Research Article

# Case Report: Interdisciplinary Management Of A Rotated Impacted Maxillary Central Incisor Using Laser Assisted Exposure And 2x4 Orthodontic Mechanics

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**Abstract**

This report presents the case of a 11-year-old female patient with an impacted maxillary right central incisor due to rotation, without any obstruction or any supernumerary tooth or other local factors. The impacted tooth was surgically exposed using laser, followed by orthodontic derotation and alignment using a 2x4 appliance therapy. The combined laser-orthodontic approach resulted in successful eruption and proper positioning of the incisor within 9 weeks, thereby preserving aesthetics and function with minimal morbidity.

## Introduction

Impaction of the maxillary central incisor is an uncommon clinical finding, with a reported prevalence of 0.06-0.2% [1] Its etiology is typically multifactorial, with common causes including supernumerary teeth (mesiodens), retained deciduous incisors, trauma to the primary predecessor resulting in dilaceration, abnormal root development, and malposition or rotation of the tooth germ [1]. Aggregated clinical data indicate that trauma-induced dilaceration is the most frequent cause, accounting for approximately 35-37% of cases, followed by supernumerary teeth (15-22%), retained primary incisors (≈10%), positional anomalies (≈14%), and aberrant root development (≈6%)[1]. Additional factors such as crowding, ankylosed or non-vital primary teeth, and local pathologies may also contribute [2,3]. In the absence of a physical obstruction, rotation of the developing tooth may itself alter the eruption path and result in impaction [1].

An unerupted maxillary central incisor has significant functional, aesthetic, and psychosocial implications. These teeth play a key role in facial aesthetics, phonetics, and incising food. Their absence is highly noticeable and has been reported as one of the most unattractive occlusal deviations, often leading to reduced self-esteem, social discomfort, and teasing in children [2,3]. Parents commonly seek early intervention because of concerns regarding aesthetics, speech, and psychological well-being [1].

Early diagnosis is crucial to prevent space loss, functional disturbances, and long-term emotional impacts [1]. Recent advances in imaging, particularly cone-beam computed tomography (CBCT), have significantly improved diagnostic accuracy and treatment planning [4]. Kolarkodi et al. (2023)[4] highlighted the importance of CBCT in precisely locating impacted incisors and identifying associated anatomical factors that may not be evident on conventional radiographs, thereby enhancing both surgical and orthodontic outcomes [5,6].

Laser-assisted surgical exposure has been shown to reduce intraoperative bleeding, postoperative pain, and edema, and facilitates immediate orthodontic bonding, particularly with diode laser wavelengths ranging from 810 to 980 nm [7,8]. Orthodontically, the 2×4 appliance is a well-established and effective modality for early correction of impacted incisors during the mixed dentition phase [9,10].

The present case highlights an uncommon etiology of maxillary central incisor impaction-isolated rotational malposition-and demonstrates the effectiveness of an interdisciplinary approach involving laser-assisted surgical exposure followed by orthodontic de-rotation using a 2×4 fixed appliance [1,10]

## Case Presentation

An 11-year-old healthy female patient presented with the chief complaint of a missing upper right front tooth since the last 1-2 years at the Department of Pediatric and Preventive Dentistry at Manav Rachna Dental College, Haryana. The patient had no significant medical history and was otherwise in good health. Upon clinical examination, the patient was found to be in the late mixed dentition phase. Intraoral examination revealed absence of the maxillary right central incisor in the arch. The adjacent teeth were fully erupted. The patient exhibited a developing Angle's class I molar relationship and a balanced facial profile, with adequate space present in the arch to accommodate the incisor. There was no evidence or history of any trauma or other complications. The overlying mucosa appeared intact without any signs of inflammation or swelling.

Fig.1.1 Pre-operative image showing the missing maxillary right central incisor

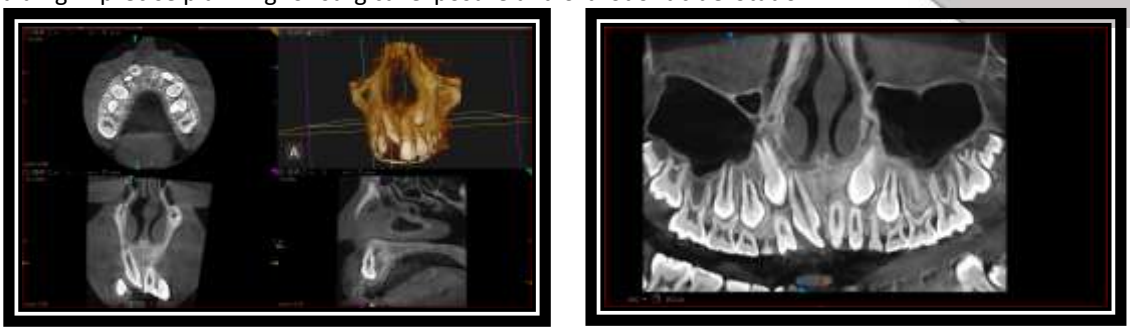
Investigation (periapical radiographic examination) confirmed the presence of an impacted maxillary right central incisor. The tooth was rotated around its long axis and was positioned within the alveolar bone. No evidence of supernumerary teeth or odontogenic cysts or other pathogenic obstruction to eruption was detected. Root development was at Nolla Stage 8 with no radiographic abnormalities. signs of ankylosis.

**Diagnosis**: Impacted and rotated maxillary right central incisor.

Fig. 1.2. Intra-oral periapical radiograph showing an unerupted maxillary right central incisor with an oblique path of eruption.

CBCT imaging was obtained to accurately assess the position, orientation, and root morphology of the unerupted maxillary central incisor, as conventional radiographs were insufficient to determine the extent of rotation and spatial relationship to adjacent structures. The scan revealed an impacted permanent right maxillary central incisor located superior to the retained primary incisor, with the crown displaced palatally and exhibiting pronounced mesio-distal rotation. The root was fully developed with a closed apex and showed no evidence of dilaceration or resorptive changes. No supernumerary tooth, cystic lesion, or

obstruction was identified along the eruption path, and adjacent permanent tooth germs displayed normal development. The 3D reconstruction further confirmed the palatal displacement and severe axial rotation, aiding in precise planning for surgical exposure and orthodontic derotation.



(a) (b)

Fig. 1.3. (a) (b) CBCT scan images

**Treatment Plan**

The treatment was carried out in two phases:

Phase I- Surgical Phase: Laser-assisted crown uncovering to minimize soft tissue trauma and postoperative discomfort.

Phase II- Orthodontic traction: 2x4 fixed appliance therapy for alignment and derotation of using 2x4 appliance system consisting of brackets bonded to the four incisors and bands on first permanent molars as done in a case report "Laser exposure and orthodontic traction of an impacted maxillary central incisor" by Bishara SE et al(Bishara SE: Impacted maxillary canines: a review. Am J Orthod Dentofacial Orthop. 1992, 101:159-71. 10.1016/0889-5406(92)70008-X).

**Surgical Phase: Laser Crown Exposure**

A diode laser (wavelength 450 nm, continuous wave mode 1Hz frequency and 2W power was employed to perform a conservative soft tissue excision overlying the crown of the impacted incisor. This technique allowed precise and minimally invasive bloodless exposure of the tooth, thereby ensuring optimum healing and improved patient comfort in post op phase.

Fig 1.4. Laser Assisted Operculectomy – Immediate Post Op

**Orthodontic Phase: 2x4 Appliance and Derotation**

On the day of the surgical exposure, 2×4 fixed appliance therapy was initiated simultaneously. MBT 0.022 brackets were bonded to the three maxillary incisors, molar bands were placed on the first permanent molars, and a 0.012-inch NiTi archwire was inserted. After exposing the crown using lasers, a lingual button was bonded and engaged to the archwire using a ligature. The wire was then changed to a 0.014-inch NiTi archwire. At the subsequent one-week review, light traction forces had produced noticeable downward

movement of the tooth. The lingual button was removed, a bracket was placed and engaged in the archwire, and the 0.014-inch NiTi wire was reinserted; the patient was scheduled for another follow-up in a week. During the next weekly visit, further downward movement was evident along with loosening of the wire. The wire was replaced again, and the patient was advised to return the following week.

Fig.1.5. Post one week follow up

Fig. 1.6. 15th day follow up

The patient was recalled one week after laser-assisted exposure rather than the conventional 3 week interval. Diode laser excision produces minimal tissue trauma, eliminates the need for sutures, and promotes rapid epithelial healing within 5–7 days, making an early review clinically appropriate. A short recall period allowed assessment of soft-tissue response, verification of bracket stability, and timely activation of orthodontic traction before any gingival rebound or tissue overgrowth could compromise access. The accelerated healing profile associated with diode laser surgery in pediatric soft-tissue procedures has been well documented in the literature (Kazakova R, Tomov G, Vlahova A, et al.( Kazakova RT, Tomov GT, Kissov CK, Vlahova AP, Zlatev SC, Bachurska SY. Histological Gingival Assessment after Conventional and Laser Gingivectomy. Folia Med (Plovdiv). 2018 Dec 1;60(4):610-616. doi: 10.2478/folmed-2018-0028. PMID: 31188758.)

After a week considerable tooth eruption of about 4mm had occurred. The wire was again changed (0.014 niti) and the bracket was then engaged in the arch wire and patient was recalled after one week. After one week derotation was started by repositioning the bracket at a more distal position from the FLACC point so as to initiate derotational forces andbring the tooth in occlusion. Strict monitoring of the force system was done and the patient was asked to send photographs every three days.

Fig.1.7. Derotation started once the central incisor erupted in position

Once considerable derotation was achieved the bracket was positioned at the FLACC point of the tooth and the wire was changed (0.014 niti) and the patient was recalled after three weeks. By the end of three weeks the tooth had aligned itself and stabilization phase was initiated.

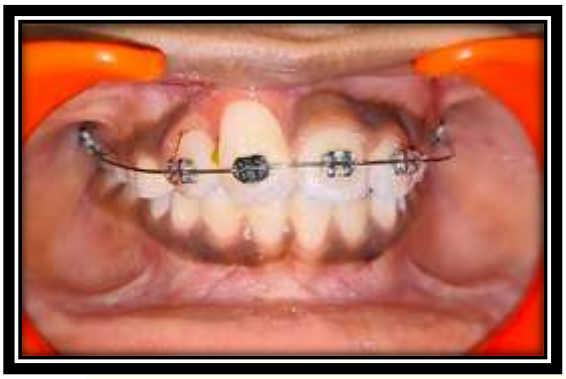


Fig.1.8. Fully erupted right central incisor in a functional position.

The wire was now changed to 0.016 niti and the patient is recalled after 3 weeks. Post three weeks the wire was now changed to 0.018 niti and then 0.018ss followed by lingual
Progressive wire sequencing, beginning with light NiTi and advancing to 0.016" and then to stainless steel, enabled completion of derotation, alignment, and torque expression while preserving anchorage and minimizing unintended displacement of adjacent incisors.
The impacted incisor successfully erupted into the arch with complete derotation and proper alignment in about 5 months. The gingiva was healthy, and aesthetics were satisfactory. The final occlusion was stable and functionally effective and to help it stabilize a lingual retainer was placed.

Fig. 1.9. Post –Op Pictures

## Discussion

Impaction of maxillary incisors due to rotation is uncommon but clinically significant. Unlike more frequently encountered causes such as supernumerary teeth or traumatic injury, rotational impaction occurs when the developing tooth germ assumes an abnormal orientation within the alveolar bone-often without any physical obstruction [1]. This atypical positioning can disrupt the natural eruption pathway, resulting in delayed or arrested eruption even when adequate space is present in the dental arch [1,3]. Clinically, such cases are challenging because the rotated crown may be completely embedded in the bone or gingiva, making diagnosis and management more complex [3].
According to Seehra et al. (2023) [11], spontaneous eruption can occur over a period of up to three years, although adjunctive orthodontic intervention is often needed to achieve proper alignment within the arch.

The current literature emphasizes the importance of early intervention in cases of impacted central incisors, as early intervention significantly reduces the overall treatment time and complexity.

Surgical exposure is frequently a prerequisite for orthodontic management in these cases [12]. In recent years, laser-assisted exposure techniques-particularly diode lasers-have gained popularity because of their numerous advantages. Laser surgery allows precise soft tissue removal with excellent intraoperative visibility, reduced bleeding due to effective coagulation, and minimal postoperative discomfort [6]. Hemostasis during exposure facilitates a clear surgical field and minimizes the need for sutures. Moreover, laser application causes less collateral tissue damage than conventional scalpel-based methods do, thereby promoting faster healing and reducing the risk of gingival scarring, which is particularly beneficial in the aesthetic anterior maxillary zone [6,12].

Once the crown is adequately exposed, orthodontic traction is initiated via fixed appliance systems. The "2×4 appliance" setup-comprising brackets bonded to the four maxillary incisors and molar bands on the first permanent molars-offers an ideal configuration for controlled tooth movement during the mixed dentition stage [9]. This approach allows precise three-dimensional control of the position of the impacted incisor, including de-rotation, extrusion, and alignment within the arch. The robust anchorage provided by the molars ensures that light, biologically appropriate forces can be applied without adverse effects on adjacent teeth or developing occlusion.

Early diagnosis and timely intervention are crucial for achieving optimal aesthetic and functional outcomes. Managing impacted incisors during the mixed dentition phase allows clinicians to utilize the patient's growth potential and minimize the need for more invasive treatments in adolescence or adulthood. Prompt correction also prevents secondary complications such as space loss, midline deviation, or psychological distress due to a missing front tooth. From a psychosocial standpoint, restoring the appearance of the anterior dentition significantly enhances a child's self-confidence and social interaction [1].

In summary, although impaction due to rotation is rare, it can lead to prolonged eruption failure if not promptly addressed. The integration of laser-assisted surgical exposure with 2×4 orthodontic mechanics provides an effective, minimally invasive, and aesthetically favorable solution. Early interdisciplinary management ensures not only successful alignment of the impacted incisor but also long-term oral health and patient well-being.

## Conclusion

Rotational impaction of maxillary central incisor is rare but requires early and timely intervention to avoid esthetic, functional and psychosocial complications. Rotated impaction of maxillary central incisors requires early diagnosis and an interdisciplinary treatment approach. Laser assisted crown exposure combined with 2x4 orthodontic therapy offers minimally invasive and effective approach . This interdisciplinary strategy not only facilitates successful eruption and alignment of impacted incisors but also contributes to long term oral health, enhanced esthetics and psychosocial wellbeing of affected children.

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