

Diagnosis and Treatment of Impacted Maxillary Canines Using CBCT



2014 AAO Annual Session
April 25 - 29, 2014
New Orleans, LA

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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

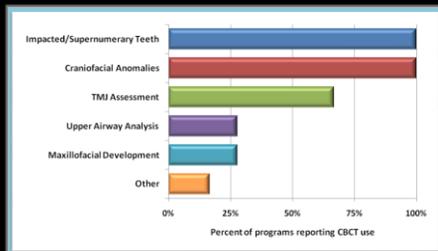
When do we use CBCT?



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...

Smith BR, Park JH, Cederberg RA. An evaluation of cone-beam computed tomography use in postgraduate orthodontic programs in the United States and Canada. *J Dent Educ* 2011;75:98-106.

Specific clinical situation for which CBCT is used...



Smith et al. *J Dent Educ* 2011;75:98-106.

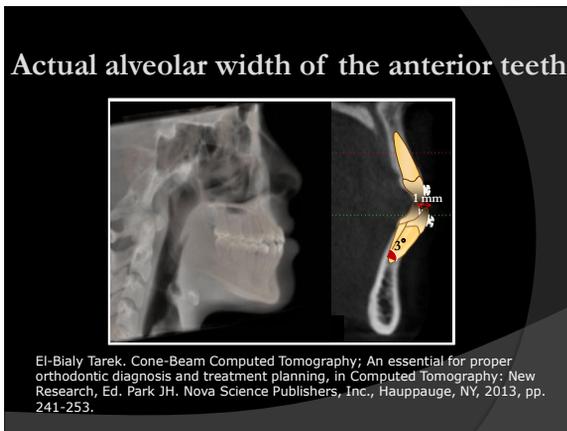
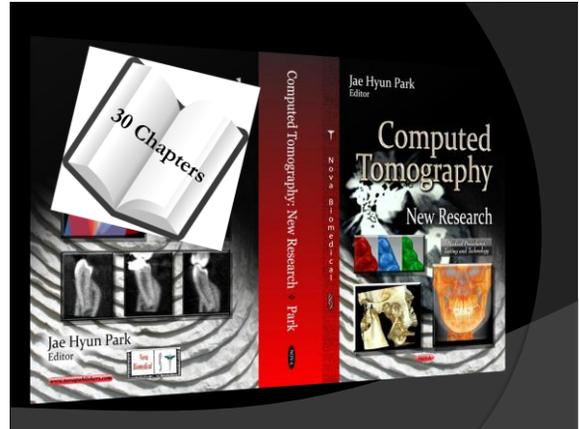
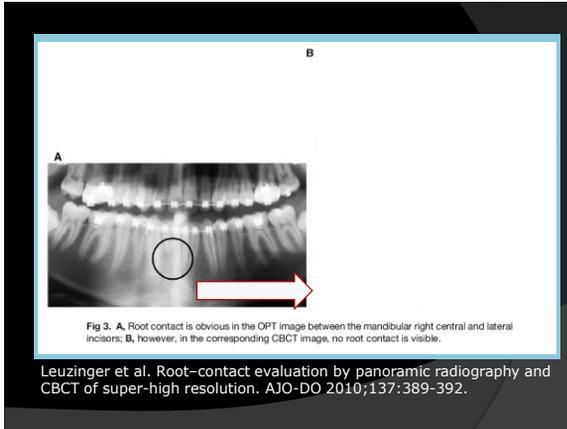
Specific clinical situation for which CBCT is used...

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

Michael Leuzinger,^a Alexander Dudic,^b Catherine Giannopoulou,^c and Stavros Kiliaridis^d
Winterthur 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.

Am J Orthod Dentofacial Orthop 2010;137:389-392.



POINT/COUNTERPOINT **AJO-DO**

Palatally impacted canines: The case for preorthodontic uncovering and autonomous eruption

David P. Mathews* and Vincent G. Kokich*
Seattle, Wash

AJO-DO 2013;143:450-458.

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

The surgical and orthodontic procedures can increase the risks of gingival recession, bone loss, pulpal damage, and root resorption.

Woloshyn et al. Pulpal and periodontal reactions to orthodontic alignment of palatally impacted canines. Angle Orthod 1994;64:257-264.

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.

Mathews DP and Kokich VG. AJO-DO 2013;143:450-458.

European Journal of Orthodontics 35 (2013) 305–309
doi:10.1093/ejod/ekj133
Advance Access publication 14 November 2012

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Prevalence rate and dentoskeletal features associated with buccally displaced maxillary canines

Manuela Mucedero*, Maria Rosaria Ricchiuti*, Paola Cozza* and Tiziano Baccetti**,*

Mucedero et al. Eur J Orthod 2013;35:305-309.

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

CLINICAL PRACTICE | LITERAL REVIEW

A review of the diagnosis and management of impacted maxillary canines

Bedoya MM and Park JH. J Am Dent Assoc 2009;140:1485-1493.

What is the prevalence of impacted maxillary canines? What are the associated dentoskeletal features? What are the treatment options? This review discusses the diagnosis and management of impacted maxillary canines. The prevalence of impacted maxillary canines is reported to be 1.5% to 10.5%. The most common skeletal relationship associated with impacted maxillary canines is Class II. The most common dental relationship associated with impacted maxillary canines is crowding. The most common treatment option for impacted maxillary canines is orthodontic treatment. Other treatment options include surgical removal, orthodontic extrusion, and orthodontic traction.

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

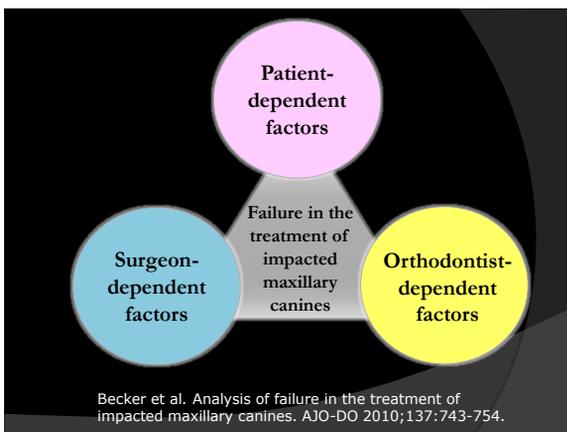
Ericson S and Kurol J. Eur J Orthod 1998;10:283-295.

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

Zuccati G, Ghobadlu J, Nieri M, Clausera C.
AJO-DO 2006;130:349-356.

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)

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 5. Canine inclination and treatment proposals

Table 5. Caninusinklination und Therapievorschlag

Grade of inclination	Treatment proposal based on panoramic X-ray			
	Frequency, n	No statement	Alignment	Osteotomy
1 (0°–15°)	1	103	0	104
	1.0	99.0	0.0	100.0
2 (16°–30°)	0	206	2	208
	0.0	99.0	1.0	100.0
3 (31°–45°)	11	187	36	234
	4.7	79.9	15.4	100.0
4 (>45°)	13	127	68	208
	6.3	61.0	32.7	100.0
Total	25	623	106	754

Wriedt S, J Orofac Orthop 2012;73:28–40.

- ◉ 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.

Wriedt S, J Orofac Orthop 2012;73:28–40.

Autotransplantation Articles

- ◉ Jae Hyun Park, Kiyoshi Tai, Daisuke Hayashi. Tooth autotransplantation as a treatment option: a review. *Journal of Clinical Pediatric Dentistry*, 2011;35:129–136.
- ◉ Kiyoshi Tai, Jae Hyun Park, Daisuke Hayashi, Asuka Miura. Autotransplantation of multiple congenitally missing teeth in orthodontic treatment. *Journal of Clinical Orthodontics*, 2011;45:399–407.
- ◉ Jae Hyun Park, Daisuke Hayashi, Kenji Yuasa, Kiyoshi Tai. Multiple congenitally missing teeth treated with autotransplantation and orthodontics. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012;141:641–651.
- ◉ Jae Hyun Park, Kiyoshi Tai. Autotransplantation of a fully developed maxillary premolar to a missing mandibular premolar site. *Journal of Clinical Orthodontics*, 2013;47:199–206.

Tooth Autotransplantation

Case 1

- Immature Root Apices

Case 2

- Mature Root Apices

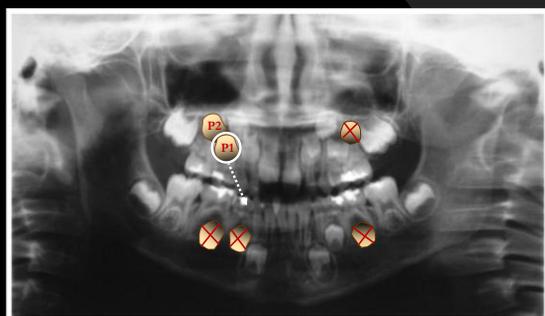
Case 1

Immature Root Apices



9 years old male

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



Missing UL5, LR4, LR5 and LL5



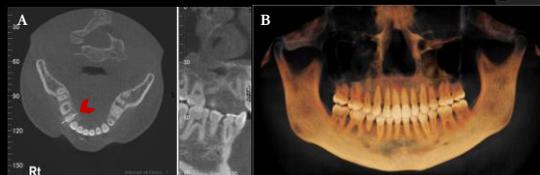
14.5 years old



26-month Posttreatment Photographs



26-month Posttreatment CBCT Images



(A) Multiplanar reconstruction (MPR) image of the transplanted tooth (B) Panoramic rendering.

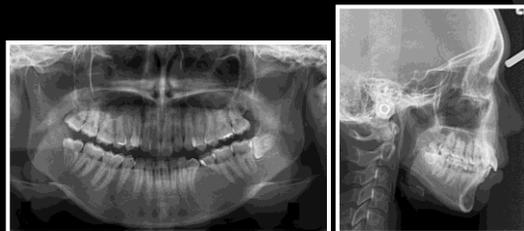
Case 2 Mature Root Apices



27 year old female

Park JH and Tai K. Autotransplantation of a fully developed maxillary premolar to a missing mandibular premolar site. J Clin Orthod 2013;47:199-206.

Pretreatment Radiographs



Tx Options

- 1) Ext. UR3 (UR4), UL4, and LLE
- 2) Ext. UR3 (UR4), LLE, and replace LLE with a dental implant
- 3) Ext. UR4 and autotransplantation

Progress Intraoral Photographs



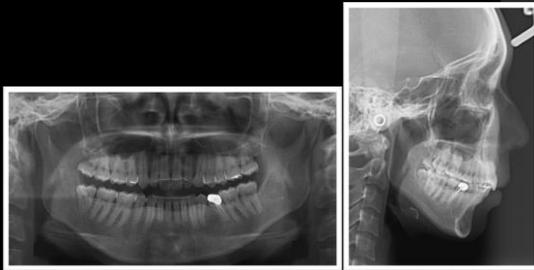
1-year Postretention Photographs



30-month Postretention Photographs



30-month Postretention Radiographs



Canine Dilaceration



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

Table 6. Canine dilaceration and treatment proposals

Tabelle 6. Caninusdilazeration und Therapievorschlagn

Canine dilaceration visible in panoramic X-ray

Frequency, n Row percent, %	Treatment proposal based on panoramic X-ray			Total
	No state- ment	Align- ment	Oste- otomy	
No	24 3.2	620 83.7	97 13.1	741 100.0
Yes	1 7.7	3 23.1	9 69.2	13 100.0
Total	25	623	106	754

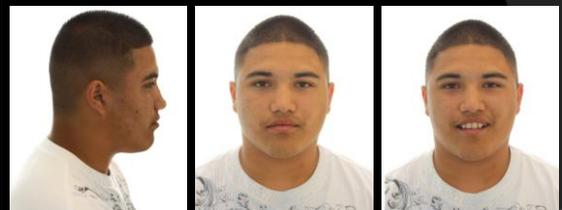
Wriedt S. J Orofac Orthop 2012;73:28-40.

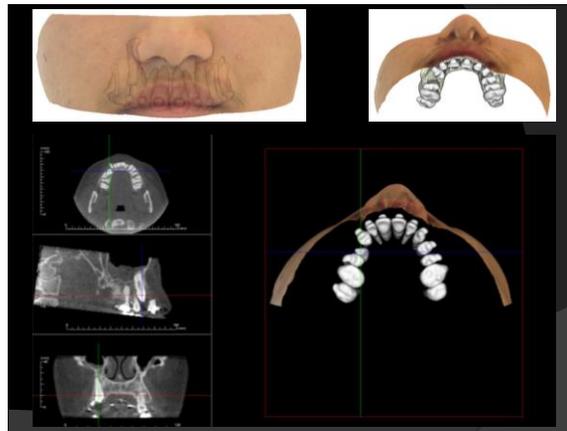
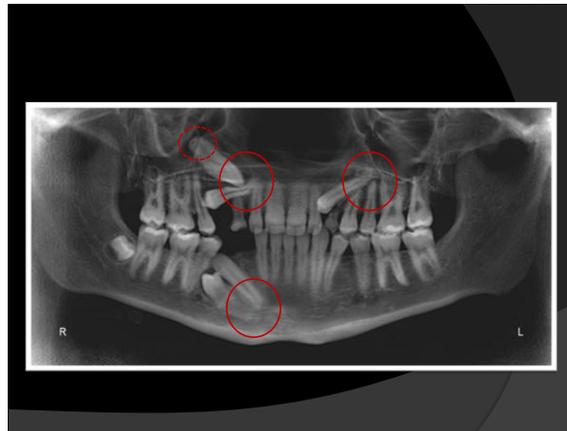
Canine Dilaceration

- ◎ 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.

Wriedt S. J Orofac Orthop 2012;73:28-40.

C. M. (18 years old)





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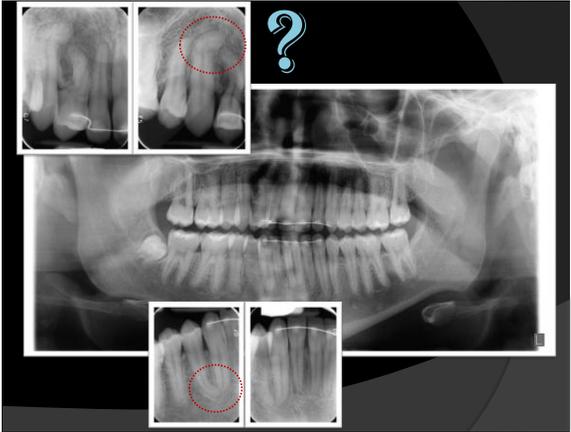
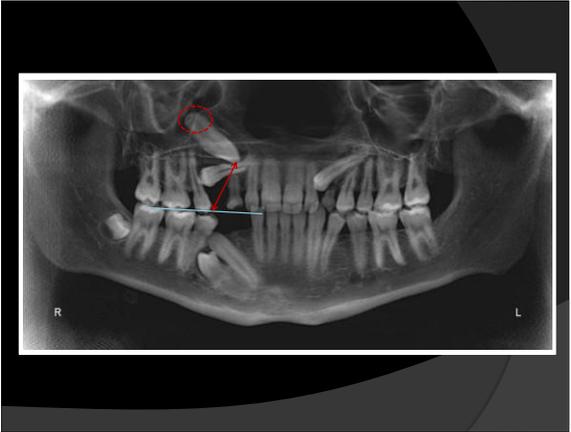
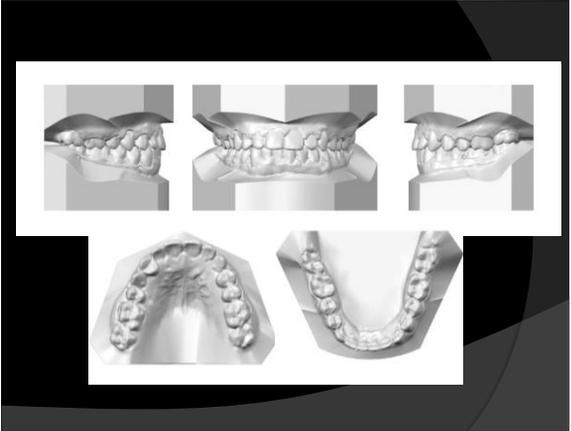
Dual Approach for Moving a Blocked-Out Tooth into the Arch

JAE HYUN PARK, DMD, MSD, MS, PHD
DONALD J. SANCHEZ, DDS, MS

Park JH and Sanchez DJ. J Clin Orthod 2008;42:356-357.



Park JH and Sanchez DJ. JCO 2008;42:356-357.





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...**

Joh BJ, Bayome M, Park JH, Park JU, Kim YJ, Kook YA. J Oral Maxillofac Surg 2013;71:1733-1741.

What is apicotomy?



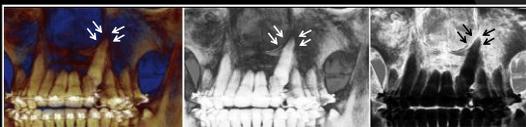
Definition

© **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)*.

Puricelli E. Head & Face Medicine 2007;3:33.

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.



Araujo et al. 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.

Puricelli E. Head & Face Medicine 2007;3:33.

What are the prognosis of the A and B?

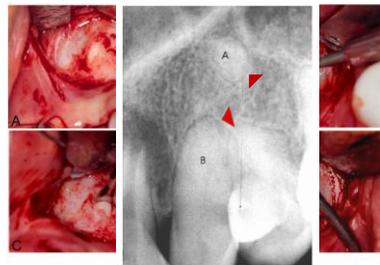


Figure 5 A. The bone cortical is removed with a number 1/2 spherical bur and abundant around 1.0 mm deep is prepared follow with the double-bezel chisel. D. After it.

Figure 6 Periapical radiograph after the complete exposure of the tooth crown in the oral cavity and position in the dental arch. A. The apical fragment remains close to its preoperative position. B. The pulp root canal is almost completely obliterated. C. A transversal groove where a groove should be produced. D. The groove becomes clearly visible.

Puricelli E. Head & Face Medicine 2007;3:33.

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.*

Answers from the Author (cont'd)

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

Impacted Maxillary Canine

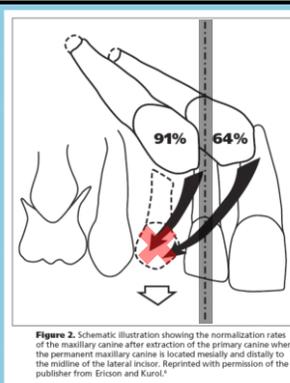
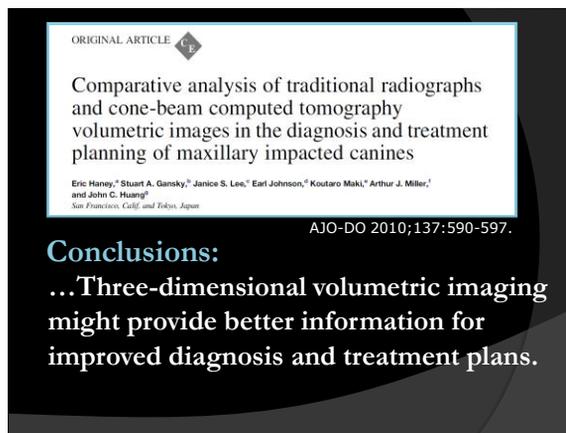
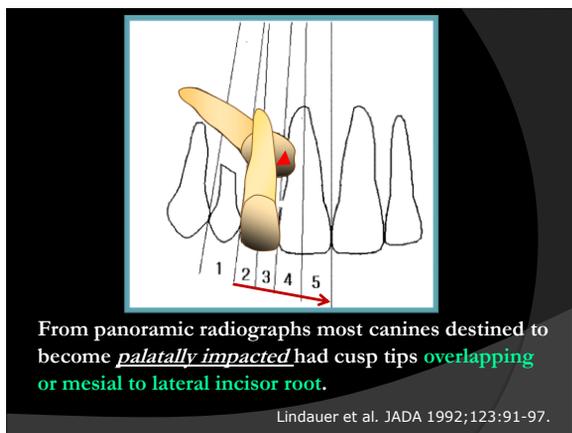
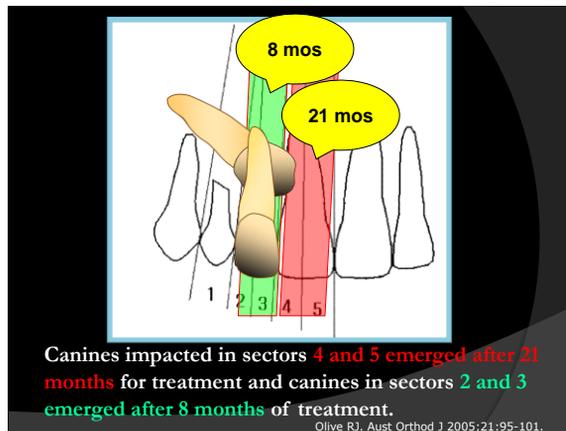
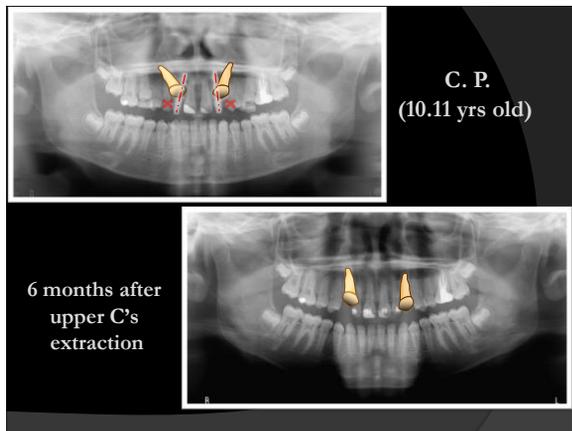
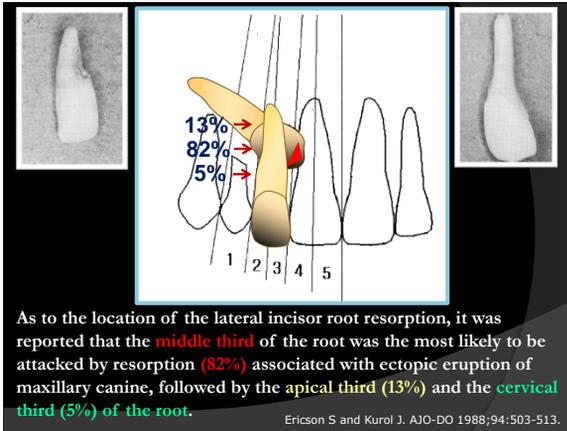


Figure 2. Schematic illustration showing the normalization rates of the maxillary canine after extraction of the primary canine when the permanent maxillary canine is located mesially and distally to the midline of the lateral incisor. Reprinted with permission of the publisher from Ericson and Kuroki.⁶

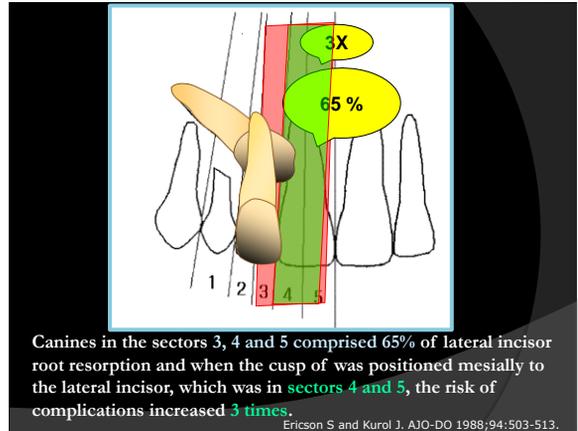
Bedoya MM and Park JH, JADA 2009;140:1485-1493.





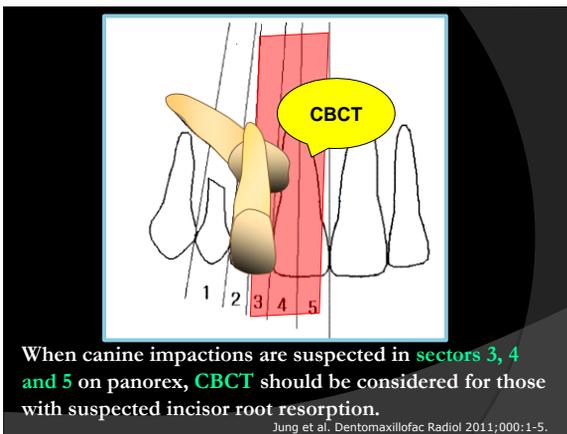
As to the location of the lateral incisor root resorption, it was reported that the **middle third** of the root was the most likely to be attacked by resorption (82%) associated with ectopic eruption of maxillary canine, followed by the **apical third** (13%) and the **cervical third** (5%) of the root.

Ericson S and Kuroi 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 4 was positioned mesially to the lateral incisor, which was in **sectors 4 and 5**, the risk of complications increased **3 times**.

Ericson S and Kuroi J. AJO-DO 1988;94:503-513.



When canine impactions are suspected in **sectors 3, 4 and 5** on panorex, **CBCT** should be considered for those with suspected incisor root resorption.

Jung et al. Dentomaxillofac Radiol 2011;000:1-5.

- ⊙ 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**.
- Wriedt S. J Orofac Orthop 2012;73:28-40.

Dental Follicle?

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

Ericson S and Kuroi J. AJO-DO 1988;94: 503-513.

UPDATE

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

Brusveen et al. AJO-DO 2012;141:427-435.

Bedoya MM and Park JH, JADA 2009;140:1485-1493.

REVIEW ARTICLE

Delayed tooth eruption: Pathogenesis, diagnosis, and treatment. A literature review

Lokesh Suri, BDS, DMD, MS,* Eleni Gagari, DDS, DMSc,† and Heleni Vastardis, 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 microsomia or macrosomia and should alert the clinician to perform further investigation.

Conclusions:

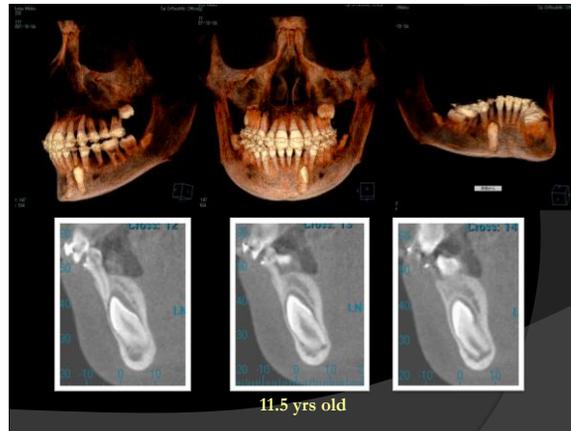
... Significant deviations from established norms should be addressed with further examination of the patient's local and systemic conditions and genetic disorders. In patients with delayed tooth eruption, careful and accurate diagnosis and treatment planning will allow the clinician to perform orthodontic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

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.

© 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**.

da Costa CT, Torriani DD, Torriani MA, da Silva RB. Central incisor impacted by an odontoma. J Contemp Dent Pract 2008;9:122-128.

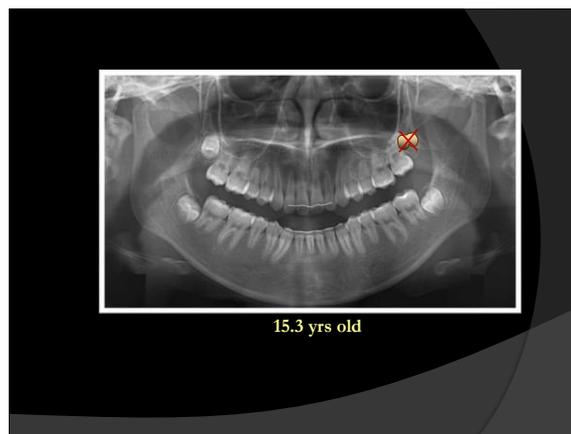


CE Test, DT Sept. 2012

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.

Park JH, Srisurapol T, Tai K. Dent Today 2012;31:62-69.



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.

Suri et al. Delayed tooth eruption: pathogenesis, diagnosis, and treatment. A literature review. AJO-DO 2004;126:432-445.

www.aaoinfo.org/practice/patient-management/forms-releases

The screenshot shows the AAO website interface. The main navigation bar includes links for Meetings & Events, Education, Practice Management, News & Publications, Library & Research, Legal & Advocacy, and Communities. Below the navigation bar, there is a section titled 'Informed Consent Videos and Forms' with a list of links. The link 'Impacted Teeth Supplemental Informed Consent Form' is highlighted with a red box.

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 require longer treatments.

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