

## CASE REPORT

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# Palatally Displaced Canine and Anterior Crossbite Management with a Combination of Palatal Flap Window and MEAW Technique: A Case Report

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## ABSTRACT

Canine impaction is a frequent problem, ranking third in occurrence behind the impaction of the mandibular and maxillary third molars. Palatally displaced canines (PDCs) require more comprehensive treatment and are more challenging to manage. This case report describes the management of a rotated palatally impacted permanent maxillary right canine using the open palatal flap window method and the multiloop edgewise arch wire (MEAW) technique. A 19-year-old female patient presented with dental misalignment, which included a skeletal Class I relationship with Angle Class I malocclusion, a protruding lower jaw, anterior crossbite, and the upper left canine being palatally impacted. The panoramic radiograph indicated the existence of a Type II impaction of the canine teeth (Yamamoto classification). The treatment employed the MEAW technique to expand the maxilla and handle an anterior crossbite. The palatal window flap technique was utilized to achieve access to the maxillary right canine by using a button chain and ligation to the upper archwire. The posttreatment outcomes demonstrated satisfactory eruption and alignment of the maxillary right canine, correction of the anterior crossbite at the maxillary right lateral incisor, and realignment of the midline. One year after retention, a satisfactory occlusion was maintained without recurrence of the anterior crossbite. The use of the open palatal window flap technique and button chain application is effective in correcting PDCs and achieving adequate tooth alignment within the dental arch.

**Keywords:** *Edgewise; canine impaction; medicine; window flap*

## INTRODUCTION

Palatally displaced canines (PDCs) or canine impaction in the palatal region is a condition that occurs with greater frequency than buccal impaction. Data indicates that roughly 85% of canine impaction instances are located in the palatal region, whereas merely 15% are found in the buccal region (Kinaia, *et al.*, 2016). The significant occurrence of these emphasises the importance of detecting and managing PDCs for achieving optimal treatment results. Surgical exposure for impacted canines is a standard procedure to promote their eruption into the dental arch (Bolooki, *et al.*, 2022). However, this process may lead to postoperative pain and discomfort.

The management of impacted canines in the palatal and buccal regions varies based on the patient's clinical characteristics and requirements. The selection of either the open or closed method for managing this case is influenced by several critical factors, including the distance from the tooth to the dental arch, the tooth's position and orientation, and the condition of the surrounding soft tissue (Wijaya & Utomo, 2014). Radiographic assessment is the key in diagnosing, creating a treatment plan, and decision-making processes (Yang *et al.*, 2022).

The open technique is typically advised for canines that are closer to the dental arch or teeth that may erupt spontaneously with no complex orthodontic assistance. On the contrary, the closed method is preferred in situations requiring complex biomechanical management. This technique is more appropriate for canines positioned deeper in the palate or distant from the dental arch, when orthodontic traction requires a longer duration and the eruption position of the teeth does not naturally align with the dental arch (Wijaya & Utomo, 2014).

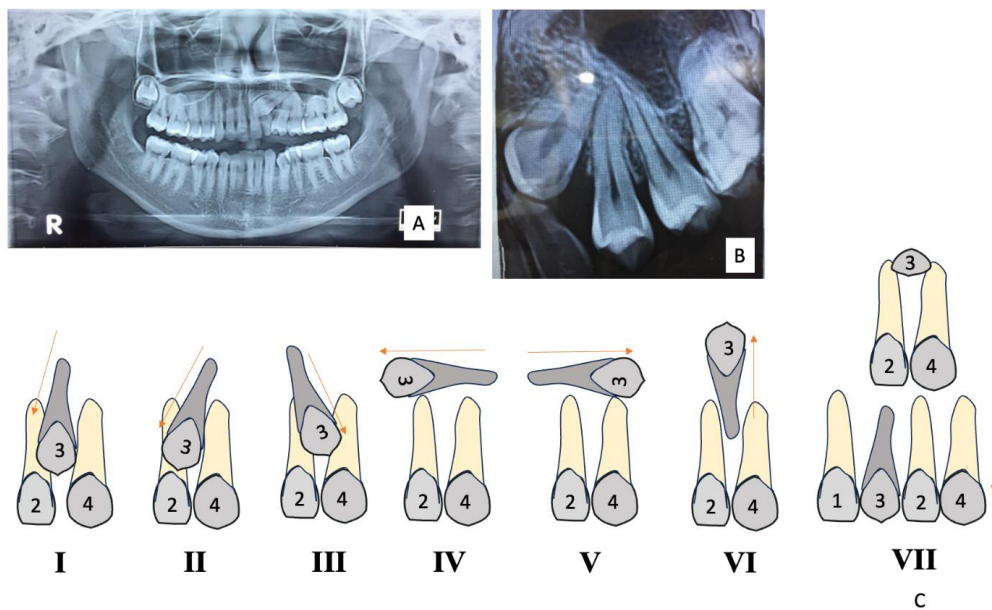
The management of PDCs is perceived as more challenging for several reasons. Surgical access for treating palatal impaction is more challenging than for buccal impaction. The palatal region has thicker tissue, is less flexible, and contains significant anatomical features, including the hard palate and the palatine main artery, requiring greater expertise and care throughout the surgical exposure procedure (Kohli & Kohli, 2020; Sun *et al.*, 2023). Moreover, the maxillary region's impacted teeth are frequently situated at a deeper level and distance from the dental arch, necessitating a more comprehensive multidisciplinary strategy and orthodontic traction planning. Palatally impacted teeth often deviate from the physiological eruption pathway, presenting additional challenges during the orthodontic traction process. This necessitates meticulous biomechanical orthodontic movement management to ensure that the teeth are positioned appropriately (Kinaia, *et al.*, 2016).

## CASE REPORT

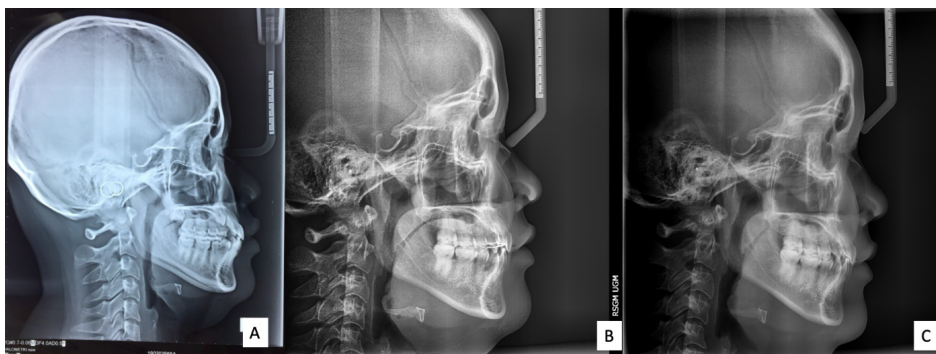
The case of a 19-year-old Asian female patient seeking orthodontic treatment at Rumah Sakit Gigi dan Mulut, Professor Soedomo presented with a complex set of malocclusions (Fig. 1A), including Angle Class I malocclusion, a protrusive mandible, crowding, anterior crossbite involving tooth 12 and 42, and impaction of tooth 23 (Fig. 1B). The upper midline shifted to the left, along with an overjet of 1.9 mm and an overbite of 1.4 mm (Fig. 1). Panoramic radiography revealed the impaction of tooth 23, classified as Type II (Fig. 2A), necessitating a comprehensive treatment approach (Fig. 2B). The canine classification proposed by Yamamoto assesses the alignment of the long axis of the canine teeth in relation to the occlusal plane (Fig. 2C) Patient also take cephalometry radiograph (Fig. 3A).



**Fig. 1** Pre orthodontic data: (A) Profile picture of the patient's; (B) Intraoral photo.



**Fig. 2** (A) Panoramic radiograph; (B) Periapical radiograph; (C) Yamamoto Canines Impaction Classification.



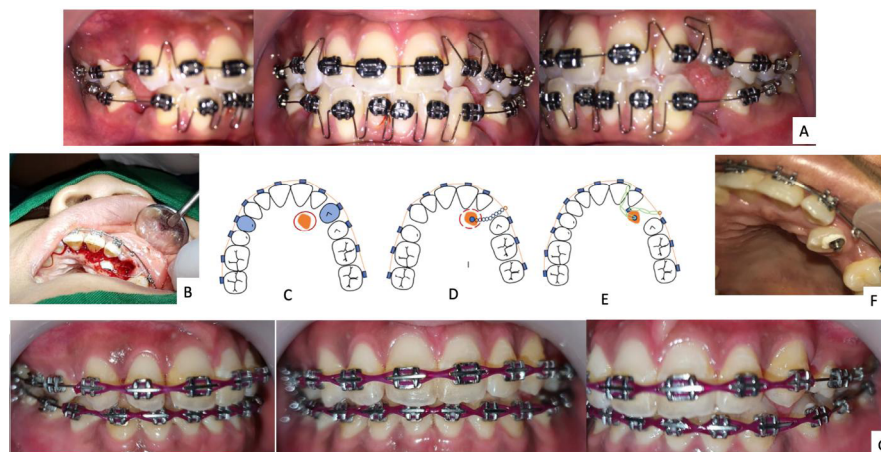
**Fig. 3** (A) Cephalometric radiograph pre-orthodontic treatment; (B) Cephalometric radiograph post-orthodontic treatment; (C) Cephalometric radiograph at the 1-year follow-up after post-orthodontic treatment.

Analysis and diagnosis results indicated Angle Class I malocclusion, skeletal Class I with a protrusive mandibular dentition, mandible crowding, crossbite anterior of tooth 12 with tooth 42 and tooth 22 with 33, open bite of tooth 24 with tooth 34, impaction of tooth 23, multiple diastema from 11 to 24 and individual tooth malpositions on several teeth.

### CASE MANAGEMENT

A comprehensive clinical and database analysis was conducted, followed by a treatment plan involving the extraction of four first premolars in both the maxillary and mandibular arches

(#14, #24, #34, #44). The treatment involved several stages, including levelling, unravelling, and general alignment. This was achieved by using multiloop edgewise archwire (MEAW) on 0.014" Australian stainless steel (SS) wire and a chinch back on the distal molar tube (Fig. 4A). The levelling then continues with 0.016" SS round plain archwire, 0.016" × 0.022" SS archwire. The midline shift in the upper incisors was corrected by individually moving the teeth and retracting the upper and lower canines. Class III intermaxillary elastics, 5/16" in diameter and force of 2.5 ounces (light), were used to help correct the anterior crossbite. The space between the teeth of the mandible was effectively closed utilising a power chain (Fig. 4G).



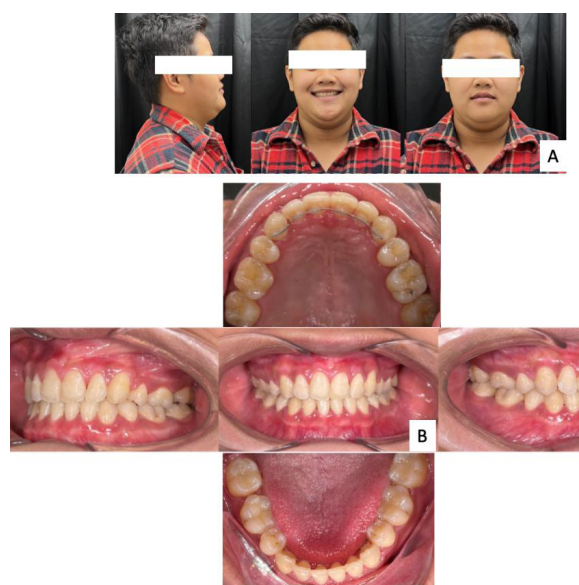
**Fig. 4** (Edgewise technique and canine exposure: (A) Multiloop Edgewise ArchWire; (B) Palatal window flap illustration and button chain for exposing caninus; (C) An incision is made to expose the 23, a palatal flap incision is performed on the palatal side where the canine teeth is located; (D) Attach a button chain to the palatal aspect of the tooth, attaching it to the main wire. Subsequent to the complete eruption of the canine, the button chain is modified to a lingual button, and a bracket is attached to the labial surface of the canine; (E) After the complete eruption of the rotate upper left canine, and reciprocal tooth movement is performed with a power chain to align the teeth within the optimal arch; (F) E-loop on mainwire; (G) Space closing with power chain.

**Table 1** Lateral cephalometric measurements

Parameters	Normal (mean ± SD)	Pre-treatment	Post-treatment	1 year-post treatment
Horizontal skeletal				
SNA (°)	82 ± 2	83.60	83.20	83.60
SNB (°)	80 ± 2	79.80	80.15	80.52
ANB (°)	2 ± 2	3.70	3.05	3.03
Angle of convexity (°)	0 ± 5	8.50	4.08	4.00
Dental				
Interincisal angle (°)	140 ± 10	128.50	136.00	143.00
U1-NA (mm)	4 ± 2	2.00	1.28	6.00
L1-NB (mm)	4 ± 2	3.10	2.80	3.40
Soft tissue				
Upper lip to E-line (mm)	1 ± 2	(+) 2.50	(-) 1.20	(-) 2.10
Lower lip to E-line (mm)	0 ± 2	(+) 1.80	(-) 1.75	(-) 2.20

A surgical procedure was conducted in collaboration with the oral surgery department to expose tooth 23, facilitating the placement of a button on its palatal surface to help tooth 23 fully erupt (Fig. 4B, 4C, 4D, 4E). E loop on the main wire between maxilla left lateral incisor and maxilla left second premolar for attaching the button chain and retract the palatally positioned canine tooth to align it more closely with the ideal arch (Fig. 4F). Rotate upper left canine then corrected by reciprocal movement using power chain (Fig. 4E) After a period of 10 months, tooth number 23 successfully moved into its correct position, the button on tooth 23 was substituted with a bracket, and the alignment of tooth 23 was performed.

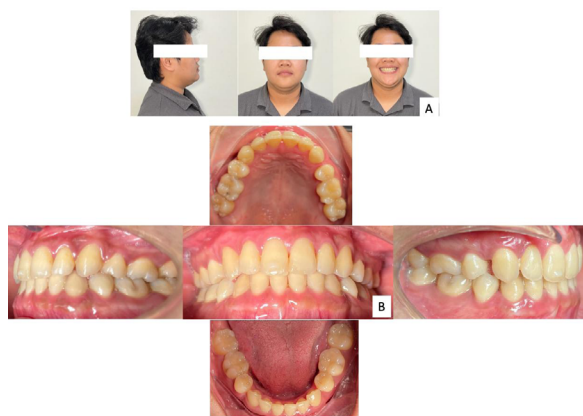
Interdigitation was accomplished utilising a 0.019" × 0.025" SS wire. The treatment was completed by removing the dental braces and providing the patient with fixed retainers in both jaw from canine to canine (Fig. 5A, 5B). The patient's final cephalometric radiograph condition after completing the orthodontic treatment is presented (Fig. 3B). The conclusive treatment outcomes revealed an overjet of 2.2 mm and an overbite of 2.3mm. The patient's lateral cephalometric measurements are as presented (Table 1). The patient's profile and intraoral following the completion orthodontic treatment are presented (Fig. 5A, 5B).



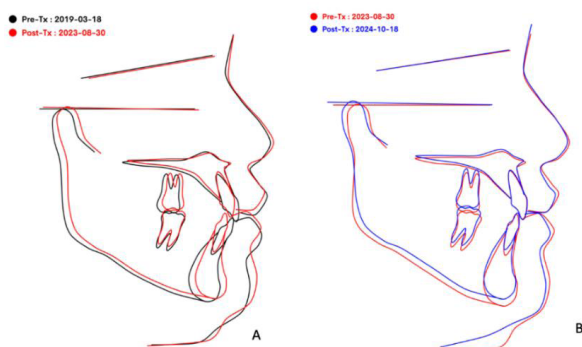
**Fig. 5** Post-orthodontic treatment: (A) Facial; and (B) Intraoral photographs.

One year after retention, a satisfactory occlusion was maintained without recurrence of the anterior crossbite (Fig. 6A), but the tooth #13, and #43 has slightly relapsed, also rotation of #33 (mesio-lingually) occurred (Fig. 6B). Comparison of the post-treatment and 1-year follow-up tracing indicated a small skeletal change in the maxilla and the mandible but no aesthetic problem or extraoral profile change (Fig. 7B.). The patient requested that the distal spacing of the right maxillary canine

tooth be closed with a composite filling due to the patient's discomfort with the tooth's unappealing appearance.



**Fig. 6** Post-treatment at 1-year follow-up: (A) Facial; and (B) Intraoral photographs.



**Fig. 7** (A) Superimposition of lateral cephalometric tracings before and after orthodontic treatment, black lines indicate tracing before treatments, while red lines indicate tracing after treatments; (B) Superimposition of lateral cephalometric tracings after orthodontic treatment and 1 year follow-up, (red lines indicate tracing after treatments, while blue lines indicate tracing at 1 year follow-up up.

## DISCUSSION

The canine classification (Yamamoto *et al.*, 2003) assesses the alignment of the long axis of the canine teeth in relation to the occlusal plane, thereby determining the complexity of treatment based on the position and orientation of impaction. Periapical and panoramic radiographs revealed that the canine showed a mesially inclined axis, with the crown approaching the root of the lateral incisor. The tooth's position appears to be

deep within the bone, at an angle that is not completely vertical nor near horizontal. The panoramic X-ray reveals the crown nearing the lateral incisor root, suggesting a position deeper than Type II.

The closed method was generally used for impacted canine teeth that are positioned far from the dental arch (Kinaia *et al.*, 2016). This technique requires the surgery to expose the tooth, the installation of orthodontic attachments, and the following repositioning of the mucosal membrane to its original position. This allows orthodontic traction to guide tooth eruption, thereby enhancing accuracy, the surrounding palatal tissue, and patient comfort (Cruz, 2019). By applying these methods, the duration of therapy and patient pain management can be reduced, and affected canines can be appropriately aligned (Ruan *et al.*, 2024). Nevertheless, there are those who contend that the close method has a higher rate of failures and requires re-exposure (Sampaziotis, *et al.*, 2018).

Parkin *et al.* (2017), evaluated the outcomes of open versus closed surgical exposure techniques for palatally impacted maxillary canines. Although the overall success rates between the two techniques were comparable, the review identified that postoperative complications such as infection and discomfort due to chain penetration through the palatal mucosa were reported exclusively in the closed technique group. In contrast, such complications were not observed in patients treated with the open technique. The palatal window flap or open method approach was used in the present case to facilitate direct access to the impacted canine teeth on the palatal aspect. Direct access to the affected canine teeth facilitates better visualisation for the clinician to determine the position and direction of tooth movement, facilitating better oral hygiene maintenance and easier clinical monitoring. The available evidence suggests that open surgical exposure is more advantageous than closed techniques in terms of treatment duration and ankylosis risk. Current reports indicate that the open surgical method is associated with a shorter

period of initial alignment of impacted teeth to the dental arch than the closed procedure, in terms of the primary outcome of treatment length. This could be due to the absence of a relocated membrane over the exposed impacted teeth, which might hinder the tooth from erupting (Alhasyimi, *et al.*, 2024). Considering these factors, the palate window flap technique is employed to minimise trauma and enhance direct access to improved adequate visualisation (Utari & Shaleh, 2022). These advantages are particularly beneficial in compliant patients with good oral hygiene, and support the clinical rationale for selecting the open approach in appropriately indicated cases.

At the one-year follow-up following fixed orthodontic debonding, a small skeletal change and a 1 mm relapse at the distal of tooth 13 were observed. Relapse is normal or minor if the change in tooth position is less than 2 degrees to 3 degrees and less than 1 mm to 2 mm in the transverse, vertical, or sagittal dimensions, occlusal contact remains stable, and chewing function and aesthetics are not significantly impaired (Alhasyimi, *et al.*, 2018; Wang, *et al.*, 2023 *et al.*). In this patient's situation, tooth 13 relapsed by 1 mm, but it did not affect occlusion, thus a dental filling was placed on distal tooth 13 at the patient's request. Minor relapses can be controlled using retainers; therefore, the patient continues to wear a removable retainer to maintain occlusal contact.

The edgewise wire applied for PDCs contains loops carefully positioned along the dental arch. These loops facilitate the formation of a more controlled force, necessary for achieving smoother and more accurate tooth movement. The purpose of utilising MEAW in this particular case was to correct the anterior crossbite, primarily by achieving controlled maxillary arch expansion and vertical dimensional adjustment. This approach aligns with the findings of Le *et al.* (2024), who reported successful correction of anterior crossbite using MEAW mechanics in combination with Class III elastics. Their case demonstrated that the resolution of an

anterior crossbite was achieved through a combination of the MEAW technique and Class III elastics, which provided effective torque control and facilitated modification of the sagittal interarch relationships. The primary objectives of MEAW treatment are to align back teeth that are angled toward the back of the mouth, eliminate posterior crowding, and reconstruct the occlusal plane (Tabancis *et al.*, 2020).

A combination of these techniques facilitates direct access, effective force application, and less invasiveness, resulting in improved treatment outcomes. The entire approach not only accelerates the treatment procedure but also improves treatment accuracy, patient satisfaction, and overall treatment effectiveness in instances of canine impaction. While the button chain and palatal window flap techniques proved effective, it may be beneficial for future case reports to explore or contrast alternative methods, such as laser-assisted exposure or closed eruption techniques.

## CONCLUSION

The use of the palatal window flap technique and MEAW techniques is effective in correcting canine impaction and achieving adequate tooth alignment within the dental arch. In addition, MEAW successfully addresses the problem of anterior crossbite by providing stable and good vertical control in tooth movement.

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