International Journal Dental and Medical Sciences Research
Volume 6, Issue 4, July. – Aug. 2024 pp 152-159 www.ijdmsrjournal.com ISSN: 2582-6018

Orthodontic Management of Unilateral Impacted Maxillary Canine -A Case Report

Dr. Suma T[1], Dr.Megha N[2]

[1] *Professor, Dept of Orthodontics and Dentofacial Orthopedics, Rajarajeswari Dental College and Hospital, Bengaluru, Karnataka, India*

[2] *Postgraduate student, Dept of Orthodontics and Dentofacial Orthopedics, Rajarajeswari Dental College and Hospital, Bengaluru, Karnataka, India*

Date of Submission: 15-07-2024 Date of Acceptance: 25-07-2024

ABSTRACT: Maxillary canine impaction is a relatively common dental finding, with significant implications for smile aesthetics and functional occlusion. The management of impacted canines often requires a multidisciplinary approach, combining surgical and orthodontic interventions. Orthodontic traction of impacted canines is complex and demands precise biomechanical control to achieve proper occlusion. Failure of canine eruption due to impaction affects occlusion and can influence the psychological development of both children and adults. This case report details the orthodontic treatment of a 15-year-old female patient with Angles'sClass I molar relationship, unilateral maxillary canine impaction on her right side and proclined upper incisors. Four first premolars (bicuspids) were extracted, and orthodontic traction was used to guide the impacted canine into normal occlusion. The treatment was completed in 20 months, achieving favourable aesthetics and stable occlusion.

KEYWORDS: impacted canine, maxillary canine impaction, orthodontic traction, surgical exposure

I. INTRODUCTION

The management of impacted maxillary canines is a frequent challenge faced by dental professionals in their daily practice. As defined by Mead, an impacted tooth is one that fails to erupt into its proper position due to factors such as malposition, insufficient space, or other obstructions.[1] Following the lower third molars, maxillary canines are the second most commonly impacted teeth.[2]Ericson and Kurol have reported that the prevalence of ectopic eruption of canines is 1.7%.[3] Literature indicates that 85% of impacted canines are positioned palatally, while 15% are located buccally.[4]Research has demonstrated that impacted maxillary canines occur with twice the frequency in females compared to males.[5]Dachi and Howell found that 92% of impacted maxillary canines are unilateral, whereas only 8% are bilateral.[5] The maxillary canine possesses a long root and substantial bony support, making it advantageous for lateral excursions and an ideal abutment for both fixed and removable prosthetic devices.Due to these characteristics, the canine is frequently termed the 'cornerstone of the maxillary arch'.The absence of a canine can result in both aesthetic and functional issues, making its preservation crucial.[6]

Development of the canine begins at approximately 4 to 5 months of age, situated high in the maxilla, lateral to the piriform fossa, and involves the longest eruption path, measuring around 22 mm.[7]On average, maxillary canines erupt between the ages of 11 and 12 years, with females typically experiencing eruption earlier than males.[8]Displacement of canines is categorized into buccal, palatal, or alignment with the dental arch.In some cases, canines may be positioned horizontally above the apices of the maxillary incisors or displaced towards the nasal region.[6]

The etiologies of buccally and palatally impacted canines differ. According to Jacoby's study, 85% of canines displaced palatally had adequate space for eruption, while 83% of canines impacted buccally experienced spatial insufficiency. Hence, dental crowding was identified as the primary etiological factor for buccal impactions.[9]

Evaluation of unerupted canines should be conducted through both clinical and radiographic assessments. Clinical examination involves visual inspection and palpation, while radiographic evaluation may employ techniques such as parallax, orthopantomography (OPG), or Cone Beam Computed Tomography (CBCT).

Clinical investigation includes visual inspection of the canine bulge, whether it is buccal or palatal, typically observed between the roots of the lateral incisor and the first premolar. The

International Journal Dental and Medical Sciences Research
Volume 6, Issue 4, July. – Aug. 2024 pp 152-159 www.ijdmsrjournal.com ISSN: 2582-6018

angulation of the lateral incisor should also be examined; for instance, a distally inclined lateral incisor may suggest a palatal impaction, whereas a mesially inclined lateral incisor might indicate a buccal impaction. Furthermore, assessing the colour and mobility of the deciduous canine is crucial, as these factors may signal root resorption. Palpation of the buccal aspect of the alveolar process distal to the lateral incisor, starting from the age of 8, can help determine the position of the maxillary canine and has been advocated as a diagnostic method by Kettle.[10] A longitudinal study involving 505 schoolchildren assessed clinical techniques for monitoring the eruption of maxillary canines. The study concluded that positive palpation was associated with a favourable prognosis for eruption, with palpation being positive in 92% of cases.[11]

Radiographic assessment is crucial for evaluating impacted canines, particularly when asymmetry or significant differences in eruption between sides are observed. Radiographs are also indicated if canines are not palpated in their expected position if occlusal development is advanced, or if the lateral incisor shows delayed eruption or notable displacement. Ericson and Kurol found that radiographic examination was necessary in only 7% of children over 10 years of age based on clinical criteria.[11] Canine palpation should begin at age 8, with abnormal findings only considered significant after age 10.

Radiographic imaging provides a three-dimensional view of impacted canines, including vertical, mesio-distal, and buccopalatal perspectives.[12] Common radiographic views used include panoramic, periapical, cephalometric, lateral skull, and maxillary occlusal. To locate impacted canines accurately in the buccolingual plane, two radiographic views are typically required.[13]The right-angle technique, involving lateral cephalometric and posterior-anterior radiographs, is less common compared to parallax and Cone Beam Computed Tomography (CBCT).

Parallax remains the preferred method for localizing impacted canines. This technique involves observing the apparent displacement of an image relative to a reference object due to changes in the angulation of the X-ray beam.[14] Typically, the reference object is the root of an adjacent tooth. According to the SLOB (Same Lingual Opposite Buccal) rule, the image of the tooth farther from the X-ray tube shifts in the same direction as the tube, while the image of the tooth closer to the tube shifts in the opposite direction.An orthopantomogram (OPG) and anterior occlusal radiograph use vertical parallax with approximately a 60° tube shift(angulation of the X-ray beam changes in the vertical plane from 8°for an OPG to 60° for an anterior occlusal).[15]Horizontal parallax, requiring two periapical or a periapical and anterior occlusal radiograph, involves changes in the X-ray beam's horizontal angle. Armstrong et al. demonstrated that horizontal parallax has a higher diagnostic sensitivity for palatally impacted canines (88%) compared to vertical parallax (69%), indicating greater accuracy.[16] Although a single OPG can help in cases with two unerupted canines by showing the palatal canine as larger, this method is challenging to apply consistently even for experienced clinicians.[17]

Computed tomography (CBCT) provides high-resolution 3D images that enhance the precise localization of impacted canines and aid in planning minimally invasive surgeries. CBCT significantly improves the detection of resorption, which can be obscured in conventional radiographs due to superimposition, increasing resorption detection by 50%. It also addresses issues related to magnification and superimposition inherent in traditional radiographic methods.[18]

The management of impacted canines typically includes five treatment options:
1. Observation: No active treatment, with regular radiographic monitoring for cyst formation
2. Interceptive treatment
3. Surgical exposure and orthodontic alignment
4. Surgical repositioning
5. Extraction

While numerous guidelines and methods for managing impacted maxillary canines are available, a consensus among scientists and clinicians is lacking. Therefore, clinicians must select the most suitable approach based on individual cases to properly guide impacted canines into occlusion. This report details the orthodontic management of a labially impacted canine in a 15-year-old female patient.

II. CASE REPORT

A 15-year-old female patient came to the Department of Orthodontics,Rajarajeswari Dental College and Hospital, Bengaluru, India with the chief complaint of spacing on her upper right side and forwardly placed upperfront teeth.No significant medical and dental history was recorded. On general examination, she was ectomorphic with an average face height. Extraoral examination (Figure 1) revealed a convex facial profile, acute nasolabial angle and an incompetent lips.

International Journal Dental and Medical Sciences Research
Volume 6, Issue 4, July. – Aug. 2024 pp 152-159 www.ijdmsrjournal.com ISSN: 2582-6018

Figure 1. Pre-treatment extraoral photographs

Figure 2. Pre-treatment intraoral photographs

International Journal Dental and Medical Sciences Research
Volume 6, Issue 4, July. – Aug. 2024 pp 152-159 www.ijdmsrjournal.com ISSN: 2582-6018

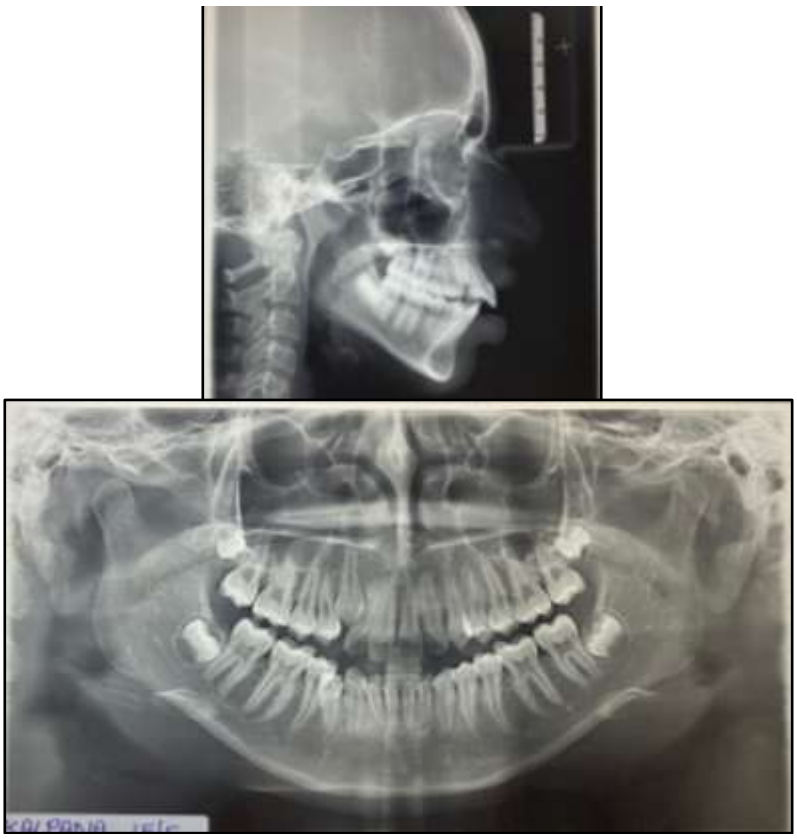

Figure 3. Pre-treatment radiographs- Lateral cephalogram and OPG

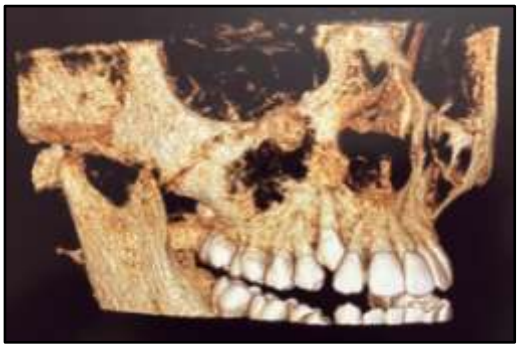

Figure 4. CBCT showing buccally impacted upper canine

Intraoral clinical examination (Figure 2) showed asymmetric maxillary and mandibular arches, spacing on right side of the maxillary arch, absence of right maxillary canine, crowding in the mandibular arch, Angle's Class I molar relation, buccally placed 44, rotations irt 15,14 and crossbite irt 14-44. There was also severe incisor proclination with an overjet of about 4 mm. The facial midline did not coincide with maxillary and mandibular dental midline, both the maxillary and mandibular dental midline were deviated by 3mm and 2mm to the right side respectively. Also, on palpation, no bulge was found on the buccal area between upper right lateral incisor and first premolar.

DIAGNOSIS

Prognostic Evaluation- Different aspects of canine position were assessed by the radiographs(Figure 3) and CBCT scan (Figure 4). The prognostic factors investigated by McSherry[20], Pitt et al[21]and Counihan et al[6]were used as references.

1. The amount of the canine crown that horizontally overlaps the adjacent incisor. In our patient, the right canine was awayfrom the

International Journal Dental and Medical Sciences Research
Volume 6, Issue 4, July. – Aug. 2024 pp 152-159 www.ijdmsrjournal.com ISSN: 2582-6018

midline, and overlapping the adjacent lateral incisorupto half root width and not overlapping the first premolar, which suggested aaverage prognosis.
2. Vertical height of the canine crown. In this case, the crown of the right canine was located at the level of the cementoenamel junction to less thanhalfwayup the root of the lateral incisor indicating a good prognosis.
3. Canine angulation to the midline. In this patient, the canine was angulated $5^0$to the midline on the right side, which suggested a good prognosis for the canine.
4. The position of the canine root apex in the horizontal plane. Cone beam computed tomography revealed that the right canine root apex was positioned above the normal canine position, indicating a good prognosis(Figure 4).

The case was diagnosed as Angle's Class I malocclusion on Class II skeletal base with an orthognathic maxilla associated with a retrognathic mandible, proclination of upper incisors, lower crowding, with impaction of right maxillary canine with favourable prognosis, buccally placed 44, rotations irt 15,14 and crossbite irt 14-44.

Treatment Objectives
1. To achieve alignment of the impacted canine into the upper arch.
2. To correct the proclination of upper teeth.
3. To achieve proper alignment of the crowded lower teeth.
4. Tocorrect maxillary and mandibular midline in line with facial midline.
5. To achieve competent lips.
6. To establish Class I canine and maintain Class I molar relationship bilaterally.
7. To achieve orthodontic functional occlusion.

Treatment plan: Extraction of 14,24,34,44
Levelling and aligning upper and lower arch
Surgical exposure of 13
Traction of the impacted canine
Releveling and realigning the upper arch
Finishing and detailing
Retention

Treatment Progress - The orthodontic treatment was started with preadjusted edgewise appliance with a 0.022" MBT bracket. Extraction of 14,24,34,44 was done.Levelling and aligning were performed on both arches. After 4 months, surgical exposure of buccally impacted upper right canine was performed, an attachment (begg bracket) was bonded on the canine, and the ligature from begg bracket was tied to the archwire. After 3 months, traction with piggyback technique 0.018 SS and 0.012 NiTiarchwire was engaged. After 2 months, the upper left canine was bonded, and both releveling and realignment phases were performed. Retraction and space closure were carried. Finishing and detailing were carried out with settling elastics. The active treatment had successfully been completed within 20 months.

Treatment Result - The buccally impacted canine was properly aligned in the maxillary arch by orthodontic traction. The upper incisor proclinationwas corrected with upper and lower dental midlines coinciding with the facial midline. Ideal overjet and overbite were achieved. Class I canine and molar relationships with a functional occlusion were established (Figures 6). Competent lips were also established at the end of treatment(Figures 5). The panoramic film demonstrated root parallelism was achieved with minimal root blunting (Figure 7). The cephalometric radiograph analysis and superimposition have shown significant changesin dental parametersbut not in skeletal parameters(Table 1). The bonded lingual retainer was placed from canine to canine in upper and lower arch for retention. In addition, the patient was suggested to use Hawley's appliance for retention phase.

Table1.Pre-treatment and Post-treatment cephalometric evaluation

PARAMETERS	PRE- TREATMENT	POST-TREATMENT
ANB	4^0	4^0
Interincisal angle	112^0	121^0
UI-SN	114^0	104^0
UI-NA	33^0	23^0
IMPA	95^0	95^0
Nasolabial angle	74^0	112^0
Upper lip to E-line	-1 mm	-2 mm
Lower lip to E-line	3 mm	2 mm

International Journal Dental and Medical Sciences Research
Volume 6, Issue 4, July. – Aug. 2024 pp 152-159 www.ijdmsrjournal.com ISSN: 2582-6018

Figure 5. Post-treatment extraoral photographs

Figure 6. Post-treatment intraoral photographs

International Journal Dental and Medical Sciences Research
Volume 6, Issue 4, July. – Aug. 2024 pp 152-159 www.ijdmsrjournal.com ISSN: 2582-6018

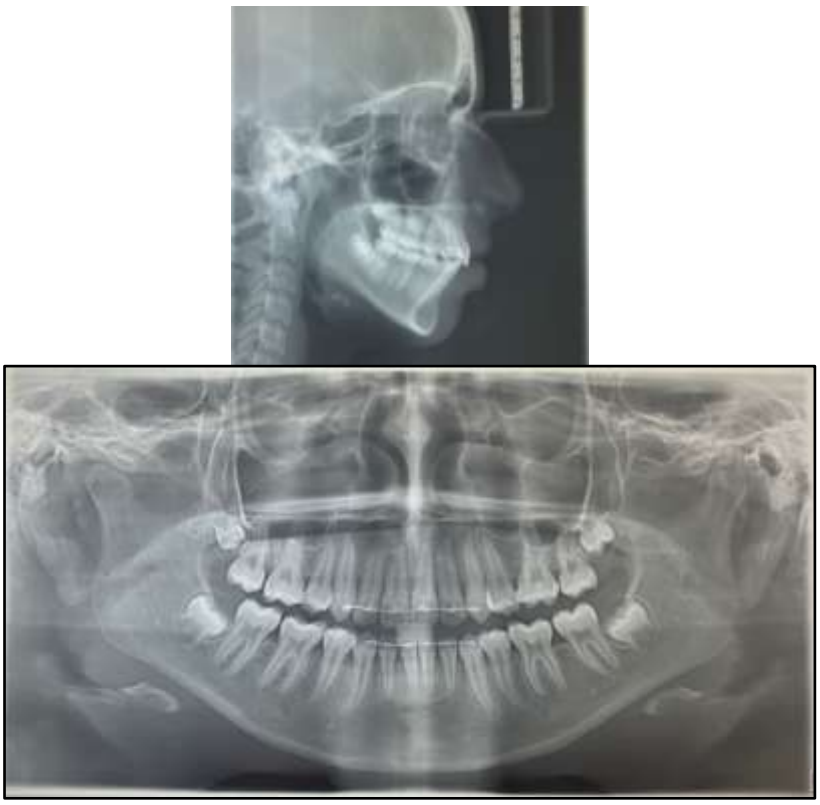

Figure 7. Post-treatment radiographs- Lateral cephalogram and OPG

III. DISCUSSION

The development of maxillary canines occurs laterally to the piriform fossa. Such teeth have the most difficult eruption path, the longest period of development and the deepest area of development.[22] According to Coulter and Richardson the maxillary canines travel almost 22 mm from 5 to 15 years of age in the three planes of space.[22]Due to their long and tortuous path of travel, maxillary canines are the most frequently impacted teeth after the third molars, with a prevalence of approximately 2%.[3]

The etiology of impacted canines involves various localized, systemic, genetic, and environmental factors. These include local hard tissue obstructions, pathological conditions, developmental disturbances, and hereditary factors. Specific causes include febrile diseases, endocrine disorders, irradiation, arch length discrepancies, prolonged retention, tooth size issues, early loss of the deciduous canine, supernumerary teeth, ankylosis, alveolar cleft, and apical periodontitis of deciduous teeth.[23]

In the present case report, important evaluations on the prognostic criteria for impacted maxillary canines like the horizontal overlap of the canine crown over the lateral incisor, vertical height of the canine crown, canine angulation to the midline, position of the canine root apex and sector analysis, were carried out. All prognostic factors were identified as favourable in our patient. Considering this finding, the orthodontic guided eruption was the method of choice for this case. Moreover, given that the treatment of an impacted maxillary canine is not completed merely with its orthodontic alignment, the treatment was followed by: extraction of all 4's, alignment and levelling, anchorage preparation, surgical exposure with closed eruption technique, bonding of attachment, traction force application, and final detailing. The biomechanics during orthodontic treatment hold an important role in treating impaction cases. In this case, the buccally impacted canine was managed using a piggybacktechnique. The orthodontic treatment was completed in 20 months and successfully obtained favourable esthetic and stable occlusion.

Assessing final periodontal health is crucial for evaluating the success of impacted maxillary canine treatment. In this case, the periodontal health of the right maxillary canine area remained intact post-treatment.

IV. CONCLUSION

Impacted maxillary canines are common, and dental surgeons should be familiar with various

management techniques. Extraction should generally be considered a last resort. Successful treatment involves a combination of clinical and radiographic diagnosis and careful orthodontic planning, which can lead to esthetic and functionally stable outcomes for buccally impacted canines.

REFERENCES

[1]. Mead SV. Oral Surgery 4th edn. St Louis: Mosby Co, 1954.
[2]. Shah RM, Boyd MA, Vakil TF. Studies of permanent tooth anomalies in 7,886 Canadian individuals. I: Impacted teeth. Dent J 1978; 44(6): 262−264.
[3]. Ericson S, Kurol J. Radiographic assessment of maxillary canine eruption in children with clinical signs of eruption disturbances. Eur J Orthod1986; 8(3): 133−140.
[4]. Hitchen AD. The impacted maxillary canine. Br Dent J 1956; 100: 1−14.
[5]. Dachi SF, Howell FV. A survey of 3,874 routine full-mouth radiographs. II. A study of impacted teeth. Oral Surg Oral Med Oral Pathol1961; 14(10): 1165−1169.
[6]. Counihan K, Al-Awadhi EA, Butler J. Guidelines for the assessment of the impacted maxillary canine. Dent Update. 2013; 40(9):770-2, 775-7.
[7]. Dewel B. The upper cuspid: its development and impaction. Angle Orthod1949; 19: 79−90.
[8]. Wedl JS, Schoder V, Blake FA, Schmelzle R, Friedrich RE. Eruption times of permanent teeth in teenage boys and girls in Izmir (Turkey). J Clin Forensic Med 2004; 11(6): 299−302.
[9]. Jacoby H. The etiology of maxillary canine impactions. Am J Orthod1983; 84: 125−132.
[10]. Kettle MA. Treatment of the unerupted maxillary canine. Trans Br Soc Orthod1957; 74−84.
[11]. Ericson S, Kurol J. Longitudinal study and analysis of clinical supervision of maxillary canine eruption. Community Dent Oral Epidemiol1986;172−176.
[12]. Stivaros N, Mandall NA. Radiographic factors affecting the management of impacted upper permanent canines. J Orthod2000; 27(2): 169−173.
[13]. Jacobs S. Radiographic localization of unerupted maxillary anterior teeth using the vertical tube shift technique: the history and application of the method with some case reports. Am J Orthod Dentofacial Orthop1999; 116: 415−423.
[14]. Mason C, Papadakou P, Roberts G. The radiographic localization of impacted maxillary canines: a comparison of methods. Eur J Orthod2001; 23(1): 25−34.
[15]. SouthallP, Gravely J. Radiographic localizationof unerupted teeth in the anterior part of the maxilla: a survey of methods currently employed. J Orthod1987; 14(4): 235.
[16]. Armstrong C, Johnston C, Burden D, Stevenson M. Localizing ectopic maxillary canines −horizontal or vertical parallax? Eur J Orthod2003; 25(6): 585.
[17]. Hunter S. The radiographic assessment of the unerupted maxillary canine. Br Dent J 1981; 150 (6): 151−155.
[18]. Mah J, Enciso R, Jorgensen M. Management of impacted cuspids using 3-D volumetric imaging. J Calif Dent Assoc 2003; 31(11): 835−841.
[19]. Ericson S, Kurol J. Resorption of incisors after ectopic eruption of maxillary canines: a CT study. Angle Orthod2000; 70(6): 415−423.
[20]. McSherry PF. The assessment of and treatment options for the buried maxillary canine. Dent Update. 1996;23(1):7-10
[21]. Pitt S, Hamdan A, Rock P. A treatment difficulty index for unerupted maxillary canines. Eur J Orthod. 2006;28(2):141-4.
[22]. Coulter J, Richardson A. Normal eruption of the maxillary canine quantified in three dimensions. Eur J Orthod. 1997;19(2):171-83.
[23]. Peck S, Peck L, Kataja M. The palatally displaced canine as a dental anomaly of genetic origin. Angle Orthod1994; 64(4): 250−256.