

## Interdisciplinary Management of Delayed Eruption and Maxillary Impacted Canines Using Closed and Open Exposure Techniques-Case Report

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### Abstract

**Introduction:** Dental esthetics and properly aligned teeth can be affected by delayed canine eruptions. The decision to expose the impacted tooth or extraction and replacement with dental implant plays an important role in function and esthetics. Surgical intervention is often used to bring the impacted canines into a normal position. This treatment requires timely management by the orthodontic and surgical teams.

**Case Report:** A 11-year-old female with an unremarkable medical history was referred for delayed eruption of primary dentition and impacted maxillary canines #6, 11. Upon clinical and radiographic evaluations, the primary canines were present. Both #6 and 11 were mesially impacted. Tooth #11 had an underdeveloped root. Treatment plan included extractions of primary teeth, maxillary expansion and later exposure of maxillary canines with close monitoring of #11 root formation. This treatment allowed more space for eruption of permanent teeth and root development. After two years, the canines exhibited adequate root formation and canine exposure was carried out. Both canines were exposed using a closed technique with secured gold chains to allow eruption. All teeth were aligned with good static and functional occlusion post canine exposure.

**Conclusion:** The current case presents the successful orthodontic and surgical management of bilaterally impacted canines. Esthetically pleasing results were achieved with adequate keratinized gingiva and stable periodontium with one-year follow-up.

**Keywords:** Esthetics; Exposure; Impacted; Orthodontics; Periodontics; Tooth

### Introduction

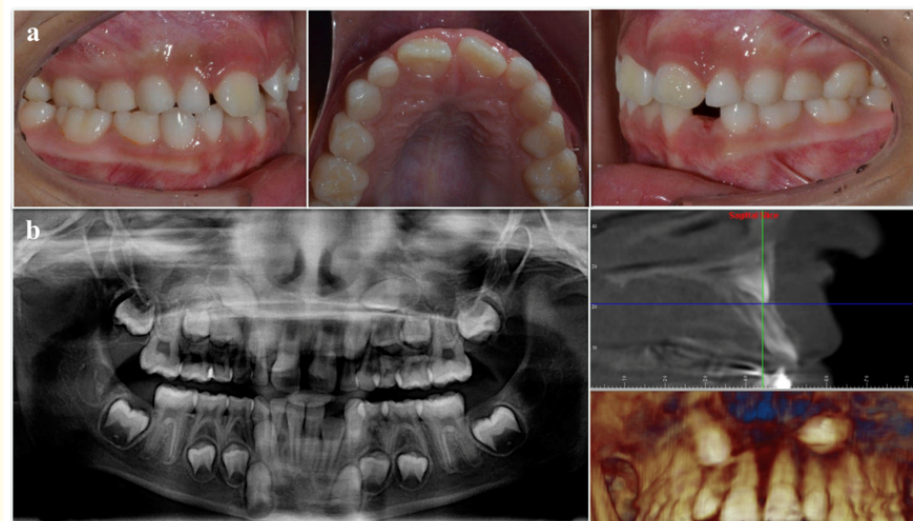
Canine impactions affect proper alignment of the dentition with unaesthetic results. Becker defined an impacted tooth as one that fails to erupt into its normal functioning position [1]. Permanent maxillary canines are the second most commonly impacted teeth [2]. Canine development begins at 4 - 5 months post-natal, with the tooth germ positioned on the anterior wall of the maxillary sinus and surrounded by the nasal cavity and orbital floor. Canine tooth germ remains above the root of the lateral incisor until the crown is calcified [3]. The maxillary canines calcification begins 12 months after birth. Calcification is completed by age six when the crown tip is at the level of the

floor of the nose [4]. By age 11, canine eruption begins and it takes approximately 2 - 3 years for root development completion. The majority of canines had attained almost three-quarters of their roots at the time of clinical emergence [5]. Early canine displacement in the mixed dentition can be detected around age 8 making it useful for intervening in potential impaction cases. Becker suggested that root development alone should be the basis for defining the expected time of eruption for different teeth. For instance, if an erupted tooth has less than the expected  $\frac{3}{4}$  of root length, its eruption is considered premature [1].

Management of canine exposure requires timely orthodontic and surgical interventions. Literature supports closed and open surgical exposure techniques to expose impacted canines [6]. The position of the impacted canine dictates which method to be used for exposure [7]. The current case highlights successful management of a patient with delayed eruption pattern and underdeveloped root #11; that was destined for extraction and implant placement. The timely orthodontic intervention to expand the arch with removal of primary dentition allowed adequate arch space and thereby proper root development #11, avoiding replacement with dental implant. Thus, the case was managed without permanent teeth extractions using correct surgical exposure techniques and the dentition was properly aligned.

### Case Presentation

A 11-year-old female with unremarkable medical history was referred for delayed eruption and impacted permanent maxillary canines. The primary canines were present and teeth #6 and 11 were impacted obliquely toward the mesial. Tooth #11 had an underdeveloped root (Figure 1).



**Figure 1:** Initial presentation: a) Facial clinical intra-oral view showing mixed dentition; b) Panorex and cone beam computed tomography showing impacted canine positions close to the nasal floor.

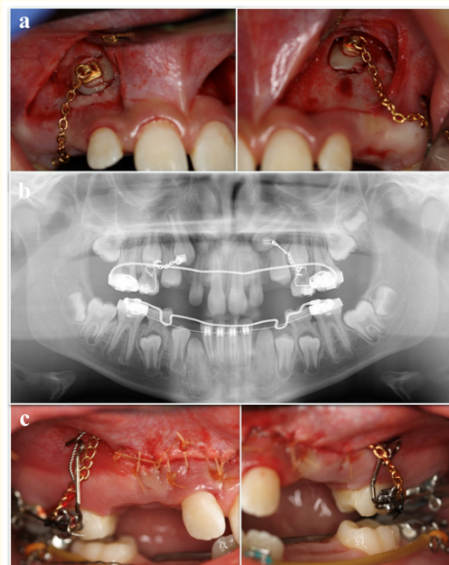
### Case management

The treatment plan included maxillary expansion, extraction of primary canines and first molars and bilateral exposure of permanent canines with #11 root formation monitoring. Verbal and written consent received from parents and patient. Maxillary expansion and primary teeth extractions allowed for more space for root development of permanent teeth (Figure 2). At age 13, the canines exhibited adequate root formation and bilateral canine exposure was indicated. A closed surgical approach was used (Figure 3). A paracrestal inci-

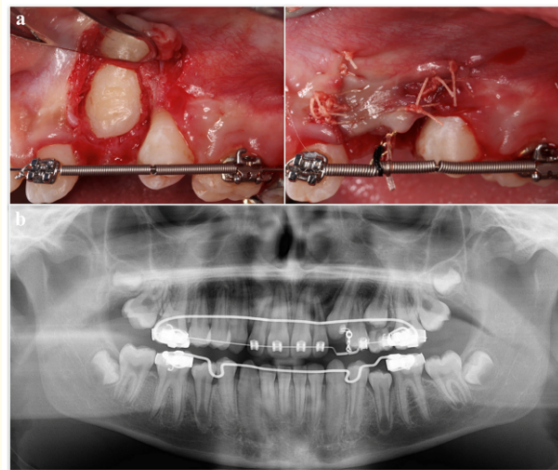
sion with two vertical incisions positioned 1 mm from the adjacent teeth were performed. A full-thickness flap was reflected and facial bone was removed to expose the anatomical crowns (Figure 3a) while maintaining an adequate band of keratinized tissue facially. A gold chain<sup>‡</sup> was secured using a composite resin<sup>§</sup> material and the flap was sutured occlusally with 4-0 resorbable sutures<sup>||</sup> (Figure 3b and 3c). Orthodontic management proceeded with distal traction of the canines. Once the canines cleared the root apices of the lateral incisors vertical traction was initiated. At age 14, the right canine erupted without need for further exposure while the left one underwent a second exposure with an apically repositioned flap. Orthodontic traction continued in a vertical direction until the tooth was in the arch (Figure 4a and 4b).



**Figure 2:** a) Intra oral photos showing maxillary expansion allowing more space for eruption of permanent teeth and root development; b) Panoramic view during expansion and before primary teeth extractions.



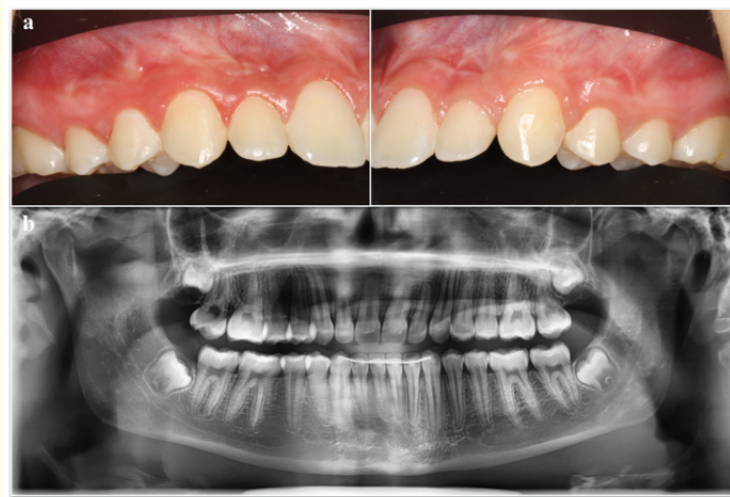
**Figure 3:** Due to high impaction position, canines were exposed using closed technique with gold chain to allow eruption: a) Facial view showing placement of orthodontic gold chain on upper right (#6) and upper left (#11) canines; b) Panoramic view of bonded gold chain post-surgical exposure; c) Facial view showing repositioned buccal flaps with gold chains secured to orthodontic appliances.



**Figure 4:** Clinical and radiographic presentation of the second (open) exposure of upper left canine (#11) at age 14: a) Apically positioned flap exposure technique maintaining adequate keratinized gingiva facially using 4-0 resorbable sutures with segmental wire attached to the first molar bands and primary second molar brackets and bent vertically to the level of the canine crowns mesial to the second primary molar bracket was used to apply the distal force to the canines without extrusion to reduce damage to the roots of the lateral incisors; b) Panoramic view showing gold chain attached post-surgical exposure.

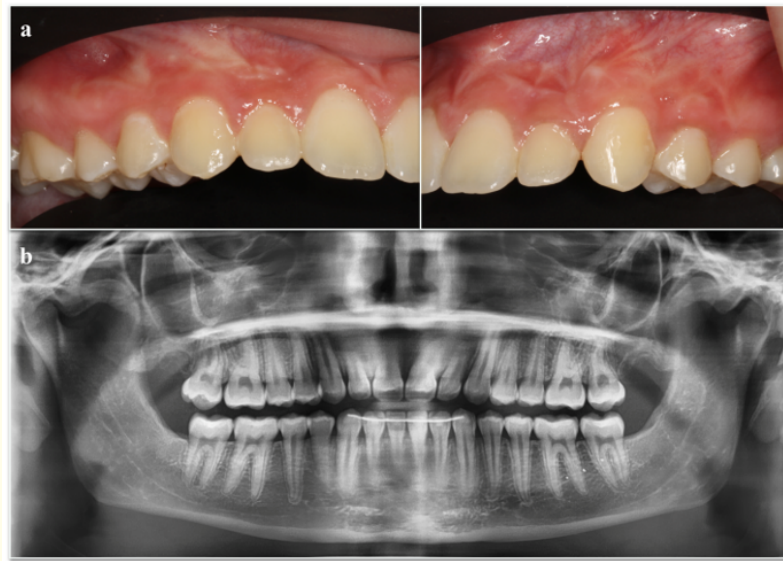
#### Clinical outcomes

Despite the under developed roots, extractions of primary teeth and palatal expansion allowed for proper root development #11. Thus, the maxillary canine was retained without need for extraction and managed using proper surgical exposure techniques. Post-surgical exposure, both permanent maxillary canines were aligned with the remaining teeth without damage or root resorption of the central or lateral incisors. An esthetically pleasing result was obtained with adequate keratinized gingiva and stable periodontium at age 15 (Figure 5a and 5b). The 12-months follow-up showed good static and functional occlusion with esthetically pleasing outcomes clinically and radiographically at age 16 (Figure 6a and 6b).



**Figure 5:** Post-orthodontic presentation at age 15: a) Facial view showing proper positioning of the two impacted canines with healthy periodontium; b) Radiographic position showing well aligned canines.





**Figure 6:** Twelve months follow-up at age 16 showing: a) Stable canines with healthy periodontium clinically; b) Properly aligned canines radiographically with wisdom teeth extracted.

## Discussion

Impacted canines create a challenge to the orthodontic and surgical teams. When the impacted canines have adequate root formation, canine exposure is generally indicated [7]. However, if canine exposure is not an option, implant placement is an alternative. Indications for extraction include unfavorable canine position, deep impactions, root dilacerations, severe arch limitations or when orthodontic movement may harm adjacent teeth [8]. Requirements for implant placement following extraction include adequate bone quantity and quality, evaluation of anatomical factors, width of cortical plates, implant selection and positioning [9].

In the current report, the patient and parents were informed about the underdeveloped of root #11 and extractions of primary teeth and expansion were recommended to improve arch space and canine root formation rather than extraction [5]. Therefore, timely extractions of primary teeth combined with maxillary expansion, allowed adequate arch space for  $\frac{3}{4}$  of the root to develop and surgical exposure.

Based on the impacted canine position, different exposure techniques were recommended [7]. A closed technique was used for #6. Due to the high impacted position of #11, the first exposure was a closed technique using a gold chain for anchorage whereas the second was an open technique. The closed procedure is preferred over the open technique as it has minimal manipulation of the dental follicle which is important in tooth eruption. Moreover, it results in preservation of keratinized tissue, less trauma to the periodontium and ideal pulling forces along the long axis of the impacted tooth with reduced chance of external resorption [7,8]. The closed technique allows adequate time for increased arch space for the canine to continue root development and the open procedure allows proper positioning of the impacted canine for orthodontic eruption [10]. Proper surgical exposure is important to minimize the chances of uneven gingival contour, asymmetrical clinical crown length, lack of attached and/or keratinized gingiva, relapse of surgical exposure or damage to adjacent teeth [8]. Hence, timely inter-disciplinary management among the orthodontic and surgical teams is important for proper outcome.

**Conclusion**

The current case report presents successful surgical management of bilaterally impacted canines using both closed and open exposure techniques. A good static and functional occlusion, proper canine positioning and esthetically pleasing results with a stable periodontium were achieved.

**Summary Table**

<ul style="list-style-type: none"> <li>• Why is this case new information?</li> </ul>	<ul style="list-style-type: none"> <li>• Delayed primary teeth eruption and inadequate jaw space affected root development of impacted permanent canines.</li> <li>• The underdeveloped canine roots affect treatment where canine exposure or canine extractions for implant replacement are recommended.</li> </ul>
<ul style="list-style-type: none"> <li>• What are the keys to successful management of this case?</li> </ul>	<ul style="list-style-type: none"> <li>• Timely extraction of primary dentition and jaw expansion allowed proper root formation of the permanent canines.</li> <li>• Close monitoring of root development to finalize treatment for permanent canine exposures versus extractions.</li> <li>• Evaluate impacted canine position to determine appropriate surgical (open versus closed) technique to be employed.</li> </ul>
<ul style="list-style-type: none"> <li>• What are the primary limitations to success in this case?</li> </ul>	<ul style="list-style-type: none"> <li>• Early detection of proper root development and adequate arch space for normal canine eruption.</li> <li>• Monitoring root formation during expansion phase.</li> </ul>

**Conflicts of Interest**

No conflict of interest.

**Bibliography**

1. Becker A. "The Orthodontic Treatment of Impacted Teeth, 2<sup>nd</sup> Edition". Informa Healthcare, London (2007).
2. Bass TB. "Observations on the Misplaced Upper Canine Tooth". *The Dental Practitioner and Dental Record* 18.1 (1967): 25-33.
3. Moss JP. "The Unerupted Canine". *The Dental Practitioner and Dental Record* 22.6 (1972): 241-248.
4. Broadbent B. "Ontogenic Development of Occlusion". *Angle Orthodontist* 11.4 (1941): 223-241.
5. Gron AM. "Prediction of Tooth Emergence". *Journal of Dental Research* 41 (1962): 573-585.
6. Kokich VG. "Surgical and Orthodontic Management of Impacted Maxillary Canines". *American Journal of Orthodontics and Dentofacial Orthopedics* 126.3 (2004): 278-283.
7. Kinaia BM., et al. "Surgical Management of Impacted Canines: A Literature Review and Case Presentations". *Journal of Dentistry and Oral Biology* 1.3 (2016): 1012.
8. Cruz RM. "Orthodontic Traction of Impacted Canines: Concepts and Clinical Application". *Dental Press Journal of Orthodontics* 24.1 (2019): 74-87.

9. Sclar Anthony G. "Strategies for Management of Single-Tooth Extraction Sites in Aesthetic Implant Therapy". *Journal of Oral and Maxillofacial Surgery* 62.2 (2004): 90-105.
10. Mathews DP and VG Kokich. "Palatally Impacted Canines: The Case for Preorthodontic Uncovering and Autonomous Eruption". *American Journal of Orthodontics and Dentofacial Orthopedics* 143.4 (2013): 450-458.

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