Diagnosis and Treatment of Impacted Maxillary Canines Using CBCT

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Today’s Topics
 Clinical situation for which CBCT is used
 Diagnosis of the impacted maxillary canines through radiographs
 Discuss factors associated with orthodontic treatment of impacted maxillary canines

When do we use CBCT?

Specific clinical situation for which CBCT is used...


Specific clinical situation for which CBCT is used...

Root-contact evaluation by panoramic radiography and cone-beam computed tomography of super-high resolution

Michael Lezajnger,1’ Alexander Dudo,2’ Catherine Giannopoulos2’ and Stergos Kiliaridis2’
Kielce, Poland, and Geneva, Switzerland

We evaluated 235 interdental sites by OPT and CBCT; 47 areas showed contact between adjacent roots in the OPT images. However, the CBCT images showed true contact in only 5 of these areas; ie, 11% of the diagnoses based on OPT images were true positive, whereas the rest (89%) was false positive.


Conclusions:
...Overall, postgraduate orthodontic program CBCT accessibility, usage, training, and interpretation were consistent in Eastern and Western regions, and most CBCT use was for specific diagnostic purposes of…


In the United States, lawsuits for mismanagement of palatally impacted canines rank in frequency, just behind periodontal problems developing during the orthodontic treatment of adults.


Most common reasons for identifying the previously impacted canines

- **Torque 28%** Reflects the difficulty in moving the root of the treated canine buccally.
- **Gingiva 27%** Indicates a difference in amount of attached gingiva or the relative heights of the gingival margins.
- **Alignment 17%** Reflects either a tendency toward relapse or a lack of complete alignment.

**Conclusion:**
The buccally displaced maxillary canine was significantly associated with hyperdivergent skeletal relationships, reduced maxillary intercanine width, and crowding in the maxillary arch.

**Factors associated with the duration of forced eruption of impacted maxillary canines: A retrospective study**


**Conclusions**
- The canines with cusp tips located mesially to the axes of the lateral incisors required **10 more visits** than the distally located canines on average.
- Less inclined canines required **longer treatment times**...

**Patient-dependent factors**

- Abnormal morphology of the impacted tooth
- Age
- Pathology of the impacted tooth
- Grossly ectopic tooth
- Resorption of the root of an adjacent tooth
- Lack of compliance (e.g., missed appointments, inadequate oral hygiene)

**Orthodontist-dependent factors**

Failure in the treatment of impacted maxillary canines

**Surgeon-dependent factors**


α: mesial inclination of the canine
A: measurement of the ectopically erupting canines utilizing panorex, the distance of the cusp tip to the occlusal plane

Surgeon-dependent factors

- Mistaken positional diagnosis
- Exposure on the wrong side or rummaging exposure
- Injury to the impacted tooth
- Injury to an adjacent tooth
- Soft-tissue damage
- Surgery without orthodontic planning

Orthodontist-dependent factors

- Mistaken positional diagnosis and inappropriate directional force
- Missed diagnosis of resorption of the root of an adjacent tooth
- Poor anchorage
- Inefficient appliance
- Inadequate torque

Grade of Inclination

<table>
<thead>
<tr>
<th>Grade of inclination (°)</th>
<th>Frequency, n (row percent, %)</th>
<th>Treatment proposal based on panoramic X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (0°–15°)</td>
<td>1 (100)</td>
<td>No statement, alignment, osteotomy, total</td>
</tr>
<tr>
<td>2 (16°–30°)</td>
<td>1.0 (99.0)</td>
<td>100.0</td>
</tr>
<tr>
<td>3 (31°–45°)</td>
<td>11 (100.0)</td>
<td>208</td>
</tr>
<tr>
<td>4 (&gt;45°)</td>
<td>11 (61.0)</td>
<td>32.7</td>
</tr>
<tr>
<td>Total</td>
<td>25 (100)</td>
<td>754</td>
</tr>
</tbody>
</table>

If the inclination of impacted canines in panoramic radiographs are more than 45°, they will more likely require surgical removal. If this is the final decision, the orthodontist must consider alternative treatments to substitute the missing canine. The options can be premolar substitution, prosthetic substitution, or autotransplantation by working together with other specialties.

Autotransplantation Articles

Tooth Autotransplantation

- Case 1
  - Immature Root Apices

- Case 2
  - Mature Root Apices

Case 1
Immature Root Apices

9 years old male

Park JH, Hayashi D, Yuasa K, Tai K. Multiple congenitally missing teeth treated with autotransplantation and orthodontics. AJODO 2012;141:641-651.

Missing UL5, LR4, LR5 and LL5

26-month Posttreatment Photographs

26-month Posttreatment CBCT Images

(A) Multiplanar reconstruction (MPR) image of the transplanted tooth (B) Panoramic rendering.
Case 2
Mature Root Apices

27 year old female


Pretreatment Radiographs

Tx Options
1) Ext. UR3 (UR4), ULA, and LLE
2) Ext. UR3 (UR4), LLE, and replace LLE with a dental implant
3) Ext. UR4 and autotransplantation

Progress Intraoral Photographs

1-year Postretention Photographs

30-month Postretention Photographs
Predicting and preventing root resorption: Part I. Diagnostic factors—

- The results showed that resorption occurs primarily in the maxillary anterior teeth, averaging over 1.4 mm.
- The worst resorption was seen in maxillary lateral incisors and in teeth with abnormal root shape (pipette, pointed, or dilacerated).

Sameshima GT and Sinclair PM. AJO-DO 2001;119:505-510.

Canine Dilaceration

- The majority of the dentists proposed removing the displaced canine if there was known root dilaceration. This is consistent with the results of Crismani et al., who reported that the prognosis for alignment was poor for retained canines with root dilaceration.


C. M. (18 years old)
Evaluation of minimal versus conventional presurgical orthodontics in skeletal Class III patients treated with two-jaw surgery

The overall treatment time was shortened by the decrease in presurgical orthodontic time...


What is apicotomy?

Definition

Apicotomy: a root fracture for surgical treatment of impacted maxillary canines with dilacerations or apical root ankylosis.

The diagnosis of apical root ankylosis is generally related to the position of the canine apex with the anatomic structure known as the Y line of Ennis (inverted Y).


The Y line of Ennis (inverted Y)

The Y line of Ennis (inverted Y) observed only on radiographs due to superimposition of the floor of the nasal cavity and the border of the maxillary sinus.

Araujo EA, Araujo CV, Tanaka OM. Apicotomy: Surgical management of maxillary dilacerated or ankylosed canines. AJO-DO 2013;144:909-915.

• Pulp tests should be performed after 3 months.
• A week after surgery, orthodontic traction should be applied with a force of approximately 100 g.
• The force should be monitored every 2 weeks because long periods without activation can lead to new ankylosis.
Conclusion
Apicotomy is a technique which has been successfully used during the past twenty years, for conservative intervention in cases of impacted upper canines with dilaceration or apical root-ankylosis. Currently, it could also be indicated for lower canines. The technique aims at freeing the tooth from its dilacerated or ankylosed portion inducing, thus, its traction and eruption. It was initially indicated after failure of conservative techniques for inducing spontaneous eruption and orthodontic traction. At the moment, image examinations allow precise diagnosis and its indication as a first surgical therapeutic option. The technique is counter-indicated for young patients with incomplete rhizogenesis or for teeth with total root ankylosis.

What are the prognosis of the A and B?

1) The apical root fragment remains inert and buried in the alveolar bone. Today, we do not withdraw any more samples of this segment.

2) If the root canal obstruction is observed, apicoectomy with retrograde obturation can be recommended. In conclusion, the prognosis for teeth treated with apicotomy thus far, reveals long permanency and functionality.

Dx of the Impacted Maxillary Canines through Radiographs

Answers from the Author (cont’d)

Answers from the Author

1) The apical root fragment remains inert and buried in the alveolar bone. Today, we do not withdraw any more samples of this segment.

2) If the root canal obstruction is observed, apicoectomy with retrograde obturation can be recommended. In conclusion, the prognosis for teeth treated with apicotomy thus far, reveals long permanency and functionality.
From panoramic radiographs most canines destined to become palatally impacted had cusp tips overlapping or mesial to lateral incisor root.


Conclusions:

...Three-dimensional volumetric imaging might provide better information for improved diagnosis and treatment plans.

As to the location of the lateral incisor root resorption, it was reported that the middle third of the root was the most likely to be attacked by resorption (82%) associated with ectopic eruption of maxillary canine, followed by the apical third (13%) and the cervical third (5%) of the root. Ericson S and Kurol J. AJO-DO 1988;94:503-513.

Canines in the sectors 3, 4 and 5 comprised 65% of lateral incisor root resorption and when the cusp of was positioned mesially to the lateral incisor, which was in sectors 4 and 5, the risk of complications increased 3 times. Ericson S and Kurol J. AJO-DO 1988;94:503-513.

In addition to routine panoramic radiograph, CBCT should be considered when...

- Canine inclination in the panoramic radiograph is more than 30 degrees.
- Root resorption in adjacent teeth is suspected.
- The canine apex cannot be identified on panoramic radiograph leading to suspicion of dilaceration of the canine root.

The width of the dental follicle showed no correlation to the resorption.

The dental follicle/tooth ratio was not significantly correlated to root resorption of the maxillary incisors.


Delayed tooth eruption: Pathogenesis, diagnosis, and treatment. A literature review
Lokesh Suri, BDS, DMD, MS,* Eleve Gagan, DDS, DMSc,* and Helen Varkevis, DDS, DMSc*

Right-left variations in eruption timings are minimal in most patients, but significant deviations might be associated with (for example) tumors or hemifacial macrosomia or microsomia and should alert the clinician to perform further investigation.

Conclusions: Significant deviations from established norms should be addressed with further examination of the patient’s local and systemic conditions and genetic disorders. In patients with delayed tooth eruption, careful and accurate diagnosis and treatment planning will allow the clinician to perform orthodontic treatment at the proper stage and might reduce the duration of orthodontic treatment.

Clinically, delayed tooth eruption is any of the following conditions:

- The normal eruption time has been exceeded.
- A tooth is absent in the dental arch and shows no potential for eruption.
- An unerupted tooth has complete root formation.
- A contralateral tooth has been erupted for at least 6 months.

Park JH, Tai K, Iida S. Unilateral delayed eruption of a mandibular permanent canine and the maxillary first and second molars, and agenesis of the maxillary third molar. AJO-DO 2013;143:134-139.

7.4 years old female
10.0 yrs old
11.3 yrs old
Park et al. AJO-DO 2013;143:134-139.

11.5 yrs old

CE Test, DT Sept. 2012

15. The appropriate amount of force used to orthodontically move an impacted canine is:
   a. 30 g
   b. 45 g
   c. 60 g
   d. 90 g


13.2 yrs old

15.3 yrs old
If the timing of eruption is delayed in terms of both chronologic and dental ages (mean ± 2 SD), it is unlikely that the permanent tooth will erupt without orthodontic intervention.


Summary

Clinical situations for which CBCT is used:
- Impacted canines, craniofacial anomalies, TMJ assessment, upper airway analysis, and maxillofacial development
- 3D CBCT images provide valuable information about impacted canines to better diagnose and treat these cases surgically and orthodontically.
- When canine impactions are suspected in sectors 3, 4 and 5 on panorex, CBCT should be considered for those with suspected incisor root resorption.

Summary (cont’d)

Factors associated with the orthodontic treatment of impacted maxillary canines:
- Patients aged more than 25 years require remarkably longer treatments than younger patients.
- From panoramic radiographs, most canines destined to become palatally impacted had cusp tips overlapping to lateral incisor root.
- The canines with cusp tips located mesially to the axes of the lateral incisors and farther away from the occlusal plane required require longer treatments.

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感謝합니다!!!