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Classical Case of Palatally Impacted Canine Treated With Modified Ballista Spring: A Case Report

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Abstract

Maxillary canine is the second most commonly impacted teeth, following third molars [1]. Impacted canines can lead to functional, aesthetic, and periodontal complications which necessitates its timely diagnosis and intervention. The management of impacted canines requires a multidisciplinary approach involving precise localization, surgical exposure, and orthodontic traction to achieve proper alignment in the dental arch.

This case report describes the orthodontic management of a unilateral impacted maxillary canine in an adolescent patient. The impaction was identified through clinical and radiographic evaluation, including panoramic radiography and cone-beam computed tomography (CBCT), which confirmed the exact position and angulation of the impacted tooth. A combination of surgical exposure and orthodontic traction was employed with the help of modified ballista spring to facilitate proper alignment. The treatment plan was tailored to minimize complications and ensure a favourable functional and aesthetic outcome. Although patient reported late, successful and stable result has been achieved after 30 months of treatment.

Keywords: Canine impaction, orthodontic traction, surgical exposure, impacted maxillary canine, Ballista spring, CBCT.

Introduction

Impaction is a condition in which a tooth is embedded in the alveolus so that its eruption is impeded and it is locked in position by bone or by adjacent teeth [2]. The etiology of tooth impaction is multifactorial, typically involving genetic and environmental factors such as lack of space in the dental arch, an abnormal frenulum, prolonged retention of deciduous teeth, ankylosis, supernumerary teeth, tumors, cysts, trauma, abnormal eruptive path, disturbance in the eruption mechanism of the tooth [3]. Adjacent anomalous or missing maxillary lateral incisors have been implicated in the etiology of palatally displaced canines by not providing proper guidance to the canine during its eruption[4]. Approximately, one-thirds of maxillary canine impactions are located labially and two-thirds palatally [5,6]. Being the most commonly impacted anterior tooth, it plays a fundamental role in dental occlusion, guiding mandibular movements, maintaining arch integrity, and contributing significantly to facial aesthetics. Their strategic position in the dental arch makes them crucial for achieving functional occlusion and long-term stability. However, when eruption is hindered, impacted canines can lead to a range of complications, including malocclusion, arch length discrepancies, root resorption of adjacent teeth, periodontal damage and development of cysts and tumours. Maxillary canine travel almost 22 mm from their position at the age of 5 years to their position at 15 years[7]. Other than third molar, an impacted tooth has to be aligned to prevent all these complications. Treatment alternatives for an impacted canine include extraction and restoration with a bridge or an implant later when growth has ceased[8,9]; extraction and closure of the space by substituting the first premolar with subsequent prosthetic restoration, auto-transplantation of the canine; and surgical exposure, orthodontic space opening, and traction of the impacted canine into its proper position.

Case Report

A 17-year-old male patient came to Department of Orthodontics and Dentofacial Orthopedics, Dr. R. Ahmed Dental College & Hospital complaining of missing upper front tooth. On Extraoral examination he was found to have mesoprosopic facial form with straight profile and competent lips . (fig-2) Intraorally there is clinically absent maxillary right permanent canine, constricted upper arch, mild crowing in lower arch with 2.5mm overjet and 3 mm of overbite (Fig-2). Lower dental midline shifts about 1 mm to the right. Chronic irreversible pulpitis with respect to 24. Radiographically, there was impacted upper right permanent canine. The largest width of the crown of erupted permanent left canine was 9 mm. The space available for unerupted right permanent canine in maxilla was 8 mm.

Panoramic (orthopantomogram or OPG), CBCT radiographs were taken to locate the exact position and morphology of unerupted right permanent canine. (Fig – 1). Radiographic examination revealed that the maxillary right permanent canine was palatally impacted (sector classification 4 according to Ericson and kurol). Cephalometric analysis revealed orthognathic maxilla, mandible, class 1 skeletal base, average growth pattern with competent lips.

Figure 1: Pretreatment Radiograph and CBCT

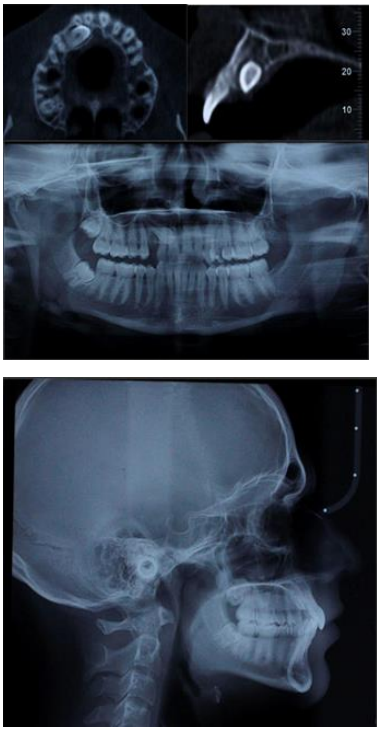
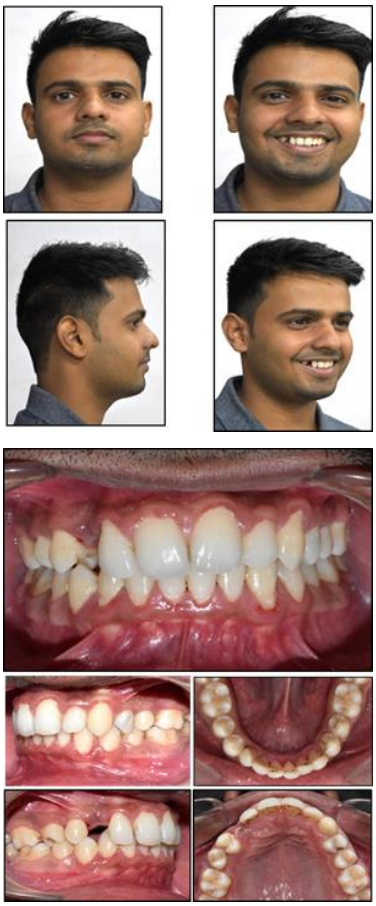


Figure 2: Extraoral and intraoral photos



Diagnosis

A 17-year-old male patient with Angle's class I molar relation on class I skeletal base with average growth pattern and missing right upper canine along with straight profile.

Treatment objectives

1. Orthodontic space opening in the maxilla and provide orthodontic traction for the impacted tooth with special attention to the gingival recession.
2. establish adequate attached gingiva and symmetric gingival margin for maxillary canines.
3. To correct the rotation of 15 and 25, proper alignment of the dentition on the basal bone with normal overjet and overbite.
4. Root canal treatment and proper restoration of 24.
5. To improve the smile, aesthetics and overall appearance of the patient.

Treatment plan

After discussing the possible treatment alternatives with the patient, a conservative treatment approach is opted to bring the tooth into its proper position. The treatment plan consisted of orthodontic space opening, surgical exposure, and traction of the impacted canine down to its normal position and its alignment to obtain a normal occlusal relationship.

Treatment Progress

Patient was treated with fixed mechanotherapy using Pre-Adjusted Edgewise MBT 022 Slot Brackets, to achieve proper alignment and levelling of the maxillary and mandibular arch. Since the impacted canine is severely displaced from its normal position in all three planes, adequate anchorage is required to bring it into alignment.

So, a trans-palatal arch was given in upper arch. Once the maxillary arch was in a relatively rigid stabilizing wire (0.019X 0.025-stainless steel wire in a 0.022-in

slot), an open coil spring was placed to create and to maintain adequate space for impacted canine. Surgery was performed to expose the maxillary right canine (closed eruption method). A circular incision was made to expose the tooth, a lingual button was bonded to the exposed canine, ligature wire(0.012 " ss) was placed to that button for applying traction in the occlusal direction (fig-3).Once the impacted tooth was exposed into the oral cavity, a modified ballista spring (0.016 AJW wire) was placed to bring the impacted canine into occlusion. Forces in the range of 60-100 gm were used. Once canines were closer to the main arch, Twin arch wires were used, a 019X025 " stainless steel base arch was placed for stabilization along with the .016 " NITI overlay wire for bringing the canine into main arch. In the mandibular arch, alignment and leveling were achieved with a sequence of 0.014 ", 0.016 " and 0.018 "nickel-titanium arch-wires, later replaced by rectangular nickel-titanium arch-wires (0.017 X0.025 " and 0.019X0.025 "). At 6-months follow-up, the right maxillary canine remained vital and responded normally to percussion and sensitivity testing with good width of attached gingiva.

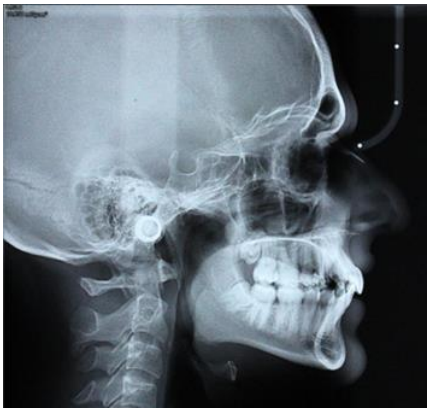
Figure 3: photos of surgical exposure & modified ballista Spring.

Treatment results

The impacted maxillary right canine was brought into proper alignment with the adjacent teeth. Bilateral Class I molar, canine and incisor relationships were achieved with ideal overjet and overbite. Rotations of 15 and 25 were corrected and successful root canal treatment of 24 was done. The final radiographs indicated intact roots, proper root alignment with no root resorption (figure 5). Minor crowding in the lower arch has been relieved. After 6 months follow up of the orthodontic treatment, the affected canine remained asymptomatic.(Fig-4) shows the post treatment extra and intraoral changes achieved.

Figure 4: Post-treatment extra and intraoral photographs

Figure 5: post-treatment Radiograph



Discussion

Maxillary canines are the cornerstone of the dental arch and play a very important role in smile esthetics and are essential for maintaining a functional occlusion [10]. The proper localization of the impacted canine plays a crucial role in determining the feasibility as well as proper access for surgical approach and proper direction for the application of orthodontic forces. Of all the radiographic techniques and analysis, cone beam computed tomography imaging technique gives us a clear and precise position of palatally impacted canine in both linear and angular positions[11]. **[**With regard to arch dimension, some studies reported an association between maxillary excess and palatally displaced canine (PDC) and other studies reported an association between PDC and maxillary transverse deficiency[12] .Extraction of impacted canine should be avoided. In the present case, metal brackets of 0.022" slot were used. After leveling and alignment phase was done by following wire sequence (0.014", 0.016", 0.018" nickel-titanium) followed by 19 x 25'' SS (stabilizing arch wire). In this report, the successful exposure of a palatally impacted maxillary canine was performed using the closed eruption method [13]. The advantage of this technique includes vertical traction of the impacted tooth toward the middle of the palate. Then, a bonded attachment was placed and tooth movement was initiated[14]. It is strongly recommended that the surgical exposure of the impacted tooth be conservative to allow for the placement of a bonded bracket or button **[15].** Ligature wire was attached from the lingual button to the main arch-wire. Once the impacted tooth got exposed into the oral cavity, a modified ballista spring (Kornhauser et al in 1995)[16] was placed. The original ballista spring was given by Jacoby[17]. These springs have an added advantage over other methods so that it could be used before and during leveling and alignment phase. For construction of Ballista spring, 0.016" round A.J Wilcock wire was used. Horizontal arm was placed in the slot of premolar and molar headgear tube. It stores its energy by being twisted on its long axis. Transpalatal arch was soldered to maxillary first molars to maintain anchorage [18]. The horizontal arm accumulates the energy when Ballista spring is activated and ligated on first and second premolar bracket. It allows to rotate the wire in slot as hinge axis. . The length of the vertical arm was kept 2 mm short from maxillary permanent canine to direct an occlusal force palatally and horizontally[19]. By modifying the vertical part of the spring, one can control the direction of eruption of the impacted tooth[20]. Once the canine was closer to the main arch, Twin arch [21] wires were used, a 019X025 stainless steel base arch was placed for stabilization along with the 016 NITI wire overlay for bringing the canines into main arch Hence, we were able to bring the impacted canine precisely into occlusion successfully using modified ballista spring.

Conclusion

The closed-eruption technique is the recommended treatment of choice when the tooth is impacted in the middle of the alveolus. This approach has been successfully used in the current case in terms of adequate attached gingival tissue preservation around the disimpacted canine. Also, a modified ballista spring can effectively position the impacted canine. Hence, it could be stated that a modified ballista spring can show a great

success for treating impacted maxillary canine within 3 to 4 months.

References

1. Kuftinec MM, Stom D. The impacted maxillary canine; II. Clinical approaches and solutions. J Dent Child. 1955;62:325–37.
2. Kuftinec MM, Shapira Y. The impacted maxillary canine: I. Review of concepts. ASDC J Dent Child. 1995 Sep-Oct;62(5):317-24. PMID: 8550920.
3. Fardi, A.; Kondylidou-Sidira, A.; Bachour, Z.; Parisis, N.; and Tsirlis, A.: Incidence of impacted and supernumerary teeth: A radiographic study in a North Greek population, Med. Oral Patol. Oral Cir. Bucal. 16:56-61, 2011.
4. Becker A, editor. The orthodontic treatment of impacted teeth. 1st ed. Mosby: Company; 1998. pp. 53–85.
5. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. Eur J Orthod. 1988;10:283–95. doi: 10.1093/ejo/10.4.283. [DOI] [PubMed] [Google Scholar]
6. Mitchell L, editor. An Introduction to Orthodontics. 3rd ed. New York: Oxford University Press; 2007. pp. 147–56. [Google Scholar]
7. Coulter, J., & Richardson, A. (1997). Normal eruption of the maxillary canine quantified in three dimensions. European Journal of Orthodontics, 19(2), 171–183.
8. Grassi, F.R.; Rapone, B.; Scarano Catanzaro, F.; Corsalini, M.; Kalemaj, Z. Effectiveness of Computer-Assisted Anesthetic Delivery System (StaTM) in Dental Implant Surgery: A Prospective Study. Oral Implant. 2017, 10, 381–389. [Google Scholar] [CrossRef]
9. Corsalini, M.; Di Venere, D.; Carossa, M.; Ripa, M.; Sportelli, P. Comparative Clinical Study between Zirconium-Ceramic and Metal-Ceramic Fixed Rehabilitations. Oral Implantol. 2018, 11, 150–160. [Google Scholar]
10. Richardson G, Russell KA. A review of impacted permanent maxillary cuspids: diagnosis and prevention. J Can Dent Assoc. 2000 Oct;66(9):497–501. [PubMed] [Google Scholar]
11. Naoumova J, Kjellberg H, Palm R. Cone-beam computed tomography for assessment of palatal displaced canine position: A methodological study. Angle Orthod 2014;84:459-66.
12. McConnell T, Hoffman D, Forbes D, Jensen E, Wientraub N. Maxillary canine impaction in patients with transverse maxillary deficiency. J Dent Child. 1996;63:190–195.
13. Schmidt, A.D. and Kokich, V.G.: Periodontal response to early uncovering, autonomous eruption, and orthodontic alignment of palatally impacted maxillary canines, Am. J. Orthod. 131:449-455, 2007.
14. Graber TM, Vanarsdall RL Jr. Orthodontics current principles and techniques. 3rd ed. St. Louis: Mosby; 2000. pp. 822–838. [Google Scholar]
15. Bishara SE. Impacted maxillary canines: A review. Am J Orthod Dentofacial Orthop 1992;101:159-71.
16. Kornhauser S, Abed Y, Harari D, Becker A. the resolution of palataly impacted canine using palatal-occlusal force from a buccal auxillary. Am J Orthod 1995;110:528-34.
17. Jacoby H. The "ballista spring" system for impacted teeth. Am J Orthod. 1979 Feb;75(2):143–151. doi: 10.1016/0002-9416(79)90183-0. [DOI] [PubMed] [Google Scholar][Ref list]

18. Becker, A.; Chaushu, G.; Chaushu, S. Analysis of failure in the treatment of impacted maxillary canines. Am. J.Orthod. Dentofac. Orthop. 2010, 137, 743–754. [Google Scholar] [CrossRef] [PubMed]
19. Jacoby H. The “ballista spring” system for impacted teeth. Am J Orthod 1979;75:143-51.
20. Raghav P, Singh K, Munish Reddy C, Joshi D, Jain S. Treatment of maxillary impacted canine using ballista spring and orthodontic wire traction. Int J Clin Pediatr Dent 2017;10:313-7.
21. Piggyback archwires P J Sandler 1, A M Murray, D Di Biase