

## Orthodontic Marvel: 2x4 Appliance for Impacted Incisor Traction - A Case Series


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Impacted incisors can pose significant esthetic and functional challenges for patients. Various treatment approaches have been proposed. The 2x4 orthodontic appliance is one of the most effective treatment plans for aligning the teeth.<sup>7</sup> This article presents two cases showing surgical traction's effectiveness using the 2x4 orthodontic appliance in managing impacted incisors. The results of this case series demonstrated successful outcomes in terms of impacted incisor alignment and overall occlusion. Patients exhibited improved esthetics and function. Therefore, Surgical traction of impacted incisors using the 2x4 orthodontic appliance can be a viable and effective treatment approach.

**Keywords:** Impacted incisors, Orthodontic Marvel, Unerupted teeth

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## Introduction

Impaction is a condition in which complete tooth eruption is hampered by its contact with another tooth. It is characterized by the absence of a tooth in the arch after its usual period of eruption. Unerupted teeth are often encountered in the mixed dentition stage. Maxillary central incisors normally erupt between the ages of 8 to 10 years, and delayed eruption adversely affects esthetic, function, and speech.[1] It may result in adjacent tooth migration, space loss, and midline deviation. Primary causes of central incisor impaction can be trauma to the primary teeth, and mechanical obstruction which might be due to the presence of supernumerary tooth, mesiodens, odontomas, or cysts developed within the eruptive path of the tooth. The prevalence of impacted maxillary central incisors in the age group of 5 to 12 years old is 13%. [2]

Eruption of the maxillary incisor is delayed if the eruption of the contralateral incisor occurred 6 months earlier, the lower incisors have erupted >1 year earlier or there is a deviation from the normal sequence of eruption. Diagnosis of impacted incisors comprises of clinical examination to identify retained deciduous teeth and palpation of the alveolar region.<sup>3</sup> The clinician may encounter a painless, incompressible, palatal, or vestibular fibro mucosal protuberance. Early diagnosis of transposition in tooth development and impaction is essential and greatly influences the prognosis. Intraoral radiographs can confirm a diagnosis. Periapical views and/or an upper standard occlusal radiograph determine the presence and position of maxillary incisor teeth and any underlying developmental anomalies or pathology.[5]

The fixed appliance 2x4 comprises four brackets bonded onto the erupted maxillary permanent incisors, two tubes bonded on the first permanent molars, and a continuous archwire to provide a good arch form. This appliance's versatility permits resolving various problems affecting the upper incisors in a simple and short period.<sup>7</sup> A 2x4 sectional fixed appliance offers more effective and efficient tooth positioning as it allows 3-dimensional control of involved teeth during the correction of aligning impacted incisors. Thus this case report documents 2 cases of management of impacted central incisors using 2x4 orthodontic appliances.

## Case 1

### History

A 10-year-old male patient reported to the Department of Pediatric and Preventive Dentistry with a chief complaint of missing teeth in the upper front tooth region.

The patient was healthy and did not have any dental or medical conditions. Extra-oral examination revealed a bilaterally symmetrical face with a concave profile.

Intra-oral examination revealed the angle's class 1 malocclusion bilaterally with the absence of maxillary permanent central incisors.

### Radiographic Examination

An occlusal radiograph was advised to determine the position of the impacted central incisors. It revealed the presence of an impacted supernumerary tooth concerning the impacted central incisors. It demonstrated that the maxillary central incisors were impacted due to the presence of the impacted supernumerary tooth which was causing hindrance in the eruption of these teeth.

The position of the supernumerary tooth was palatal and in between the central incisors.

### Diagnosis:

- Impacted supernumerary tooth irt 11, 21
- Impacted central incisors irt 11, 21

### Treatment Plan

The treatment was planned in 2 stages; The first stage consisted of surgical extraction of the impacted supernumerary tooth. In the second stage, surgical exposure and traction of the impacted central incisors with the fixed 2x4 orthodontic appliance was planned.

### Treatment

In the first stage of treatment, Infraorbital and nasopalatine nerve blocks were administered. Palatal incisions were given and the flap was raised with a periosteal elevator. Bone cutting was done to expose the embedded supernumerary tooth. The supernumerary tooth was then extracted. The extracted site was irrigated with betadine and sutures were placed.

Post-operative instructions were given and the patient was prescribed antibiotics, analgesics, and mouthwash. The patient was then recalled after 10 days for suture removal.



**PRE-OPERATIVE**



**SURGICAL EXPOSURE OF IMPACTED INCISORS**



**BRACKETS PLACED ON IMPACTED CENTRAL INCISOR**



**NITI 0.12 WIRE PLACED**



**NITI 0.14 WIRE PLACED**



**NITI 0.16 WIRE PLACED**



**POST OPERATIVE**

In the second stage of treatment, a nasopalatine nerve block was administered and the labial flap was raised to expose the impacted incisors. Brackets were placed on the labial surface of the impacted incisors and lateral incisors, molar tubes were placed concerning the maxillary 1st molars. The patient was recalled after 48 hours and placement of 0.12NiTi wire was done. Loose sutures were placed 11, and 21. After 1 month the patient was recalled, and the wire was changed to 0.14 NiTi wire. The patient was recalled after 3 months. The wire was changed from 0.14 to 0.16 NiTi wire. The central incisors had erupted at this stage (8 months). After one 1-month patient was recalled and the brackets were removed. A lingual retainer was given from the maxillary left canine to the maxillary right canine. A satisfactory result was achieved after a total active orthodontic time of 1 year.

## Case 2

### History And Diagnosis

A 10-year-old female patient reported to the Department of Pediatric and Preventive Dentistry, with a chief complaint of missing tooth in the upper front teeth region for 2 years. The patient had no relevant dental or medical history. Both the extraoral and intraoral examinations were done. In the extra-oral examination, no abnormalities were detected while intraoral examination revealed the absence of the left maxillary central incisor with the angle's class-I molar relationship bilaterally.

### Radiographic Examination

An Intraoral periapical radiograph was advised to determine the position of the left maxillary central incisor. It revealed the presence of an impaction of the same tooth. The largest width of the crown of the erupted permanent right maxillary central incisor was 8 mm. The space available for the unerupted right permanent central incisor in the maxilla was 6 mm.

### Diagnosis:

- Impacted central incisor w.r.t 21

### Treatment Plan

The treatment was planned in 2 stages: The first stage consist of maxillary arch expansion with a jack screw expansion appliance, to create a space for the unerupted tooth.

In the second stage, exposure and traction of the impacted tooth with the 2x4 orthodontic appliance were planned.

**Treatment:** The removable Maxillary lateral expansion appliance was made extra orally.

Appliance design: A simple removable plate was devised as the mode for expansion. An appliance was constructed with the jackscrew placed at the deepest part of the vault along with two well-fitting Adam's clasps (permanent 1st molars) and ball end clasps ( on between primary 1st and 2nd molars. The acrylic plate allowed for easier expansion.

### Expansion protocol

The rate and rhythm of screw activation was 1/8th turn 6 days a week. The appliance was given for one month, once the crown of the impacted tooth erupted further stage of treatment was done. The remaining crown exposure was done with electrocautery w.r.t 21 and then the bracket was bonded on the labial surface of the tooth.

MBT brackets were bonded on permanent maxillary central and lateral incisors bilaterally and 0.012 Niti wire of supreme grade was used to align the left central incisor.

The patient was recalled after a month, initial wire was removed and replaced with 0.014 NiTi wire. In the 3 months desired result was achieved. The patient showed normal clinical crown length with acceptable gingival contour and width. The patient was satisfied with the esthetic results.



**Pre-Operative**





**Maxillary Expansion**



**Crown exposure with Electrocautery**



**MBT bracket placed w.r.t 12,11,21,22.**



**0.012 Niti wire placed**



**0.014 Niti wire placed**



**Post-Operative After 3 months**

## Discussion

The occurrence of unerupted maxillary incisors can be associated with hereditary and environmental factors. Often the position of the impacted incisor i.e., distance from the alveolar crest, rotation, angulation, and inclination determine

The successful alignment of the impacted teeth.<sup>1</sup> The timing of intervention has been suggested as being important, the younger the age, the quicker the tooth erupts. To avoid unnecessary complications the intervention should not be delayed. [2]

According to some studies, the prevalence of impacted central incisors has been estimated at 2.6%. In about 0.42-2.1% of the patients with impacted central incisors, the etiology of the impaction was the presence of supernumerary teeth. [3] This was similar to case 1 of this case report.

There are various treatment options for impacted central incisors which include, 1) extraction of an impacted tooth, 2) extraction of an adjacent tooth, or 3) non-extraction treatment involving orthodontic space opening and surgical exposure. The spontaneous eruption has been reported in many cases after space creation. [5] The non-extraction or surgical exposure and orthodontic traction of impacted teeth is the treatment of choice in the majority of the cases. Often orthodontic space opening is carried out before the surgical exposure as done in Case 2 of our case series. This was done to create a space to enhance the natural eruption of teeth.

Following supernumerary tooth/teeth extraction, various retrospective clinical studies have found success rates for the spontaneous eruption of the permanent incisors to be 42 % (Omer et al. 2010), 50 % (67.8 % when the supernumerary was a mesiodens) (Patchett et al. 2001), and 75 %. [4] Pavoni et al. (2013) conducted a study that reported that rapid maxillary expansion followed by surgical removal of an obstacle in the eruption pathway (supernumerary or odontoma) may increase the likelihood of spontaneous eruption of the impacted incisor. These results indicate that interceptive orthodontic treatment increases spontaneous eruption in the management of impacted teeth. When the permanent central incisor does not erupt after mesiodens removal, surgical exposure of teeth is done. [1]

There are two types of surgical approaches for exposure of the impacted teeth namely open and closed approaches. Open or the apically positioned flap technique, consists of apically repositioning a flap that will incorporate the attached gingiva which

Overlies the impacted teeth. Another technique is the closed-eruption technique, a flap is raised that will incorporate the attached gingiva over the impacted teeth. This is followed by attaching an orthodontic bracket to the teeth, and then fully replacing the tissue over the tooth and bracket. Both techniques offer certain advantages during the forced eruption of impacted teeth.<sup>6</sup> The open technique permits easy reattachment of a bracket if debonding occurs. However, the closed-eruption technique is believed to provide the most aesthetic results. In the above-mentioned cases closed eruption technique was used. The treatment option was because this technique provides a better aesthetic result and good periodontal health. Bayram L. et al. (2006) stated in their article that forced eruption of impacted teeth must always be considered in young patients because this technique can lead to suitable results from a periodontal, occlusal, and esthetic perspective at an earlier stage better than with other treatment options.[3]

In both cases, the successful eruption of impacted incisors took place. An appropriate gingival contour and attached gingiva were seen towards the end of both cases. Satisfactory esthetics were achieved. No further Treatment Was Required.

## Conclusion

Treatment of impacted central incisors can be a challenging task. Early diagnosis and interventions are required for a successful result. Appropriate surgical treatment followed by orthodontic traction is usually the most common treatment option.

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