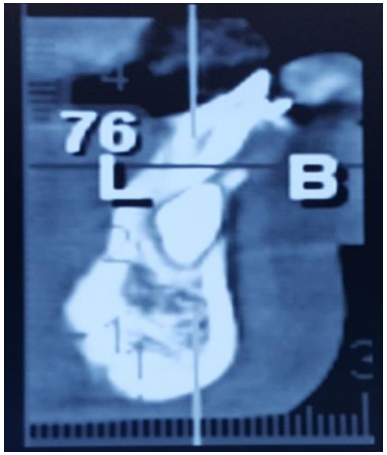
Relationship of the Mandibular Canal with Impacted 3rd Molars



The medial root of the right 3rd molar appears to penetrate the inferior alveolar nerve. In reality, the nerve bundle was running into a hollowed canal at the tip of the root (thin arrow).

The distal root (thick arrow) is deflected over the mandibular canal.

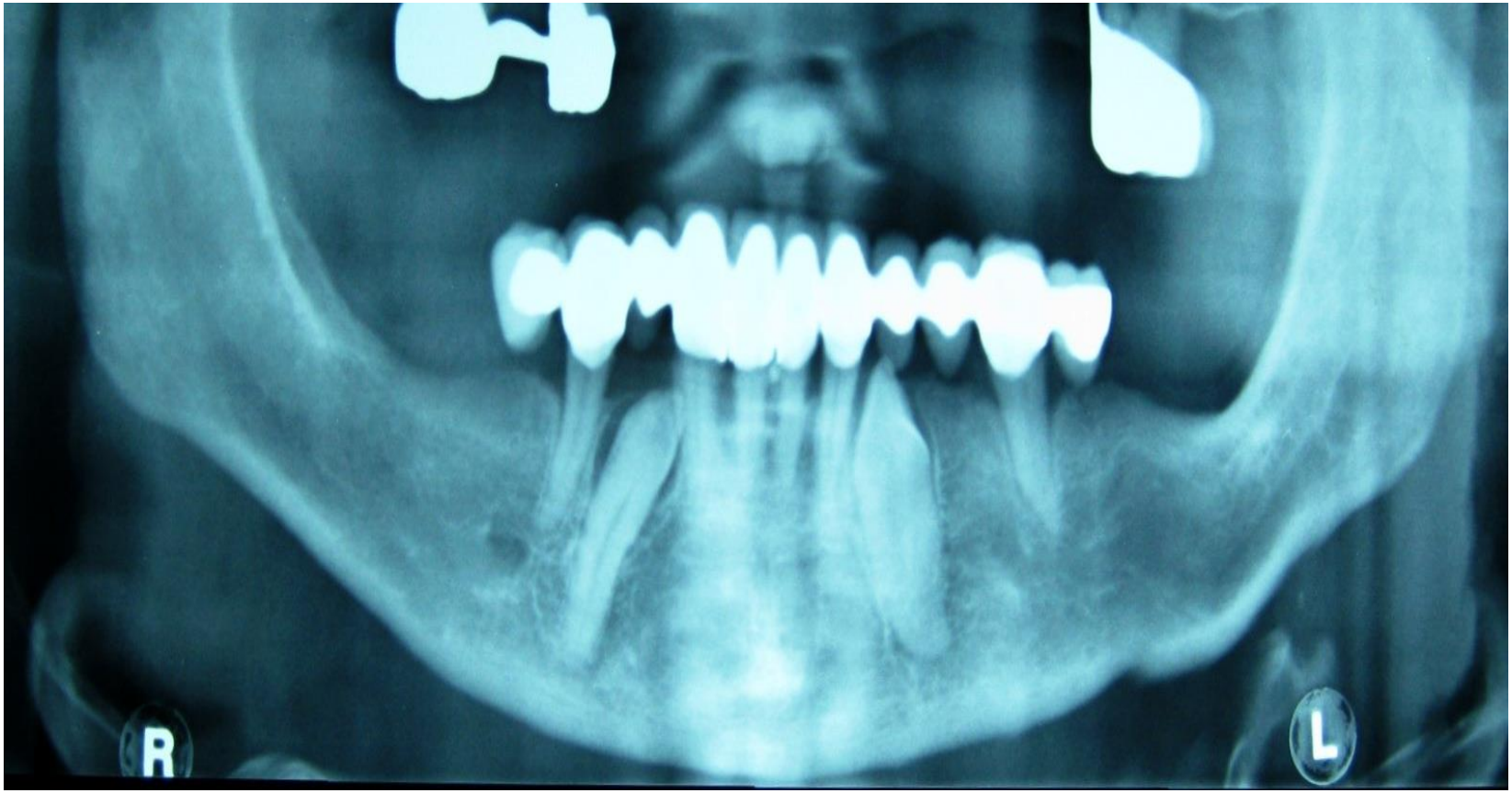




Impaction of the left mandibular canine.

Sagittal CT reveals it's lingual position, just behind the lateral incisor.

Bilateral



Panoramic radiograph demonstrates a case of bilaterally impacted mandibular canines.

Transmigration

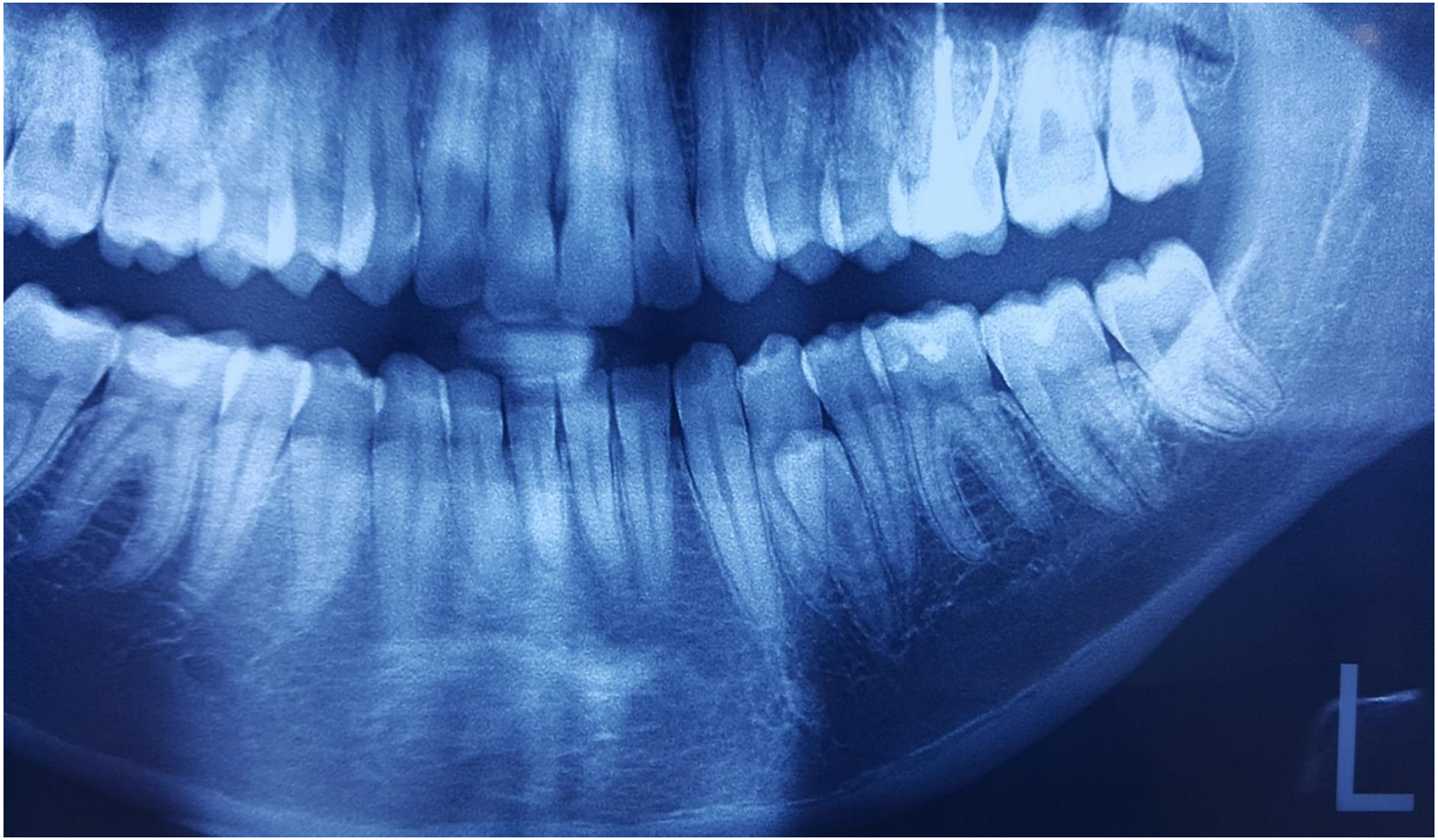
Panoramic radiograph shows the left impacted mandibular canine transmigrating towards the right side.

Transmigration: rare phenomenon seen almost exclusively in the mandibular canine, by which an unerupted canine migrates across the midline.

Transmigration

Both mandibular canines are impacted with the right tooth transmigrating to the left side.

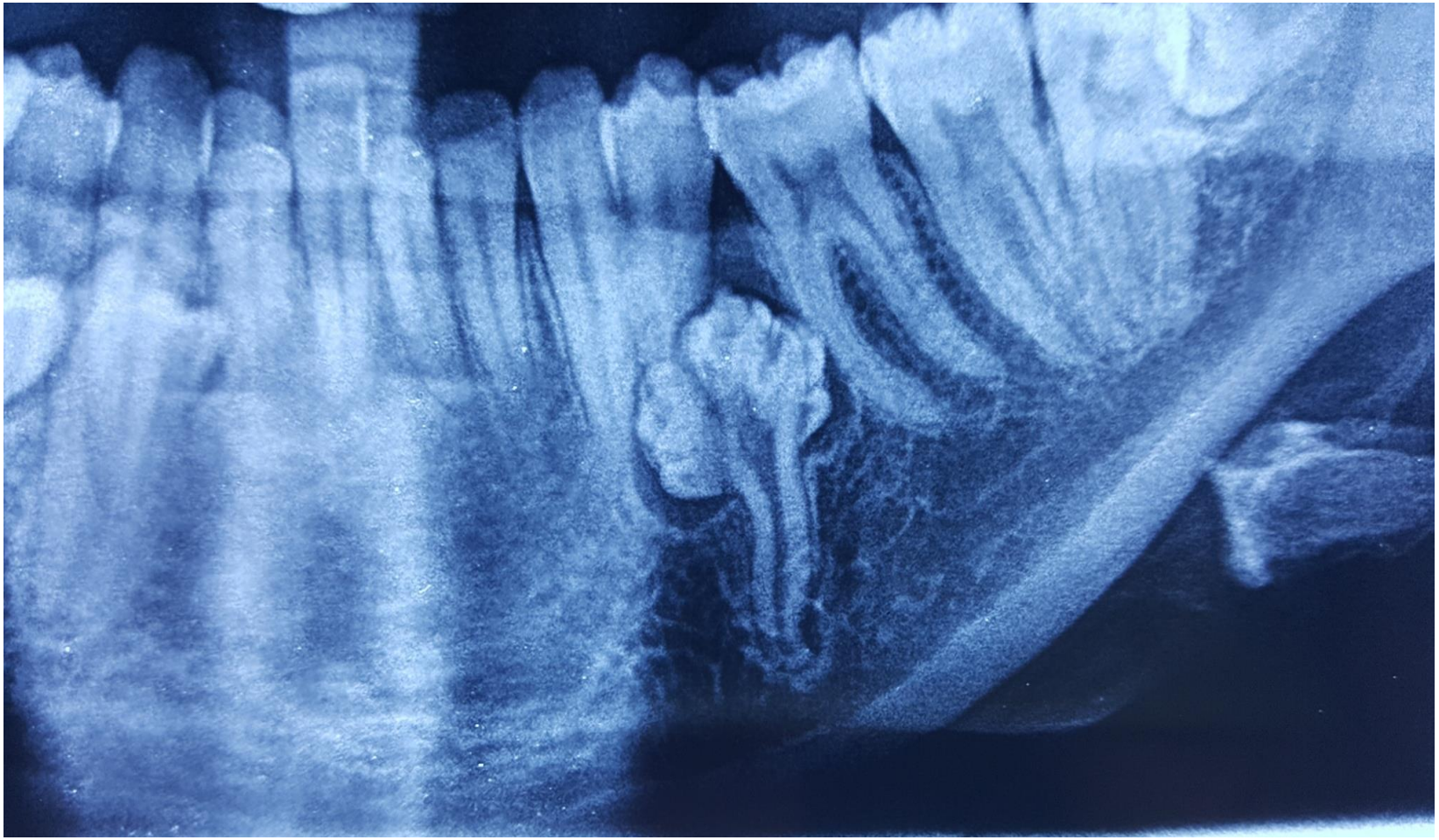
1st premolar impaction



An impacted supernumerary and fully developed left mandibular 1st premolar.

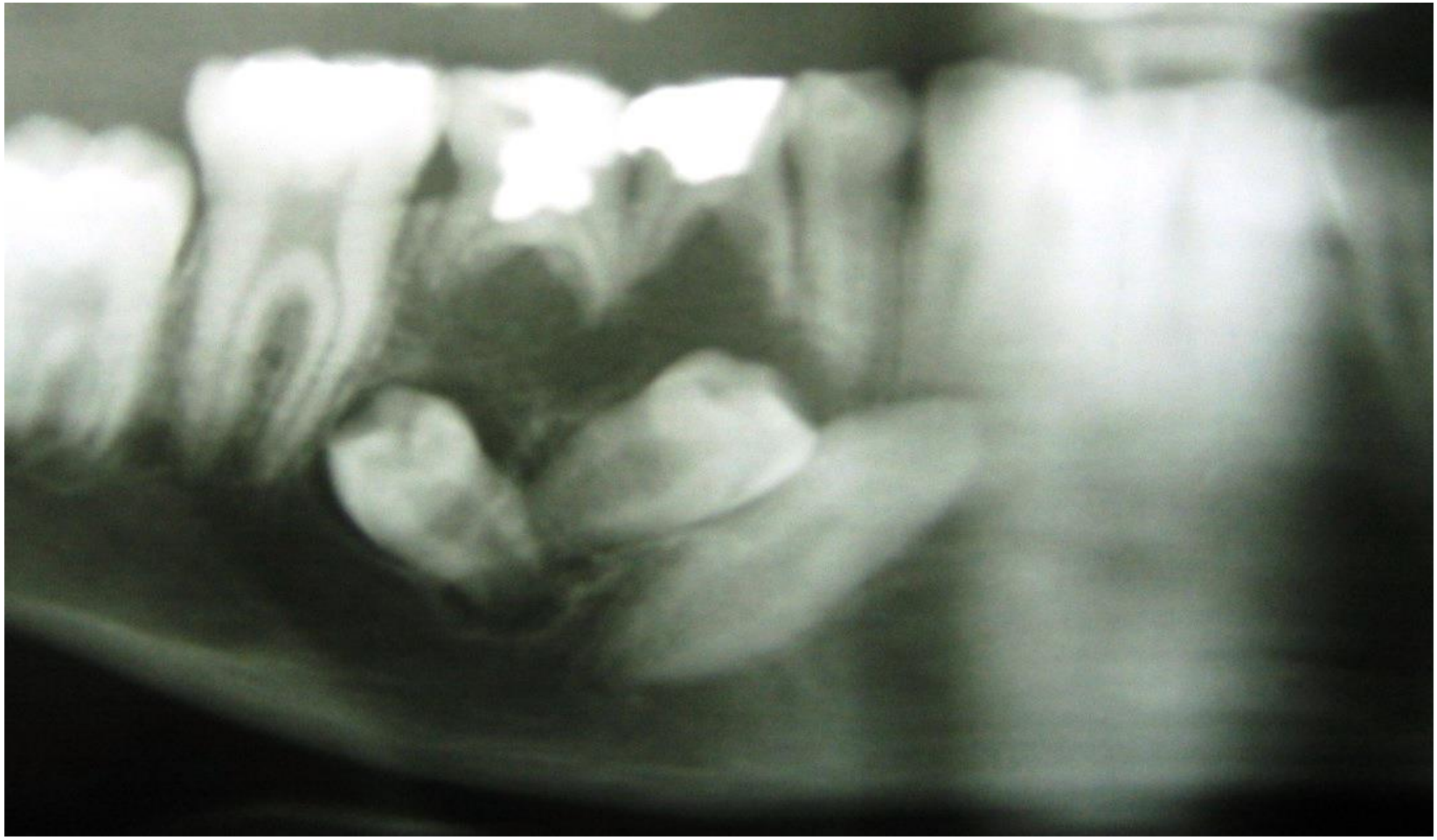
Hyperdontia: a condition in which there are more than 32 teeth in the oral cavity (***supernumerary teeth***).

2nd premolar impaction



An impacted 2nd left mandibular premolar. An odontoma obstructs the eruptive path.

Odontomas: mixed epithelial and ectomesenchymal tumors composed of dental hard and soft tissues.



Multiple impactions of the right mandibular canine and both premolars.

Impaction of Maxillary Teeth

Maxillary 3rd molar impaction

Classification

A. Archer's classification [1], according to the inclination of the impacted tooth in relation to the longitudinal anatomic axis:
   1. *Mesioangular Impaction*
   2. *Distoangular Impaction*
   3. *Vertical Impaction*
   4. *Horizontal Impaction*
   5. *Buccoangular Impaction*
   6. *Linguoangular Impaction*
   7. *Inverted*

B. A more clinically orientated classification takes into account the distance of the maxillary 3d molar roots to the floor of maxillary antrum:
   1. *Sinus approximation*. No bone or a thin bony lamina is present between the roots of the impacted tooth and the floor of maxillary antrum.
   2. *No sinus approximation*. At least 2mm of bone exists between the roots of the impacted tooth and the floor of maxillary antrum.

[1]Archer, WH. *Oral & Maxillofacial Surgery*, 5th Edition. Saunders, Philadelphia, PA. 1975

Mesioangular Impaction

An impacted upper left 3rd molar orientated in a mesioangular position.

Distoangular Impaction

The impacted left maxillary 3rd molar lies in a distoangular position.

Vertical Impaction

The upper left 3rd molar vertically impacted into the maxillary bone.

Horizontal Impaction

The left upper 3rd molar is orientated in a horizontal position.

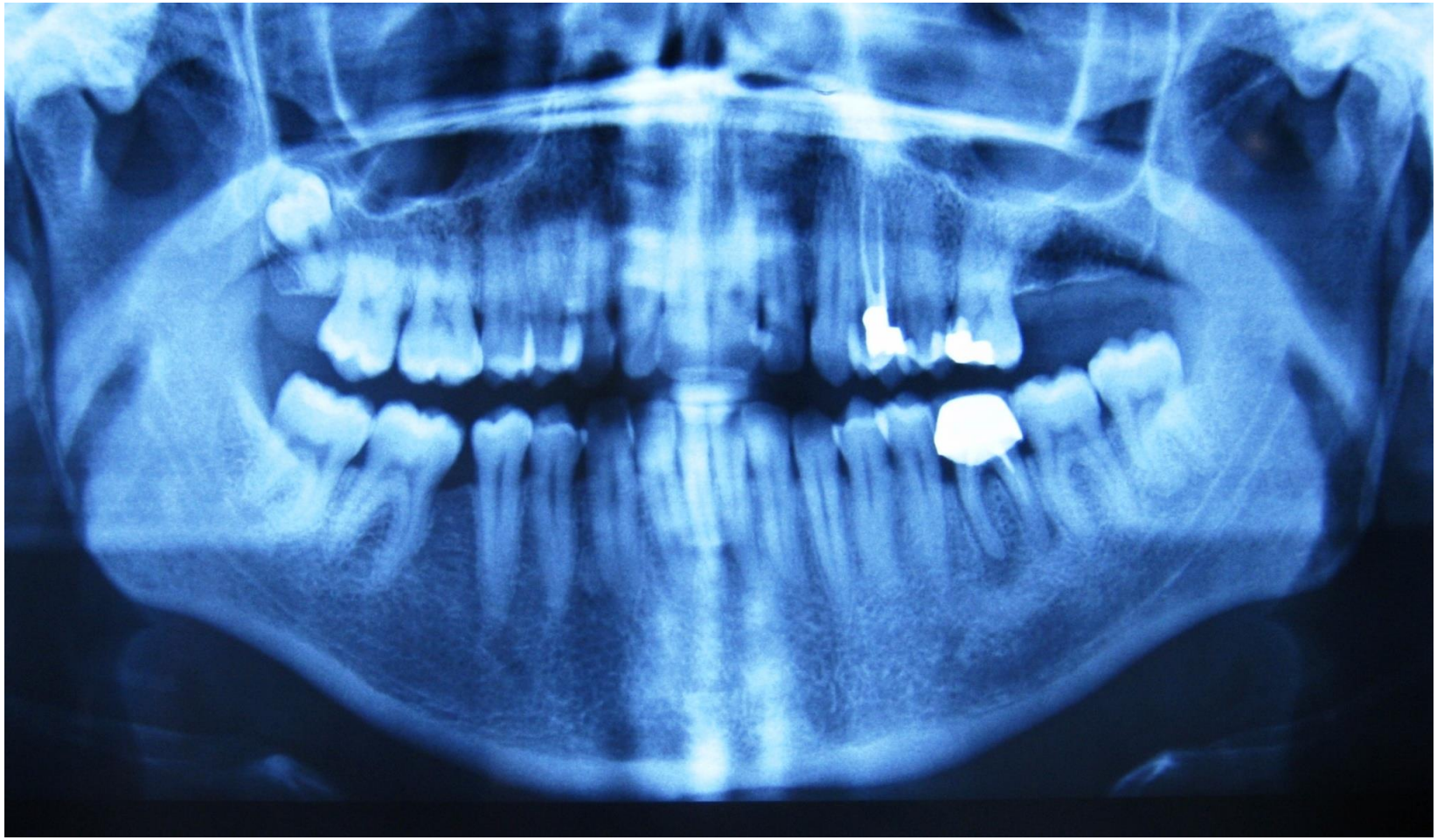
Buccoangular Impaction

The impacted left maxillary 3rd molar lies in a position with its crown facing buccally.

Linguoangular Impaction

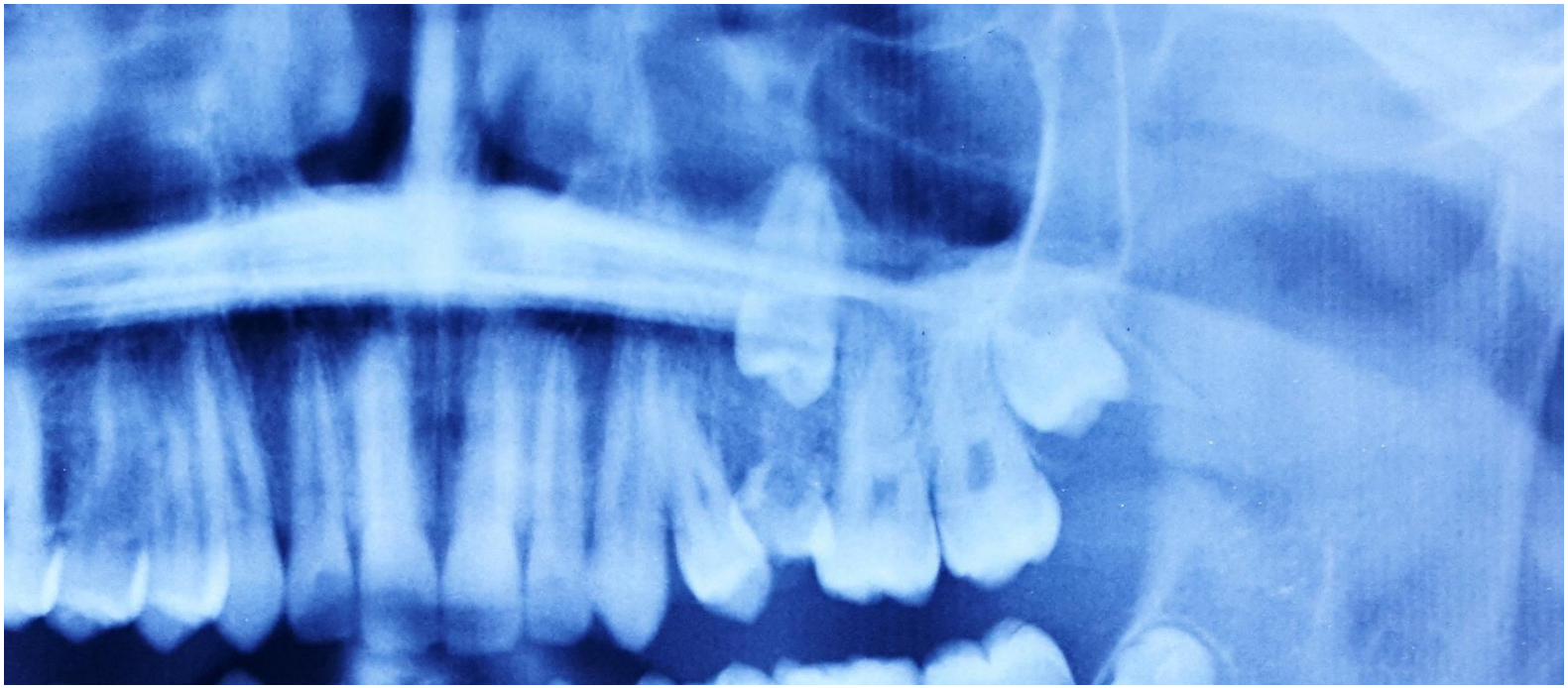
An impacted right maxillary 3rd molar is orientated in a linguoangular position.

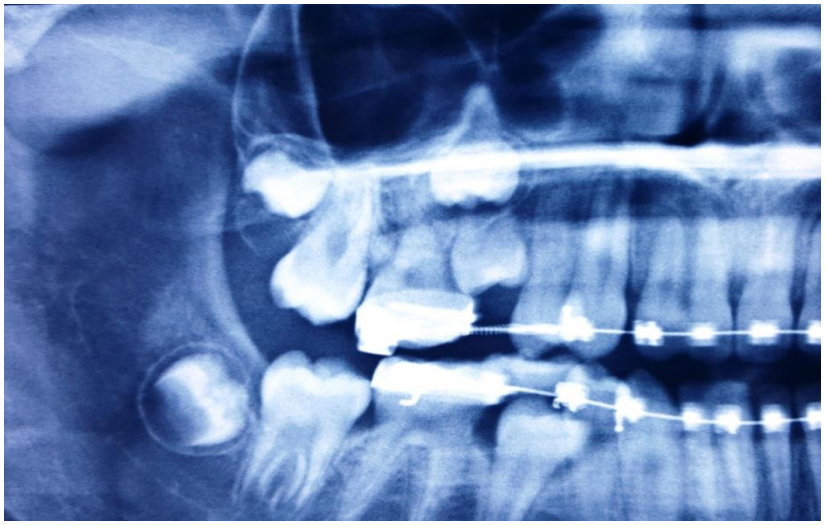
Inverted



An inverted right maxillary 3rd molar.

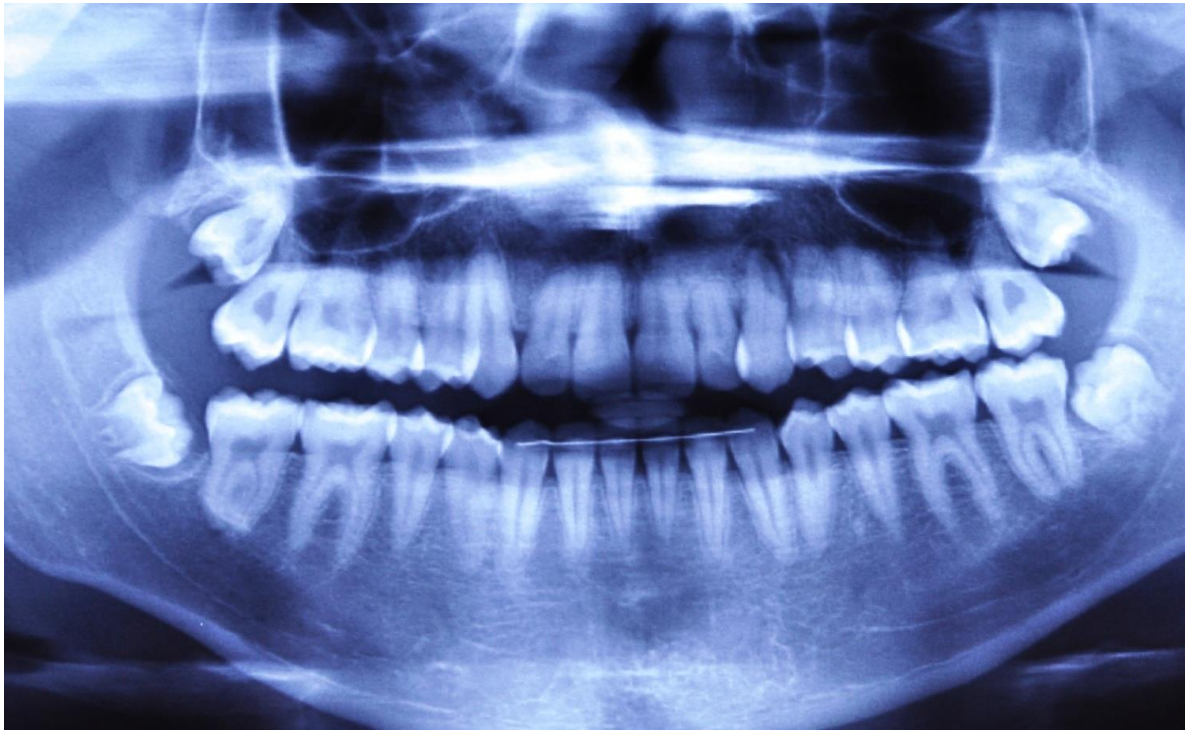
Impacted Upper Posterior Teeth and Maxillary Antrum



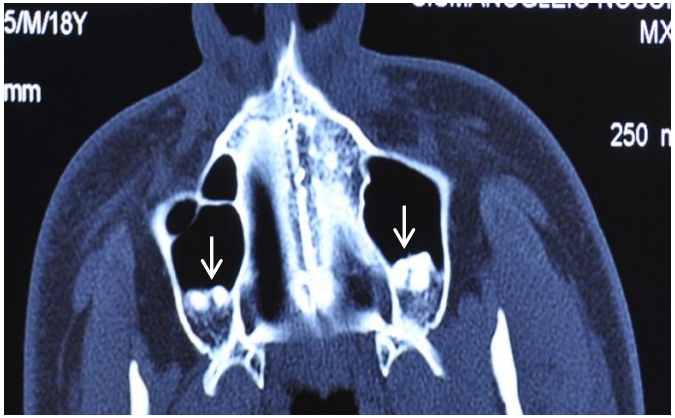


When the roots of the posterior maxillary teeth protrude into the sinus floor, the projections cause small bony elevations or prominences.

Root Insertion into Maxillary Sinus

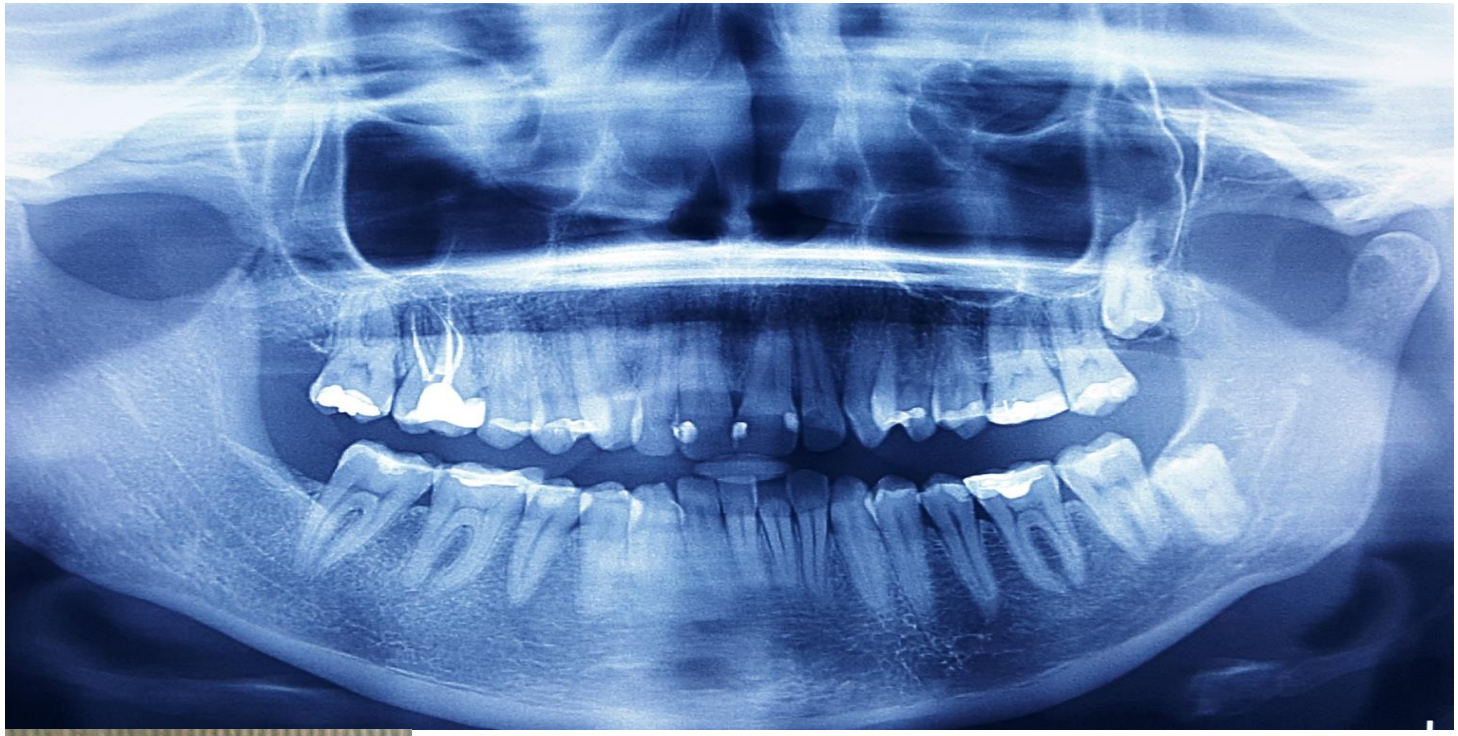


In the panoramic view no bone is present between the roots of both impacted upper 3rd molars and the floor of the maxillary antra.



In the axial CT scan, the roots of both the 3rd molars as they embed into the maxillary sinuses are clearly visible (arrows).

Pseudo-insertion of Root into Maxillary Sinus

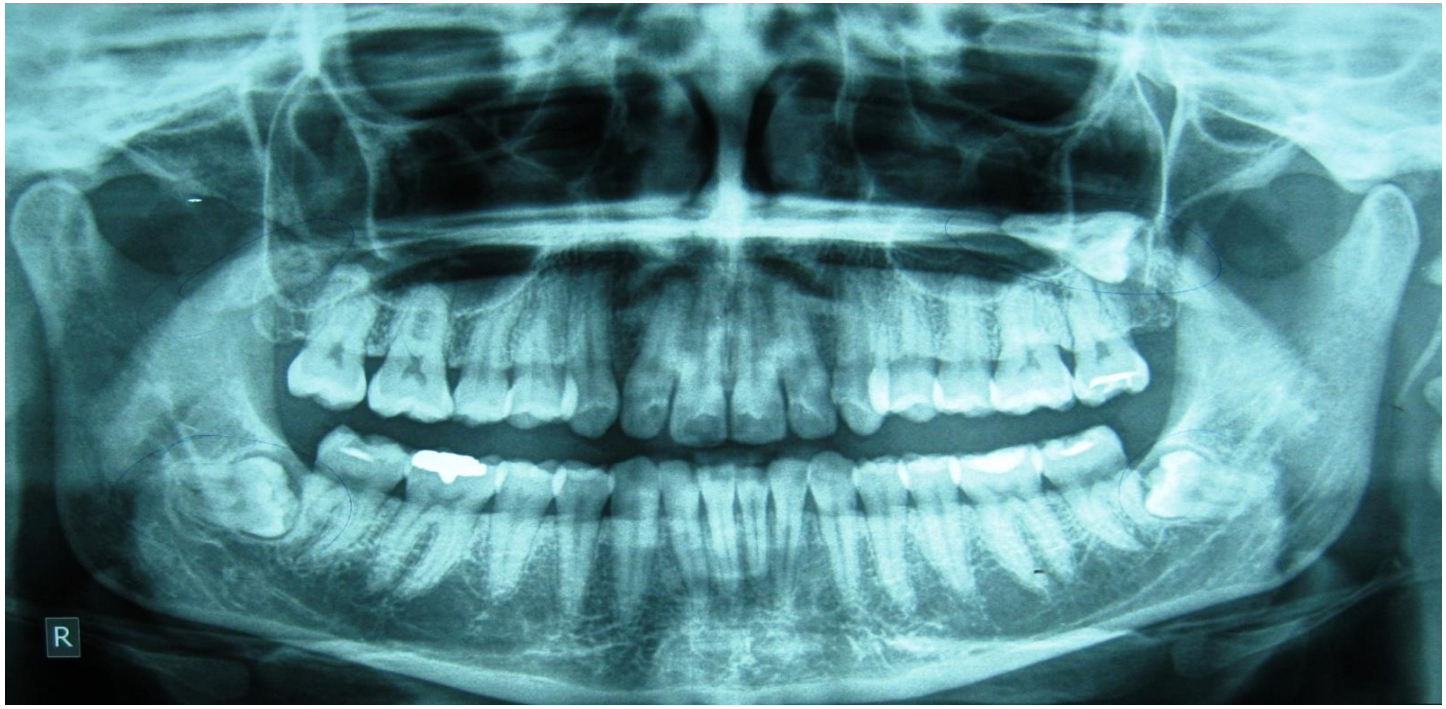


The panoramic view demonstrates that the root of the impacted left upper 3rd molar is projecting into the maxillary antrum. During surgery no evidence of oro-antral communication was found.

The sinus floor "followed" the groove between the roots, with no direct relation to the antrum.

Only CT scanning is able to demonstrate the relationship between teeth and sinuses with accuracy.

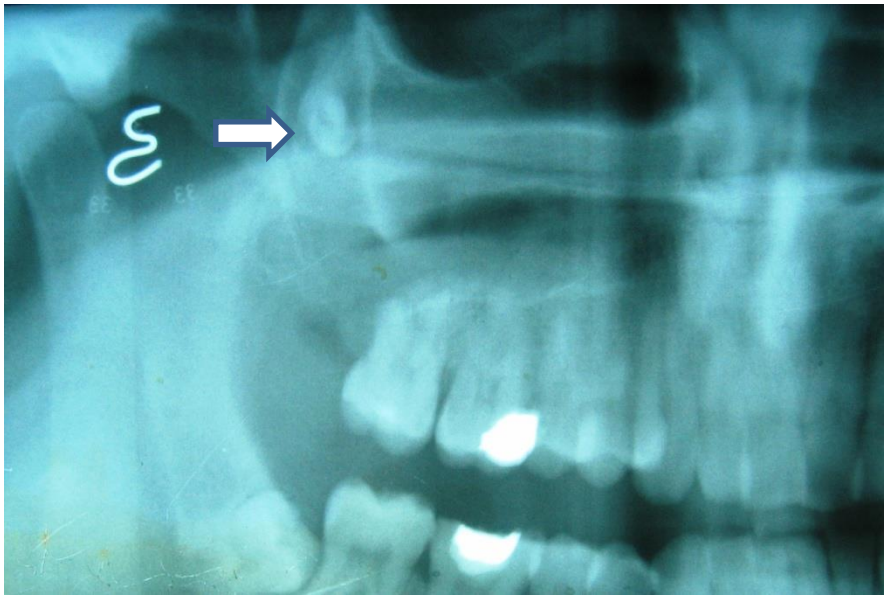
3rd Molar Insertion into the Maxillary Sinus

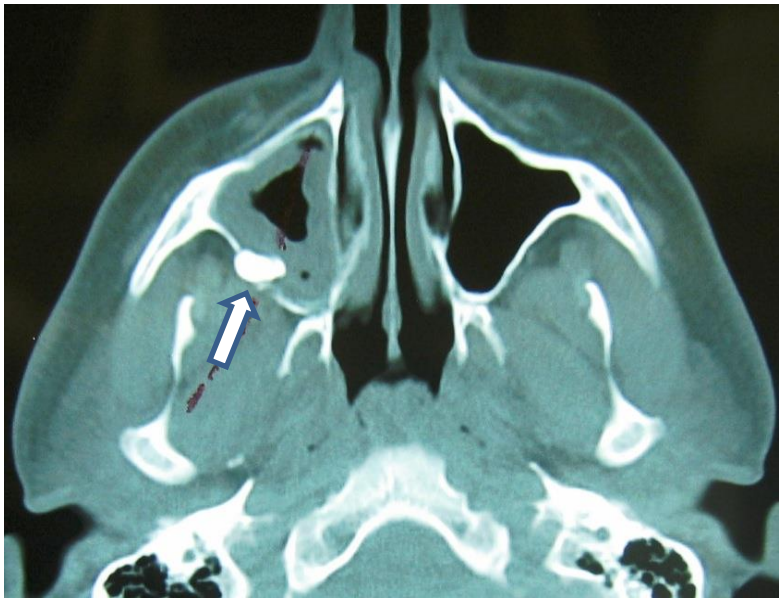


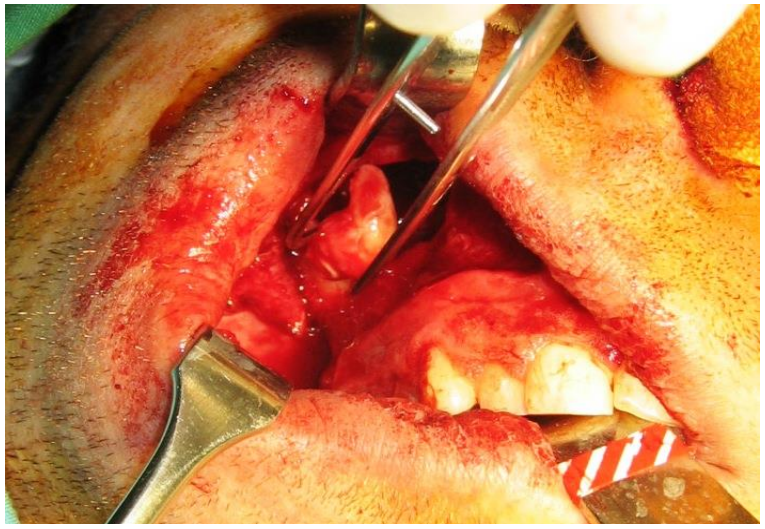
An horizontally impacted left 3rd molar is fully developed into the maxillary sinus.

Axial CT scan reveals the tooth into the left maxillary sinus with no evidence of sinusitis.

Ectopic 3rd Molar in the Maxillary Sinus

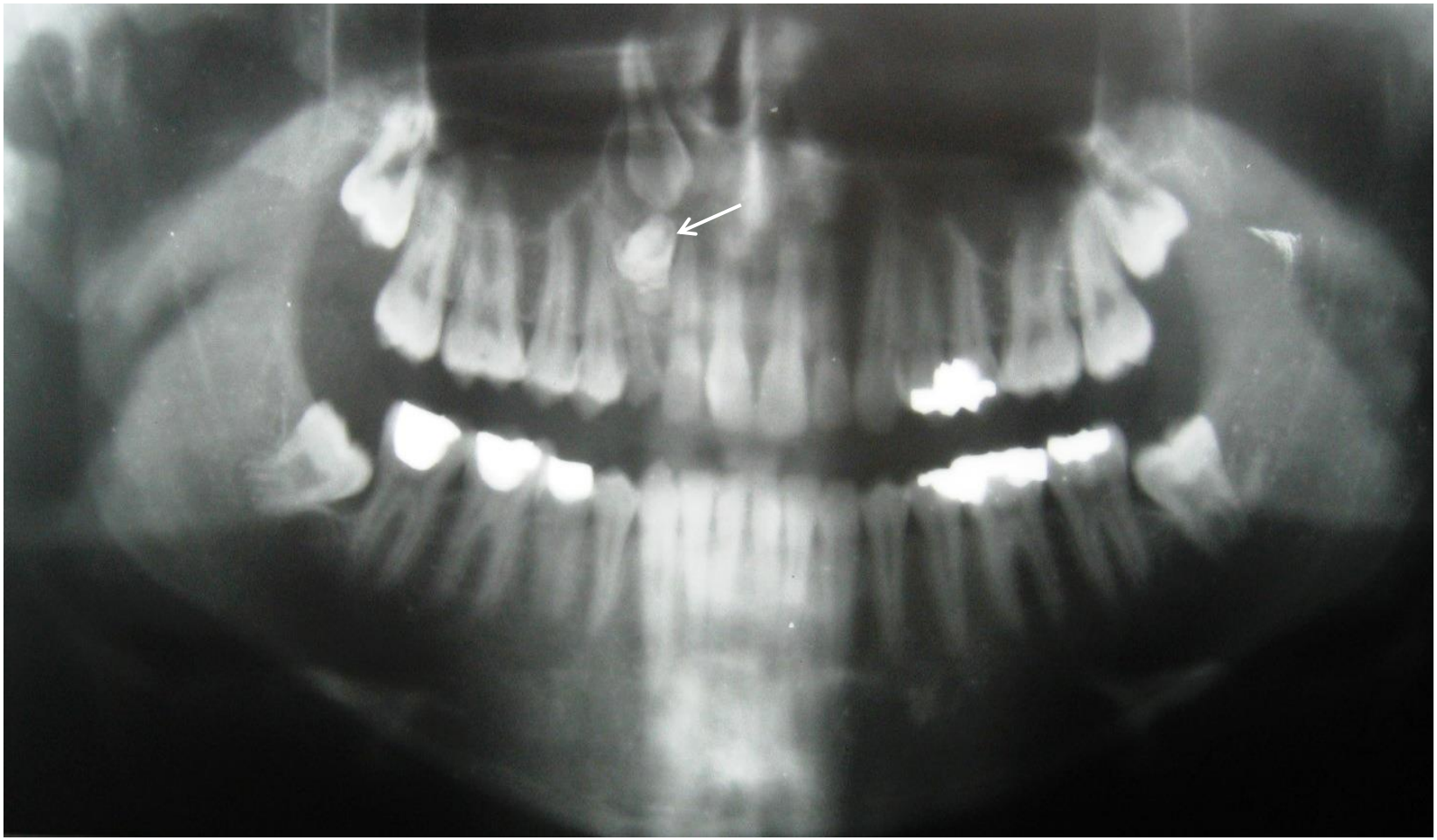






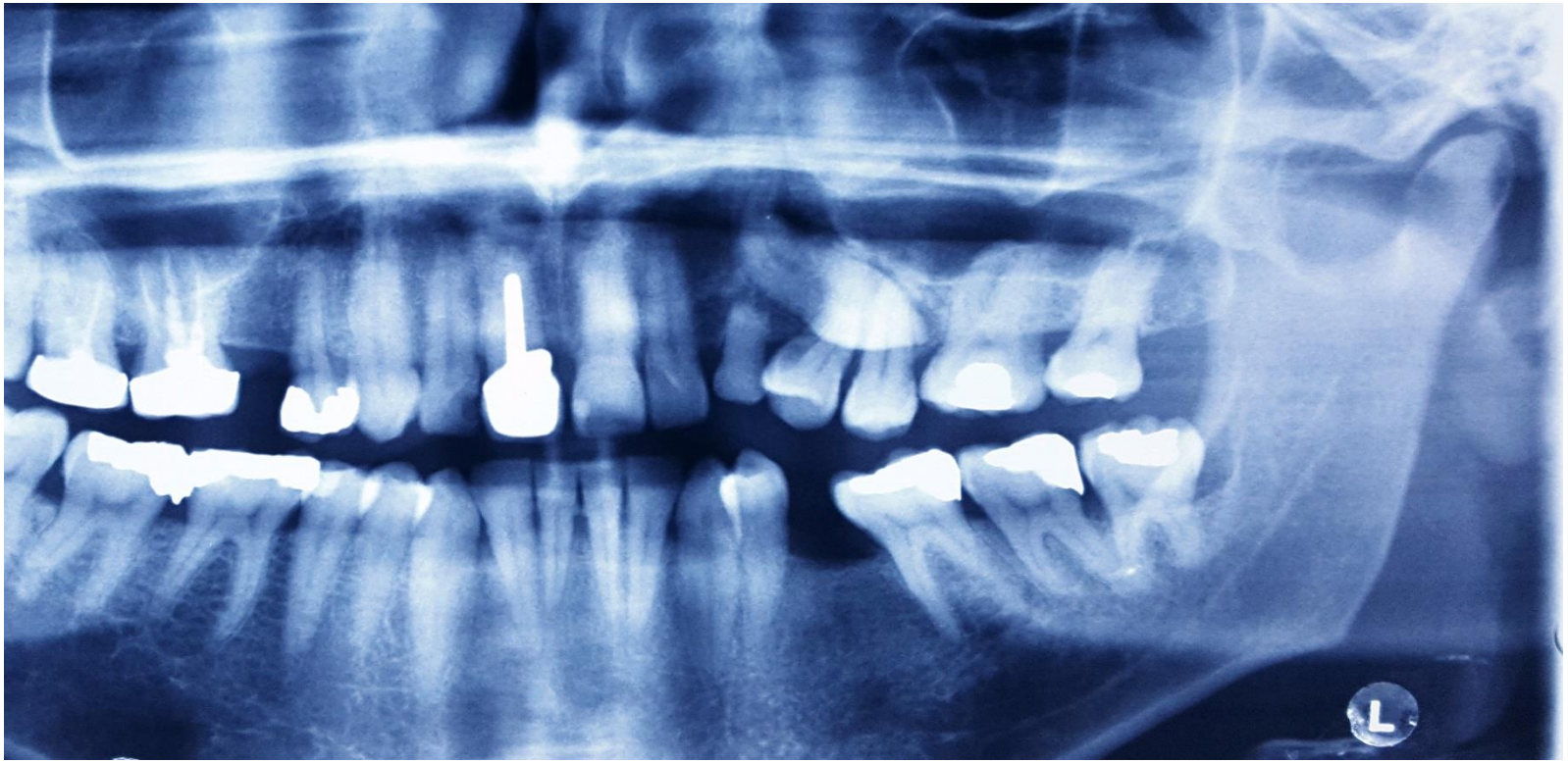
An ectopic maxillary right 3rd molar lies on the posterior wall of the maxillary sinus.

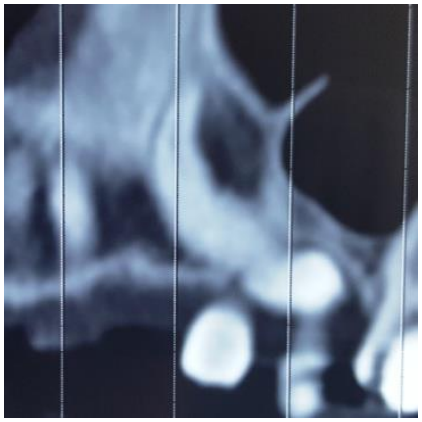
Surgical exposure and tooth removal via a Galdwell-Luc approach (left).



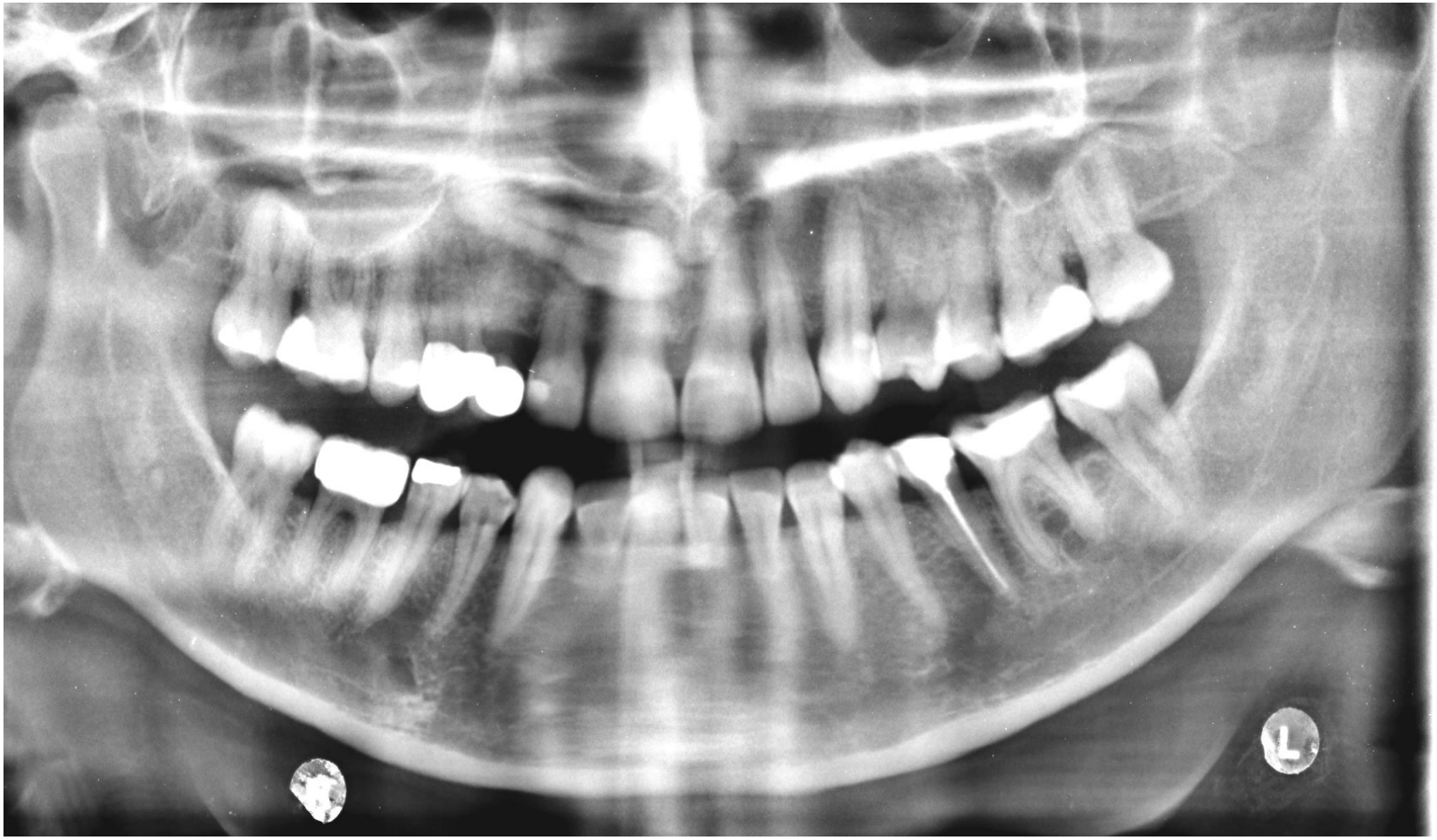
An impacted right canine in vertical position.
The eruptive path of the tooth is obstructed by an odontoma.

An impacted right canine in mesioangular position with it's crown mesially tipped.



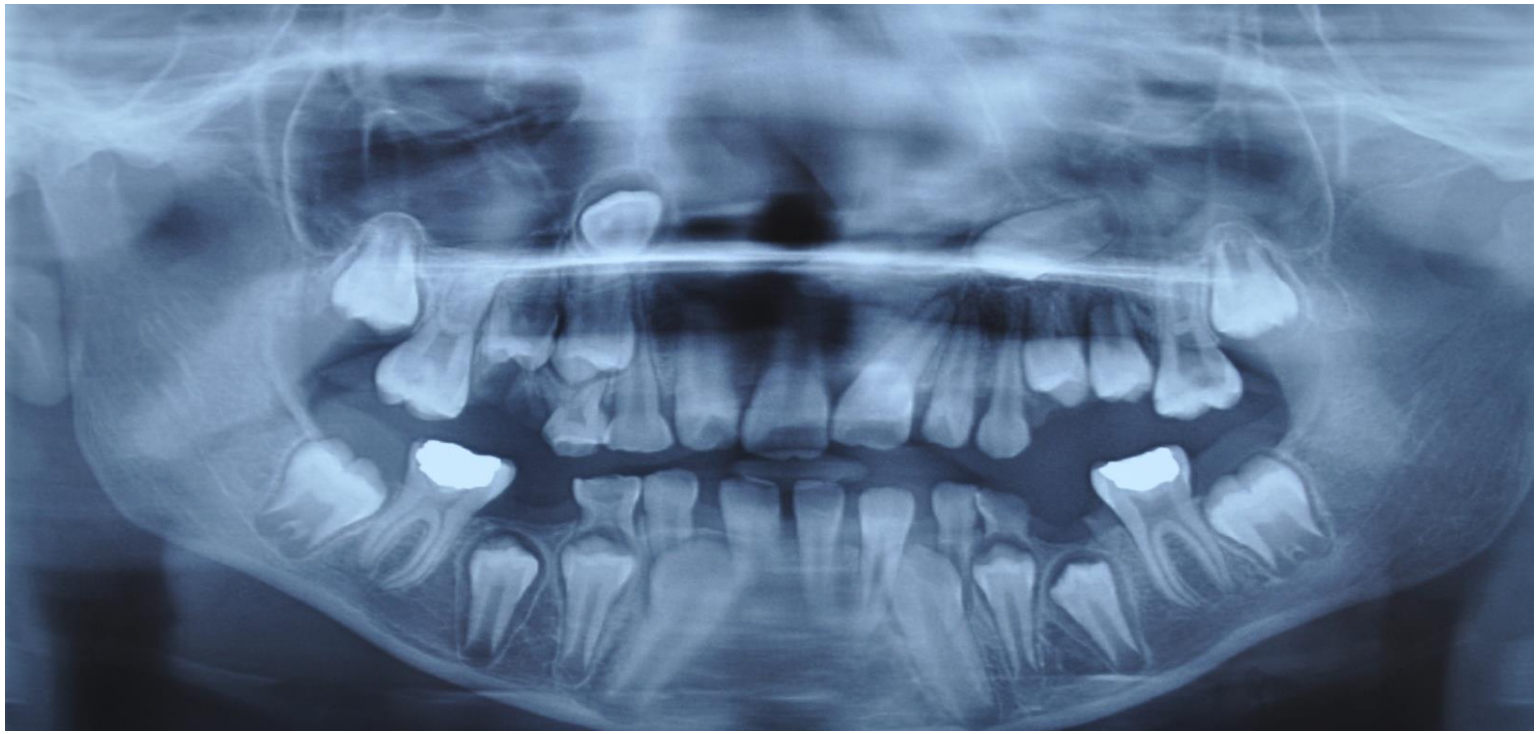


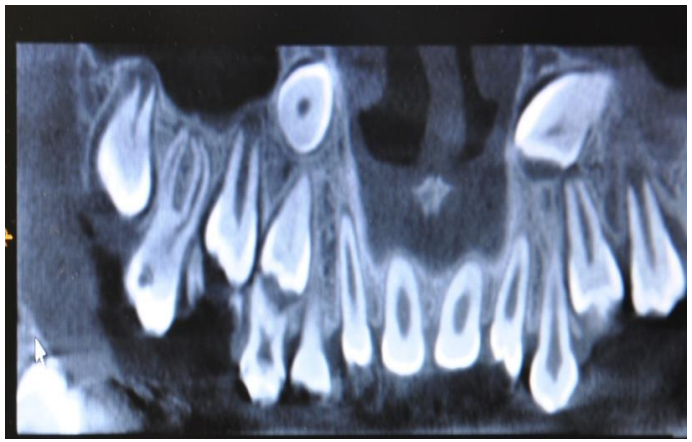
A distoangularly positioned, impacted and dilacerated left canine.



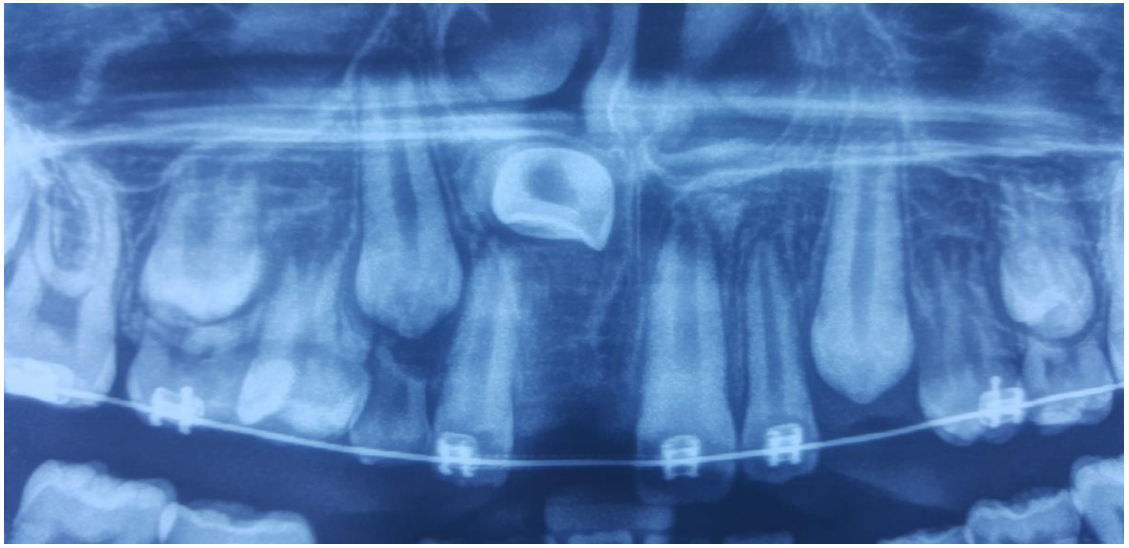
A right canine, impacted in horizontal position.

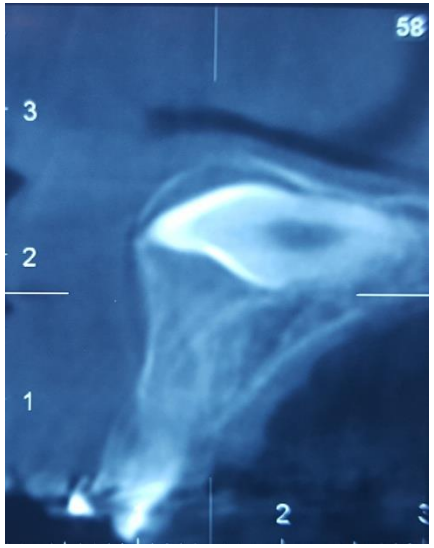
Bilateral Impacted Maxillary Canines

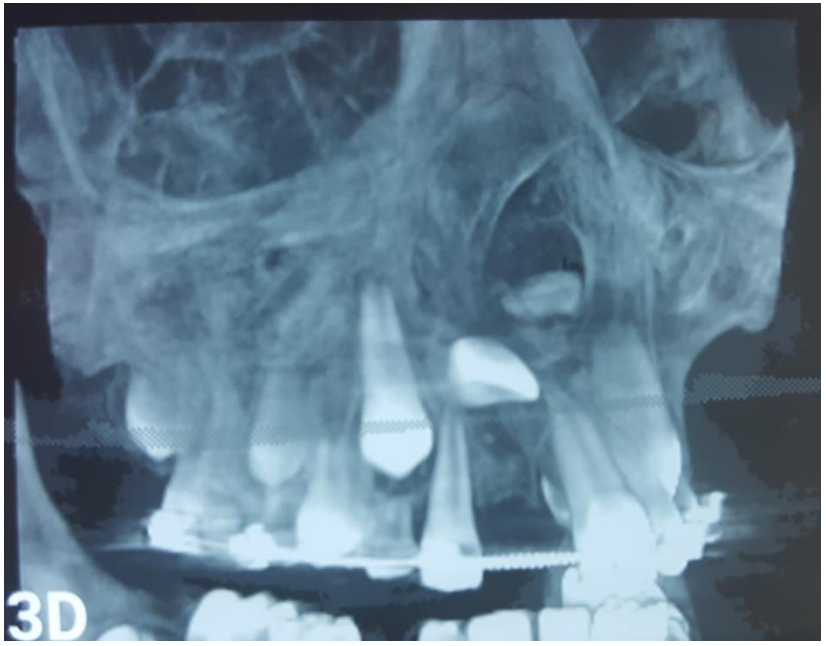




In the CT scan, the teeth appear to be in close contact both with the sinus and the nasal cavities.

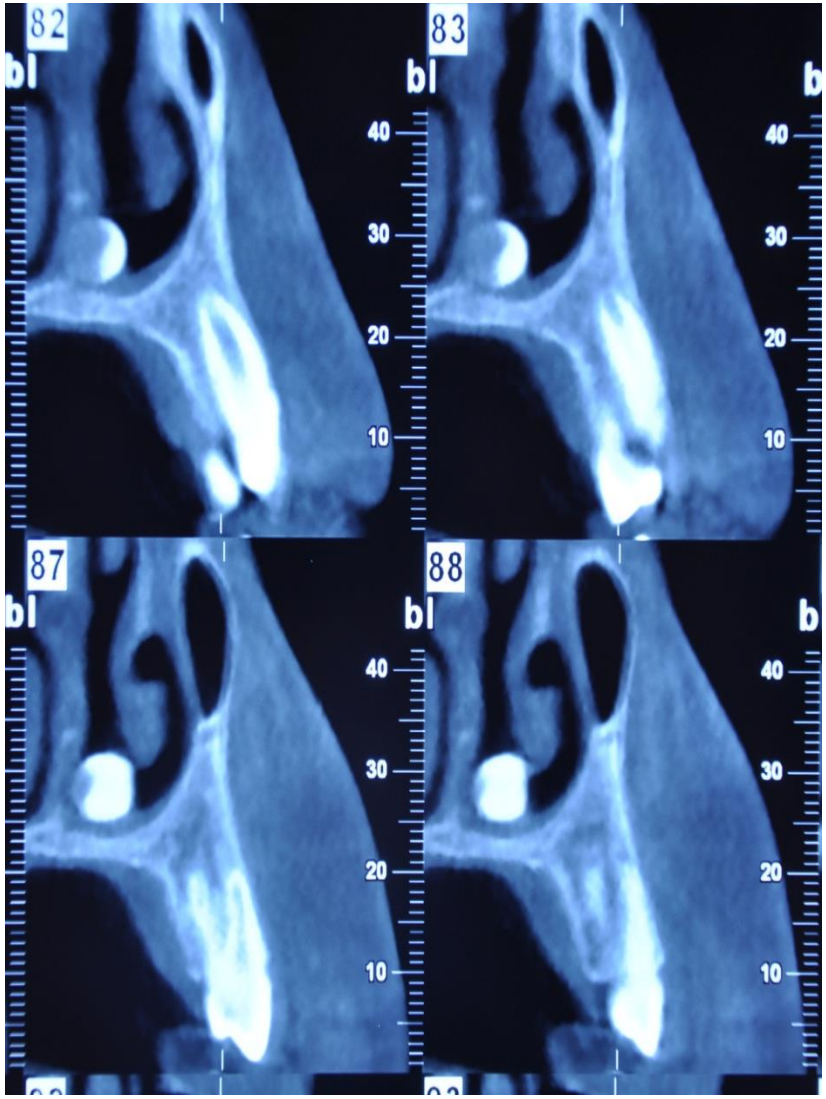


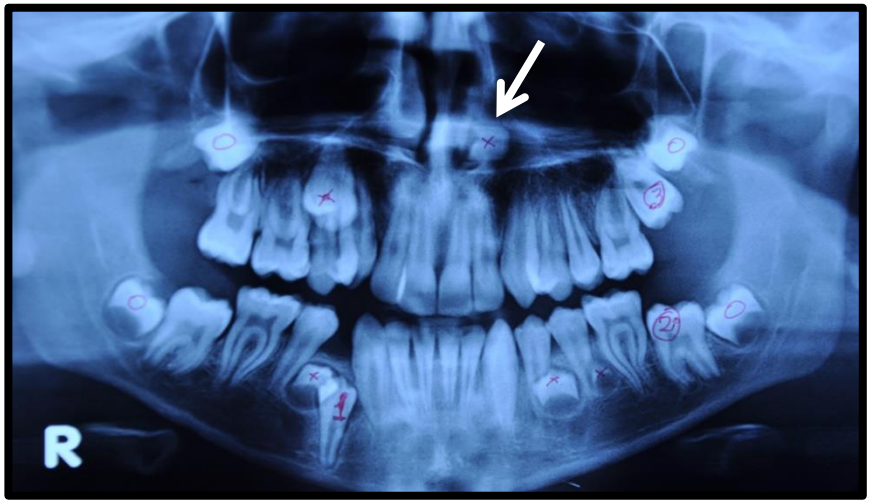




Impacted right central incisor in a horizontal position, lying just below the nasal floor.

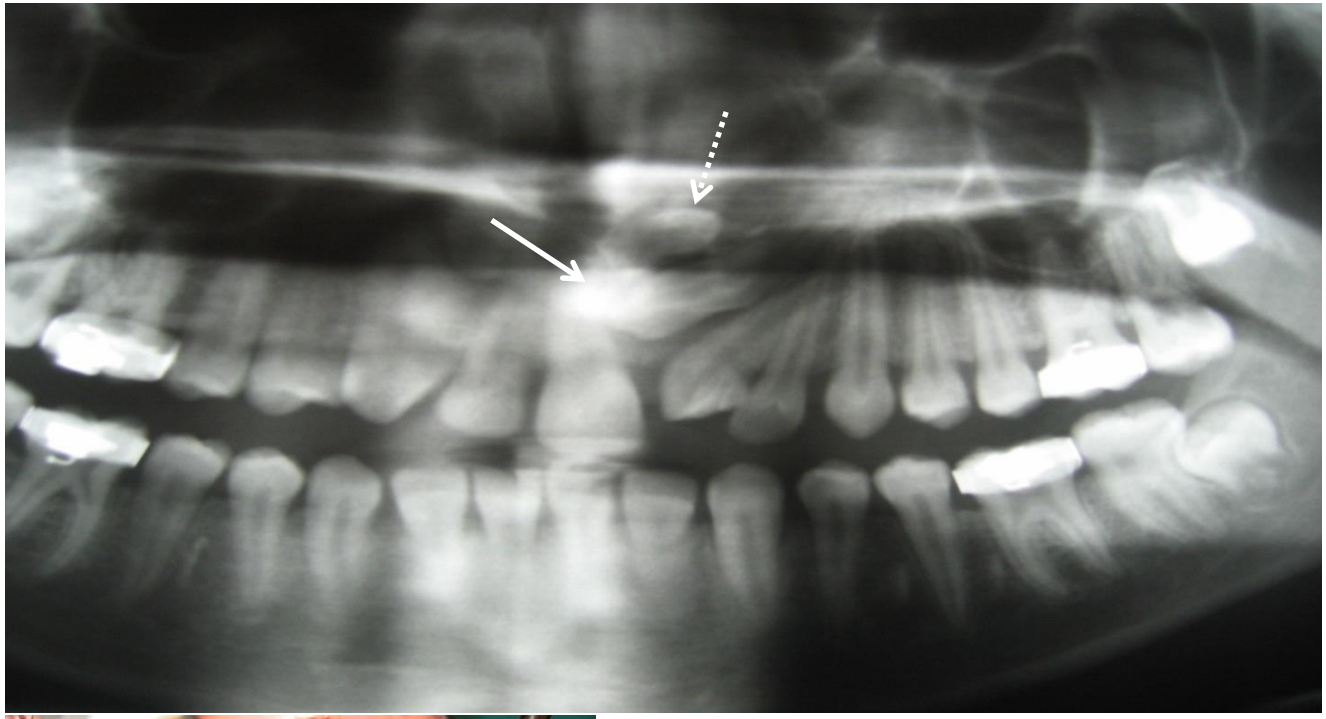
3D reconstructed imaging clearly demonstrates the relation of the tooth to the nasal cavity.

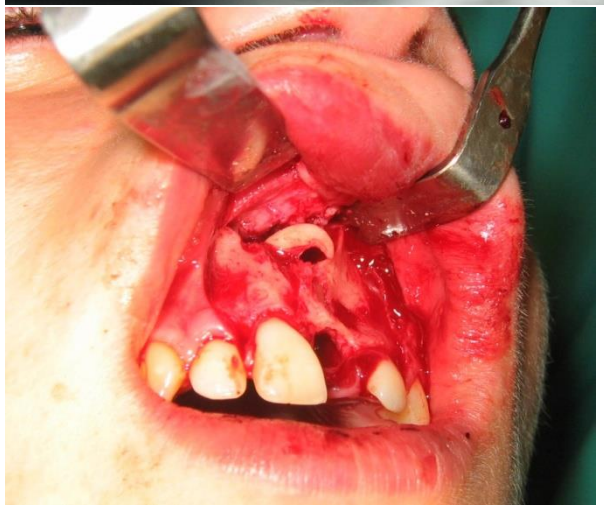




Impaction of a supernumerary incisor in a high position (arrow).

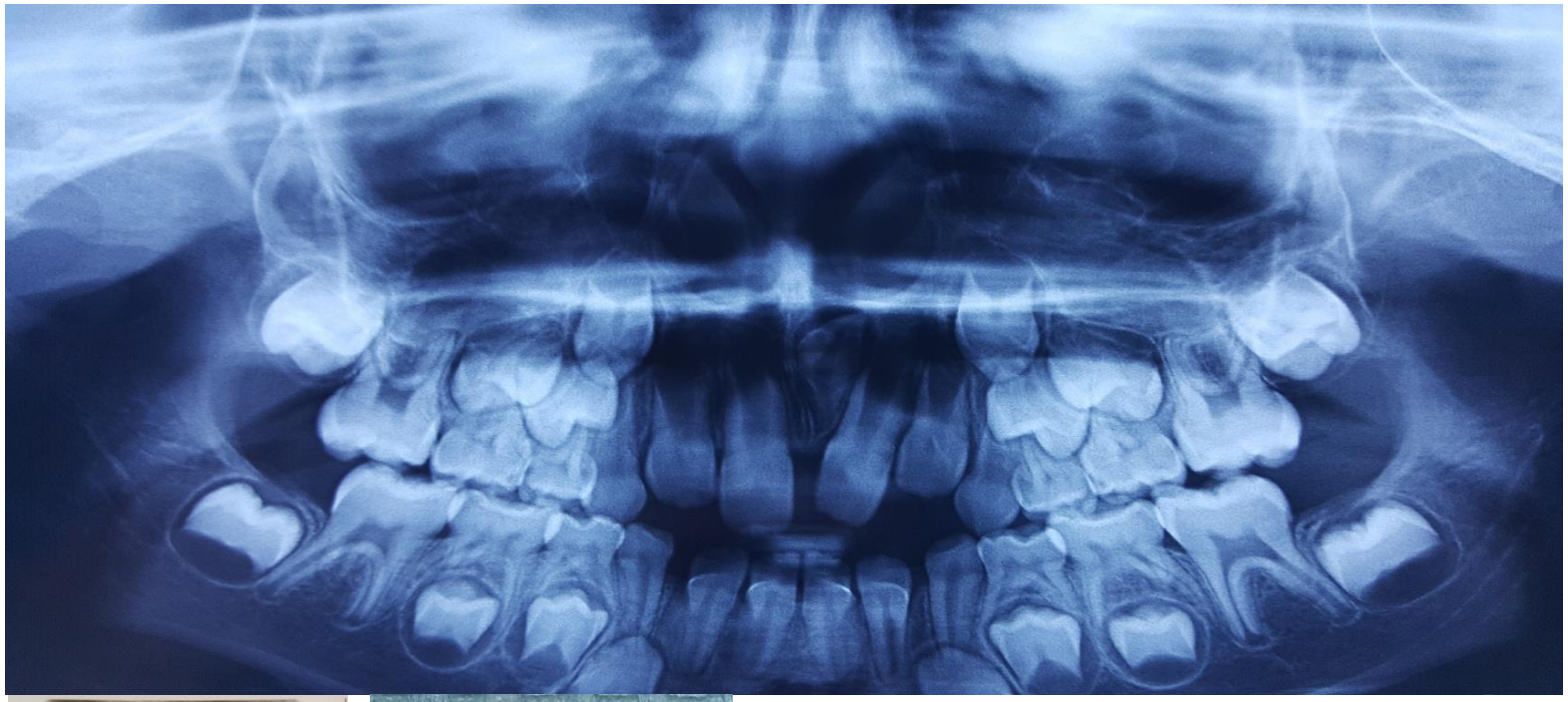
Cone beam computed tomography shows the ectopic position of the tooth in the nasal cavity. The tooth is in an early stage of development with no root formation.





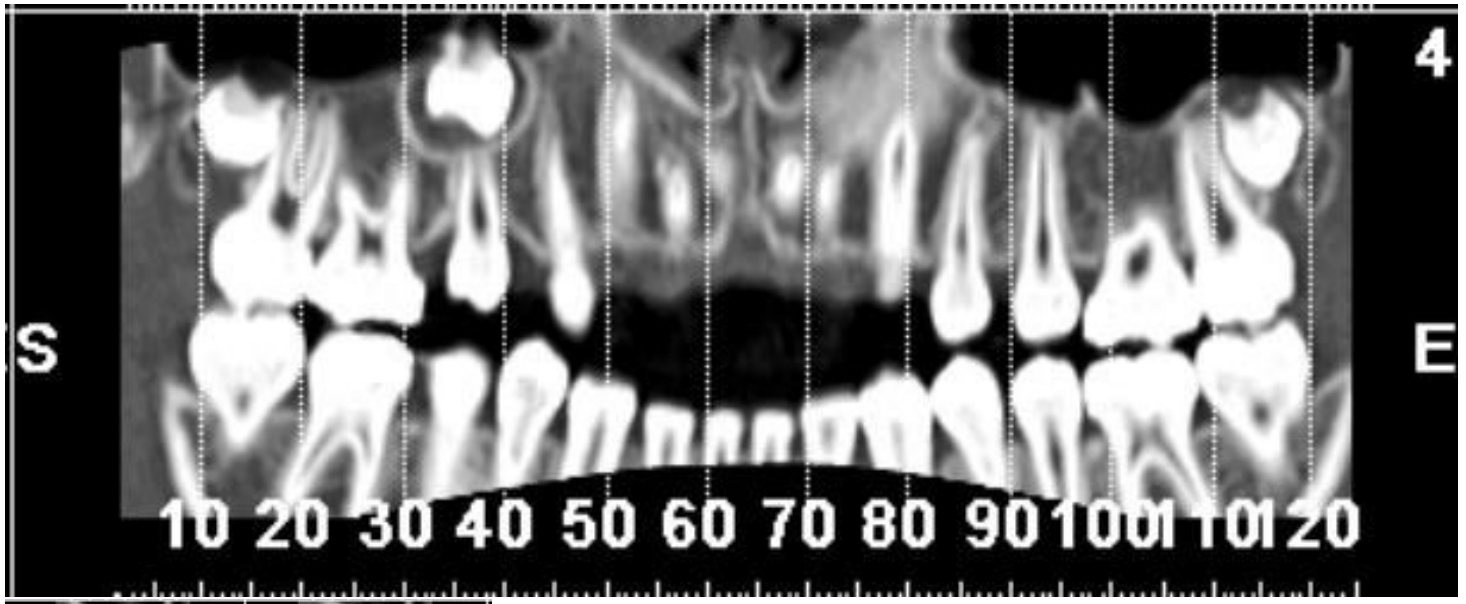
A permanent (arrow) and a supernumerary (dotted arrow) central incisor are both impacted in the maxilla.

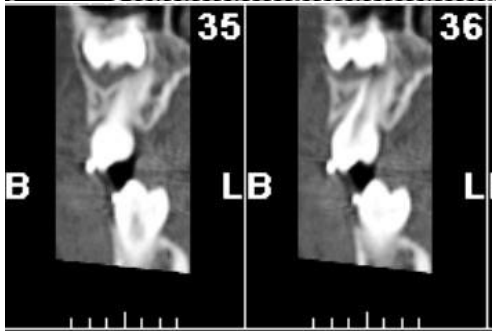
The supernumerary tooth lies above the permanent one, perforating the nasal floor.



A supernumerary central incisor lies between the two permanent ones in a reversed position.

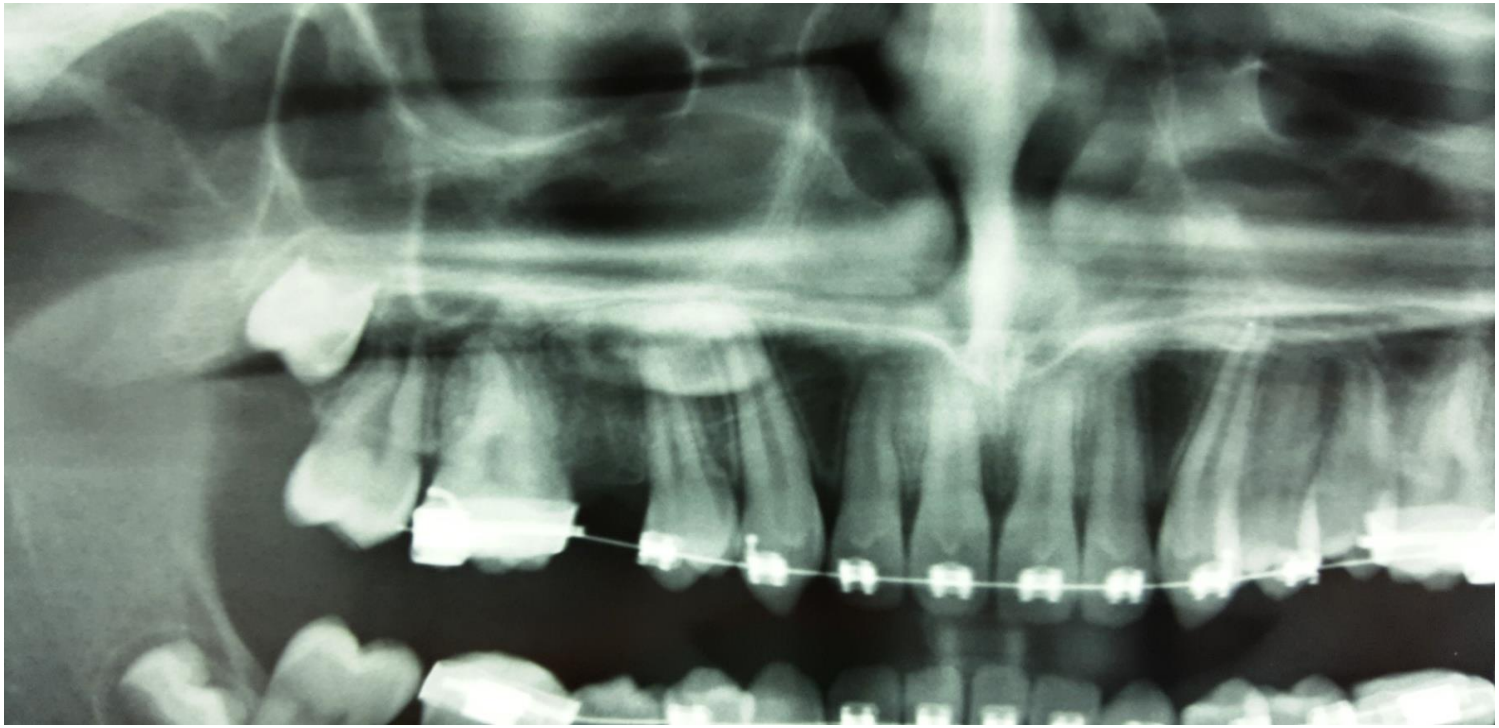
Mesiodens: a supernumerary tooth present in the midline between the two central incisors.

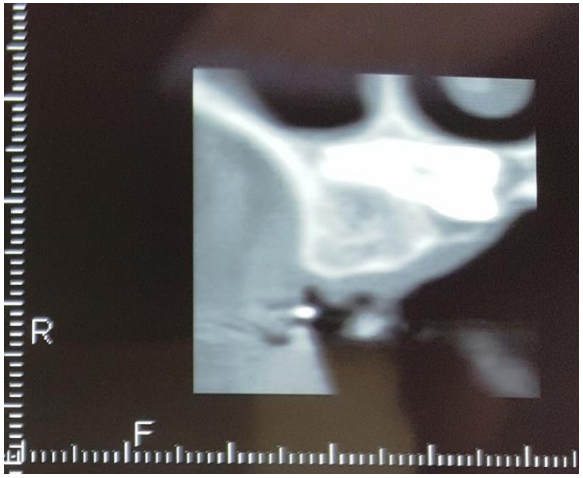




An undeveloped impacted 1st premolar lies just above the roots of the 2nd one.

Coronal, sagittal and transverse views of the CT reveal tight relation of the tooth with the maxillary sinus.

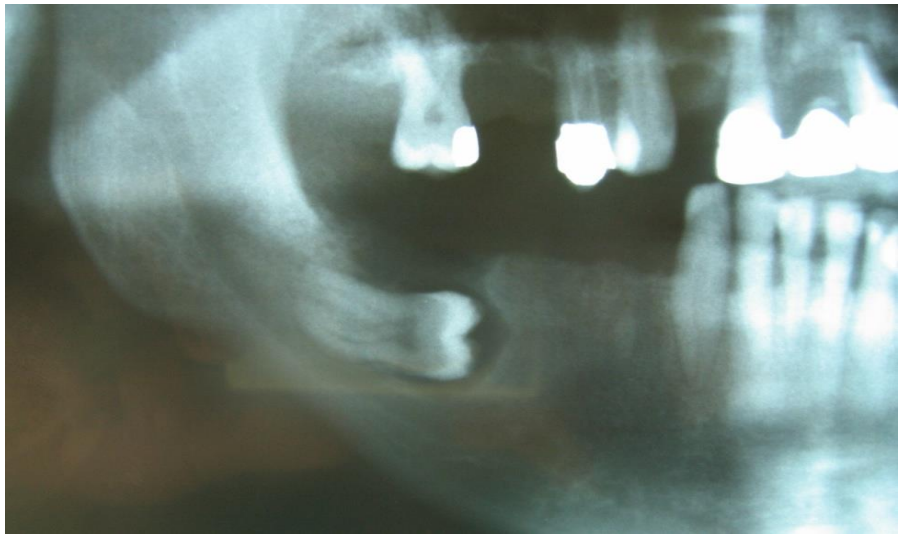




A fully developed impacted 2nd upper premolar lies horizontally.

CT scan shows close proximity of the tooth with the nasal and antrum floor.

Tooth Impaction Association with Pathological Conditions

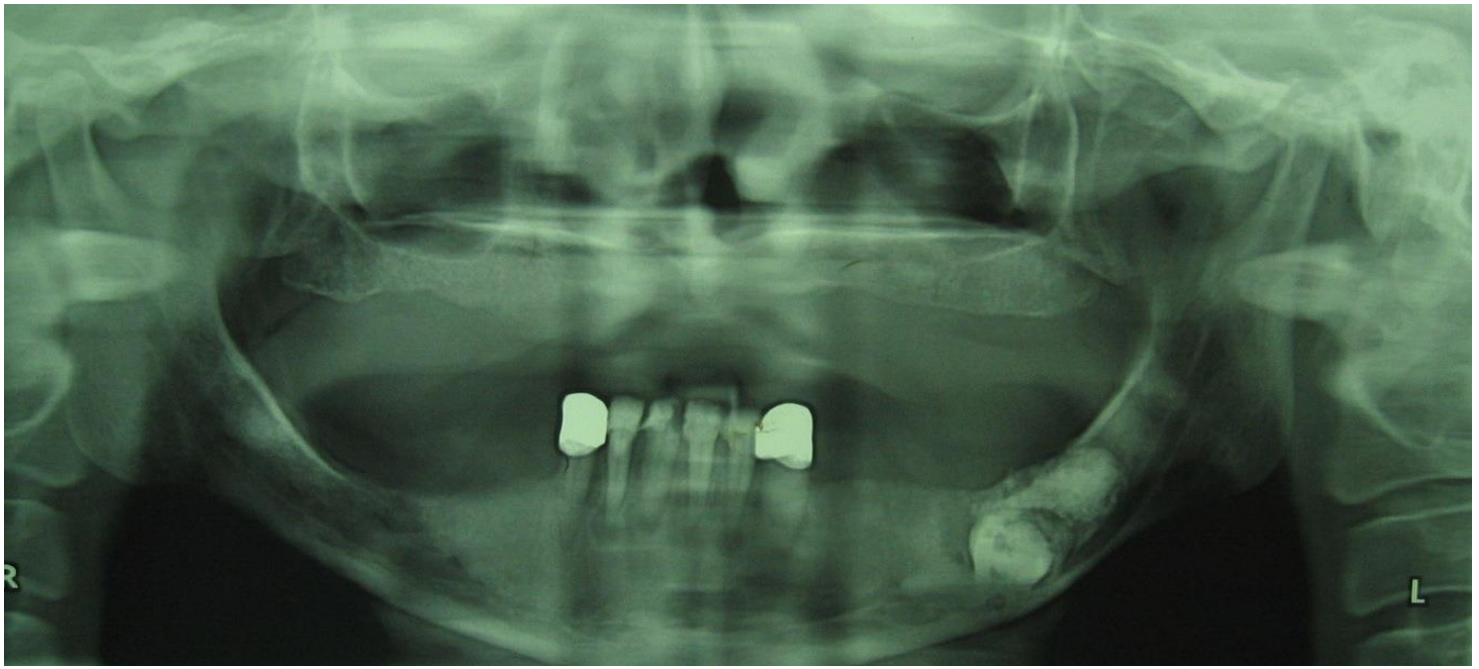


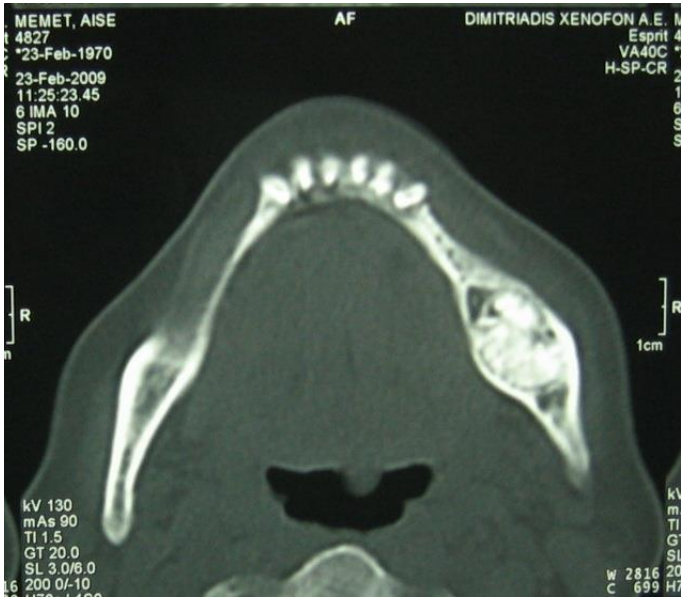
An acute submandibular abscess caused by the impacted 3rd right lower molar. The infection is extended to the neck.

Acute buccal space abscess due to the impacted 3d left upper molar.

The patient reveals reduced opening of the mouth (trismus).

Trismus: difficulty opening the jaw.

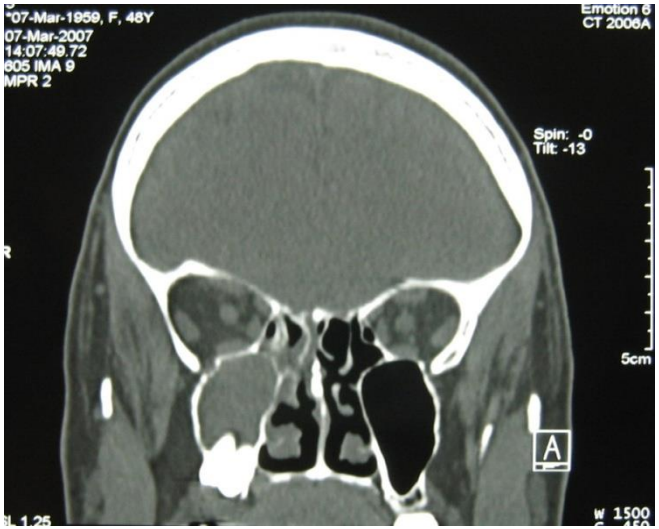




Chronic mandibular osteomyelitis around an impacted left 3d molar.

A sequestrum is depicted at the panoramic and the axial view of the CT scan.

Sequestrum: a fragment of dead bone separated from healthy bone.

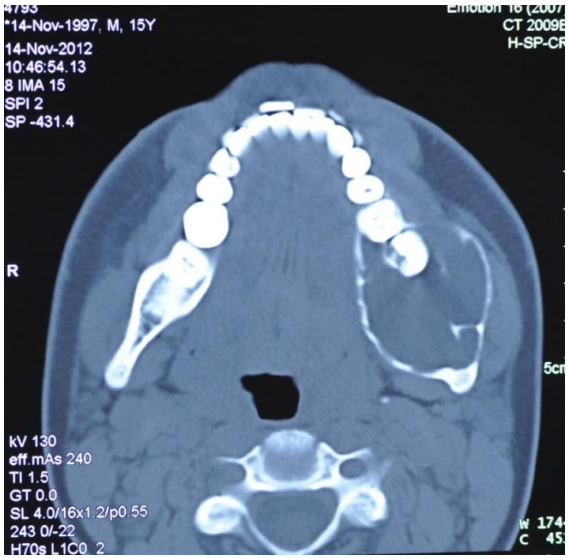


Right maxillary sinusitis caused by infection of the impacted upper 3rd molar.

Opacification of the maxillary right side sinus is seen at the coronal view of the CT scan.

The lower 3rd molar is located at the distal end of the body of the mandible where the relatively thin ramus is connected. The impacted 3d molar weakens the mandibular angle predisposing to fracture.

In this case the right lower 3rd molar is involved in the fracture line.



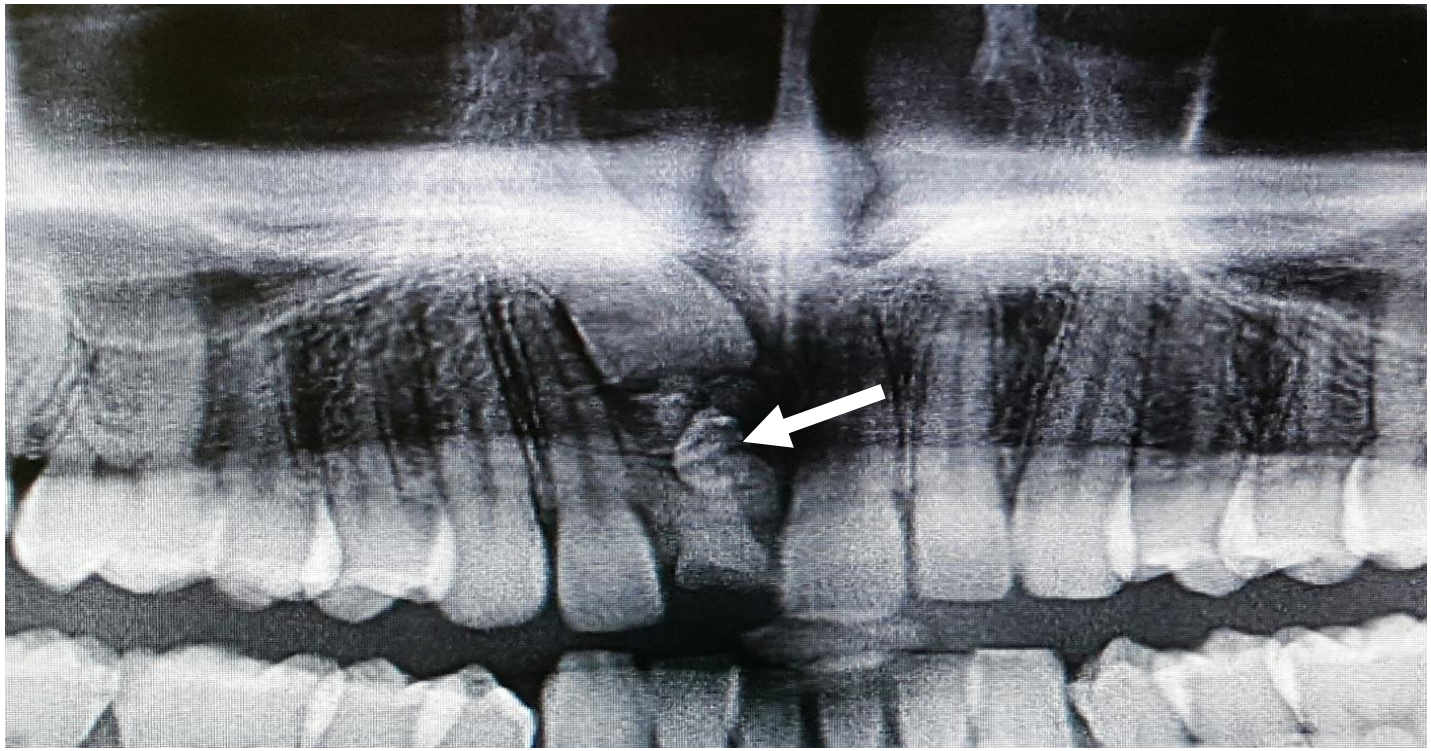
A rare keratocystic odontogenic tumor (formerly known as odontogenic keratocyst) involving the angle, ramus and body of the left mandible.

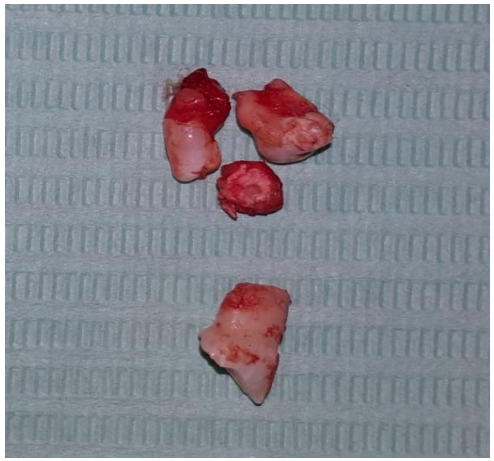
The tumor displaces the developing impacted second and third molar teeth.

Keratocystic odontogenic tumor: a benign but locally aggressive developmental tumor that arises from the dental lamina (odontogenic epithelium).

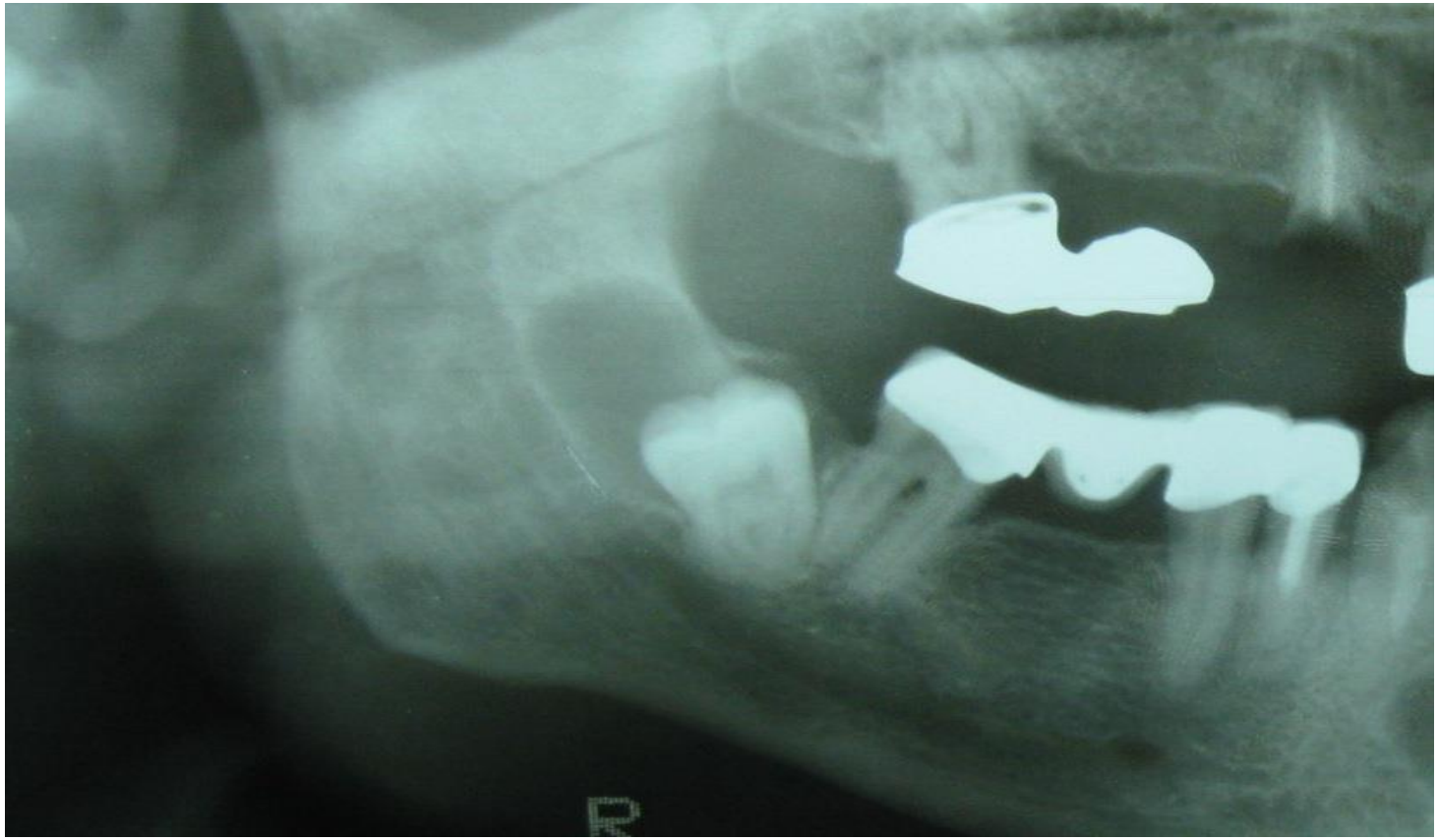
An ameloblastoma of the right mandible, involving the impacted 3rd molar in a young patient.

Ameloblastoma: a benign but locally aggressive epithelial neoplasm being one of the most common dontogenic tumors.



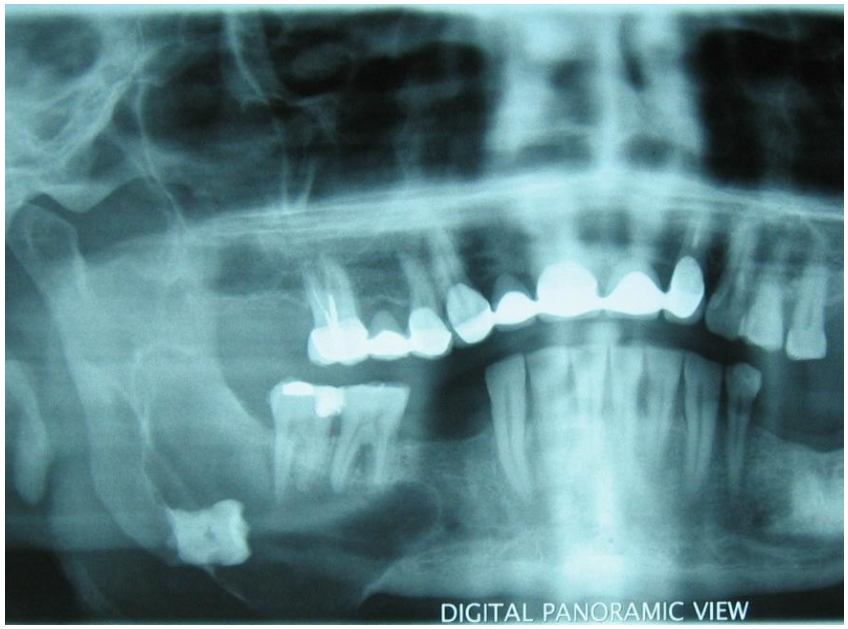


An odontoma of the right maxilla in a young patient. Right central incisor failed to erupt and remains impacted.

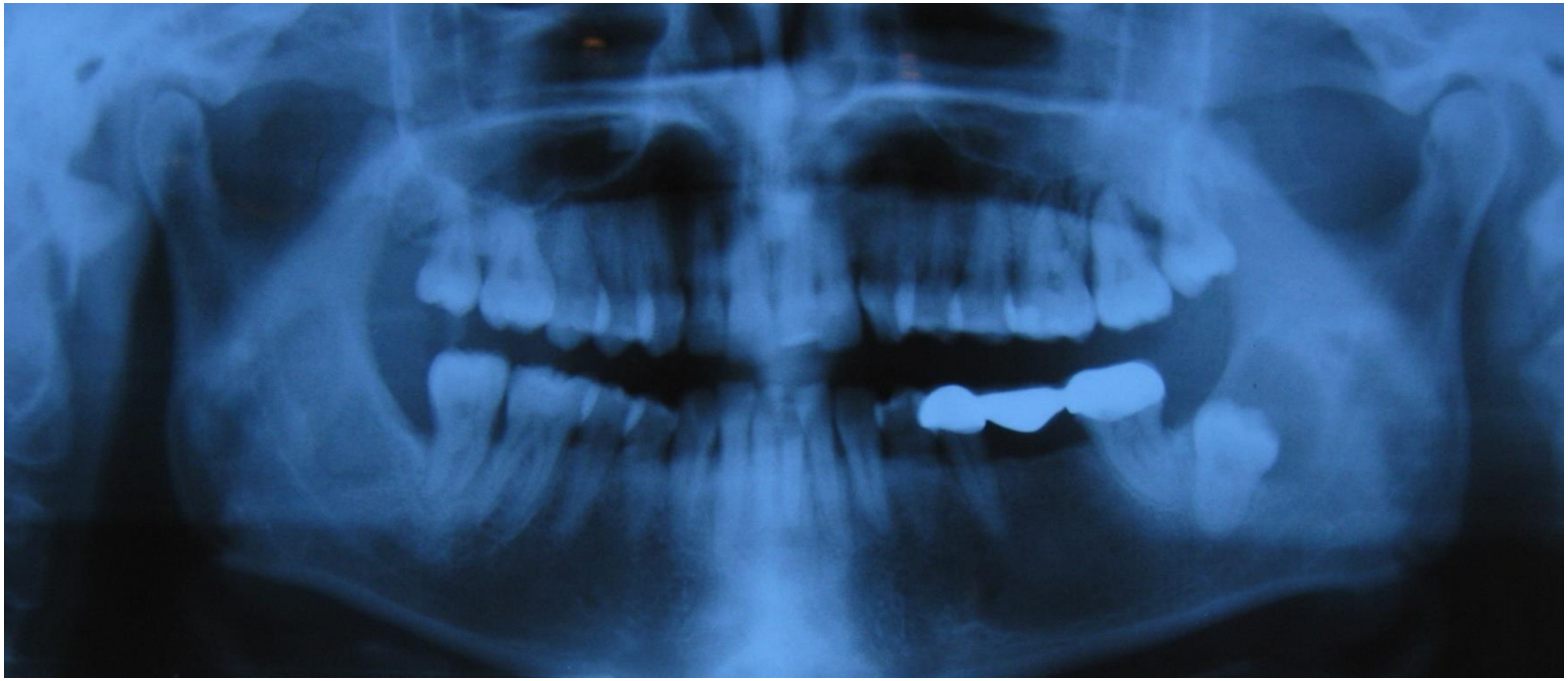


Panoramic radiograph showing a dentigerous mandibular cyst associated with an impacted lower 3rd molar in the right mandible.

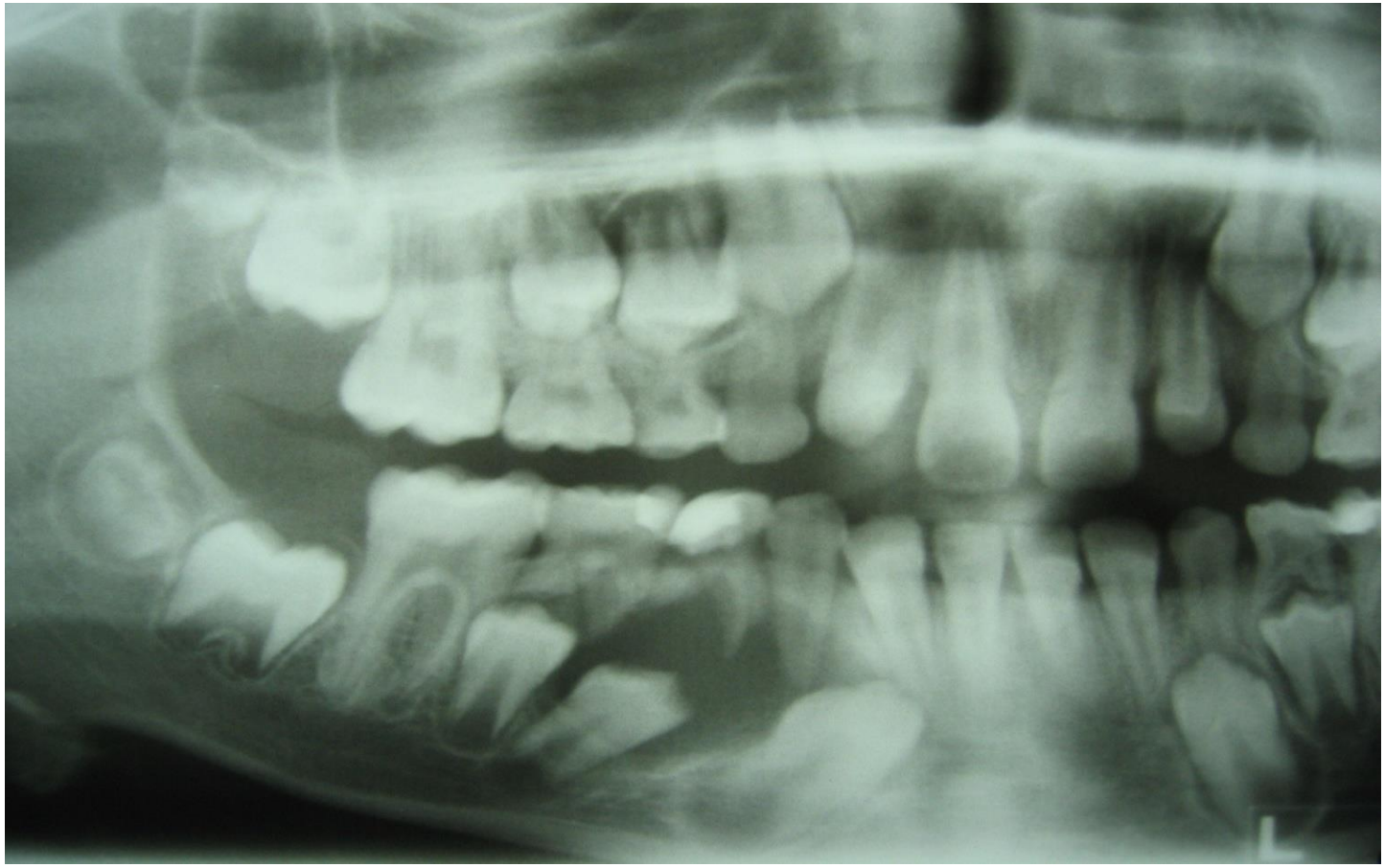
Dentigerous cysts: developmental cysts that arise from the crown of an impacted or unerupted tooth.



A large dentigerous mandibular cyst involving the angle, body and ramus of the right mandible associated with the impacted lower 3rd molar in the right mandible.

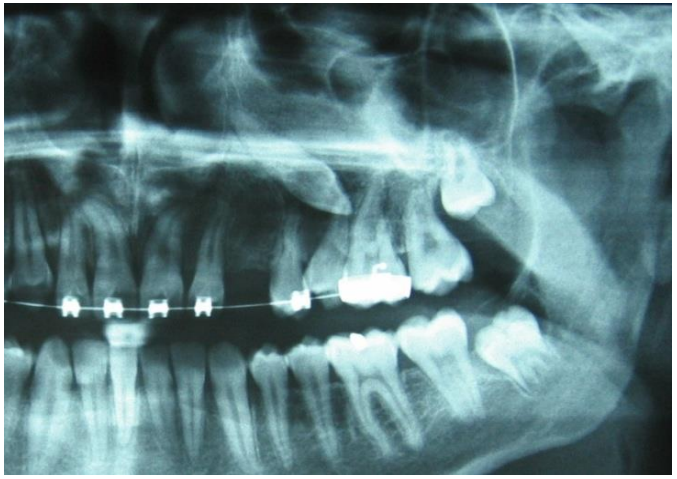


A dentigerous mandibular cyst in a young patient involving the ramus of the left mandible associated with the impacted lower 3rd molar.



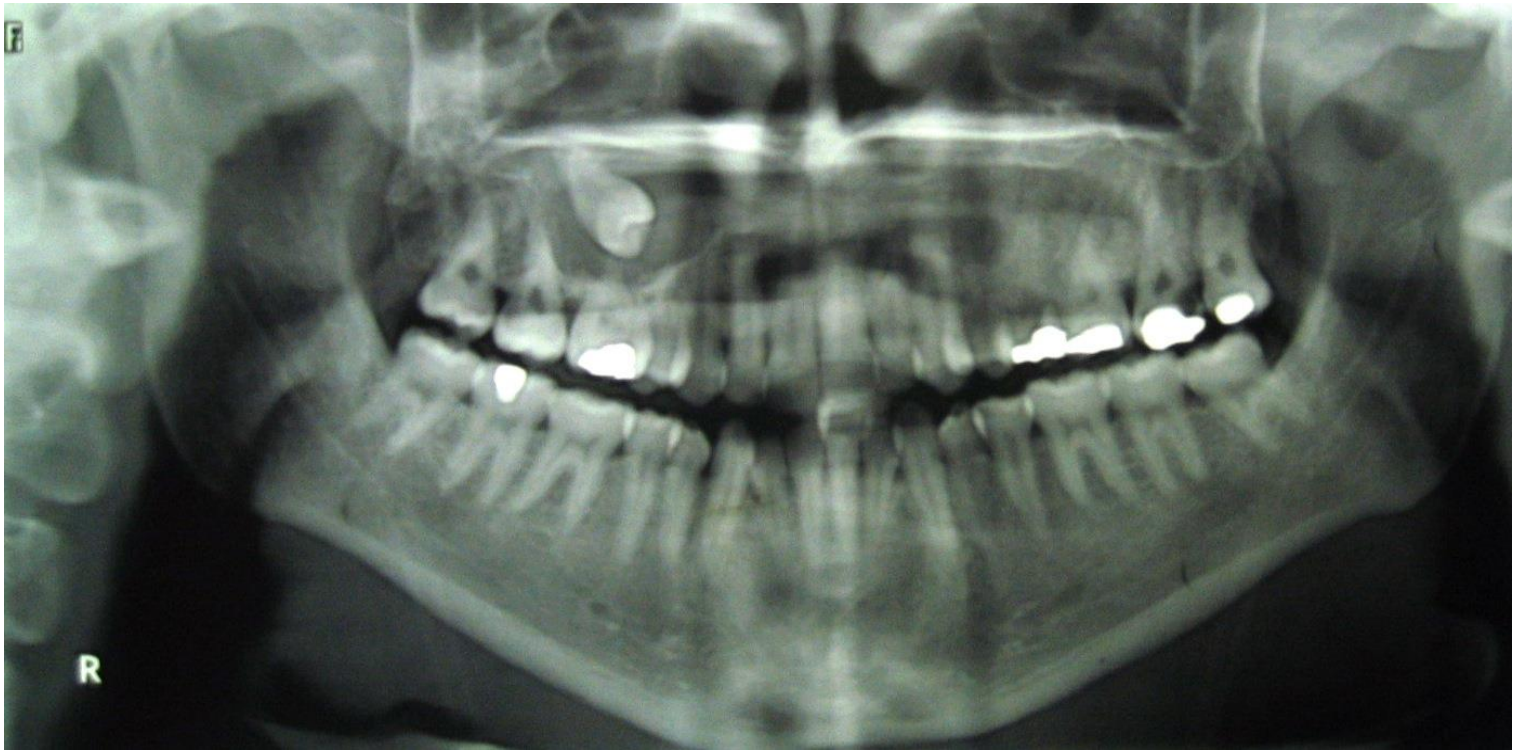
A dentigerous mandibular cyst in a young patient associated with the impacted lower 1st right premolar.

The cyst displaces the adjacent permanent teeth.



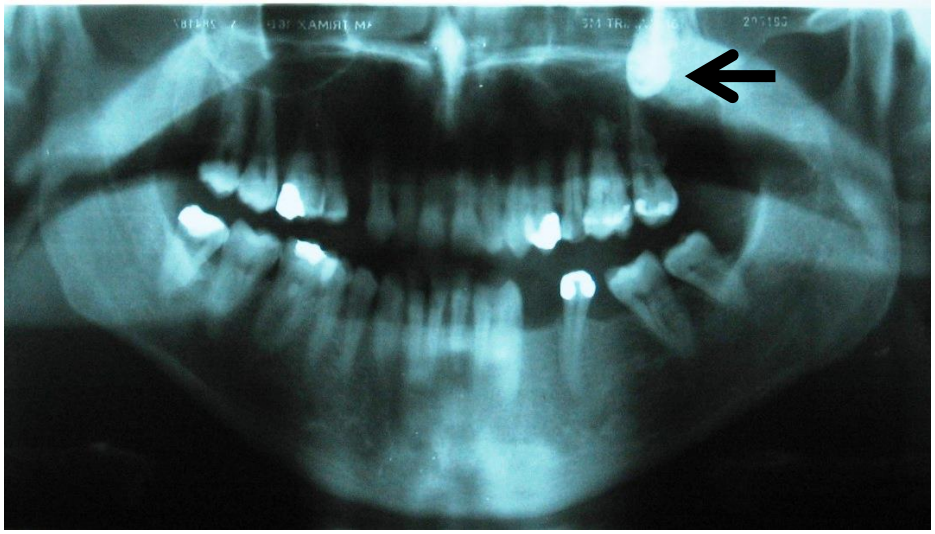
Extensive left maxillary cyst involving the impacted upper canine.

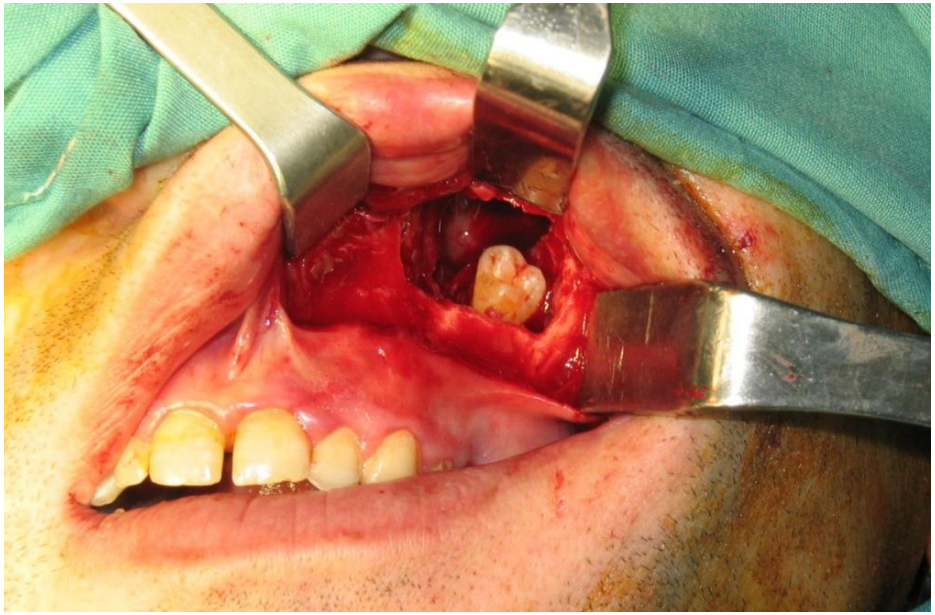
One year after marsupialization and decompression of the cyst, formation of new bone is present. The canine will "come down" into place by orthodontic traction (left).

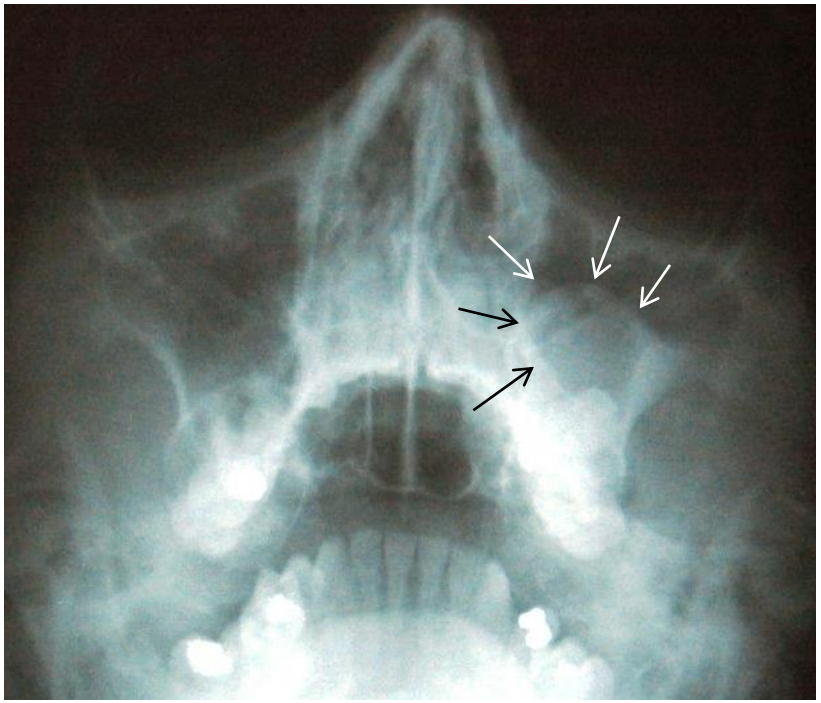


A cyst of the upper right maxilla, associated with the impacted upper 2nd premolar.

The cyst extends up to the nasal floor and slightly erodes the maxillary antrum.

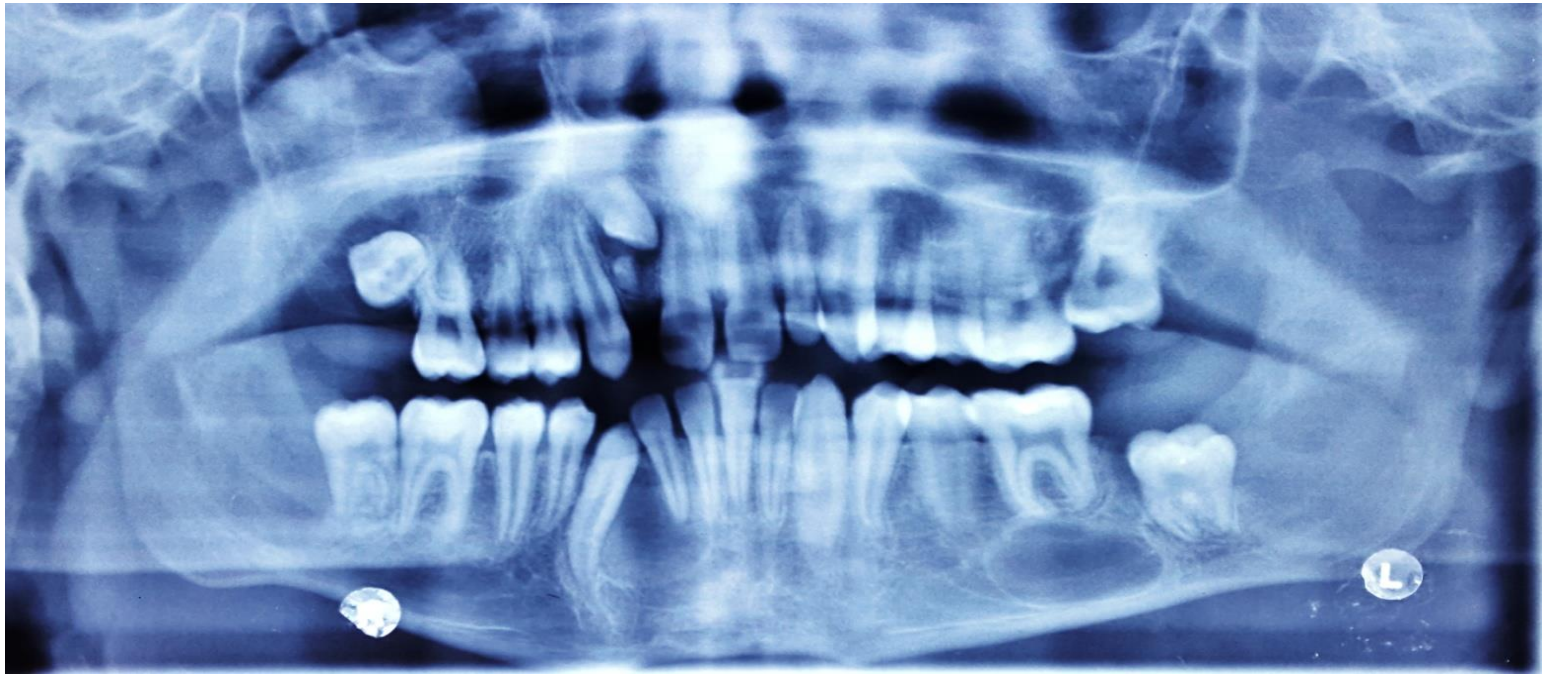






A cyst (multiple arrows) arising from the highly impacted left 3rd molar (thick arrow) was developed in the left maxillary antrum.

An impacted wisdom tooth may force against the adjacent 2nd molar, causing damage to its lateral surface. Moreover, this pressure can cause orthodontic problems by crowding of the other teeth.



Impacted teeth may be associated with various Syndromes (i.e. Cleidocranial Dysostosis, Down's Syndrome, Progeria, Achondroplastic Dwarfism).

In the depicted case of a Goltz- Gorlin syndrome, panoramic radiograph shows multiple ceratinocysts with multiple impacted teeth. Multiple nevi of the skin and skeletal anomalies are present.

Goltz-Gorlin syndrome: a multisystemic disease affecting multiple organ systems including skeletal, eye, skin, reproductive and neural systems.

Further Reading

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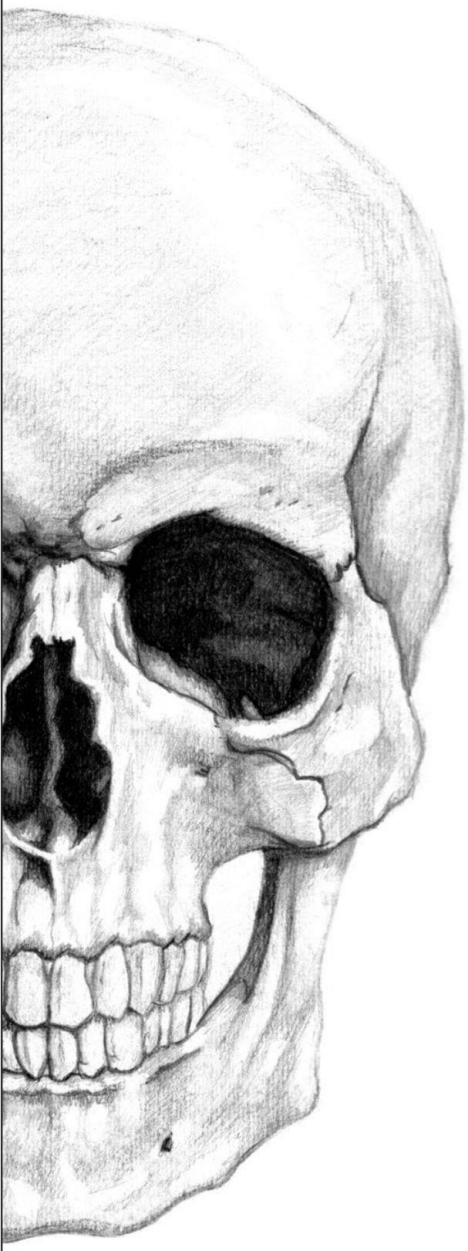

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