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Treatment of permanent maxillary central impaction: a case report.

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CASE REPORT

ABSTRACT

The 2x4 appliance consists of using four brackets to the anterior teeth (upper or lower), accompanied by two tubes on the molars, which can be fixed directly or inserted into orthodontic bands. This technique allows efficient correction of malocclusions during mixed dentition, such as aligning poorly positioned permanent teeth, correcting anterior crossbite, controlling tooth inclination and rotation, and reducing overbite. When carried out with adequate theoretical and practical knowledge, the method is effective and agile, but can lead to complications if poorly executed. An essential precaution is to monitor the position of the roots of the upper permanent lateral incisors to avoid contact with the crown of the erupting upper permanent canine, preventing root resorption. This case report describes the diagnosis and treatment of an 11-year-old female patient with impaction of the upper permanent central incisor (11), a common anomaly in the mixed dentition. Initially, a ulectomy was performed and the impacted tooth was pulled with nickel-titanium wires and a bonding button. The 2x4 method was used to align and level the anterior teeth, favoring the repositioning of the impacted element in the arch. The treatment was successfully completed, restoring aesthetics and function, and demonstrating the effectiveness of the 2x4 method as a conservative and efficient approach to correcting anterior crossbite and traction of impacted incisors.

Keywords: mixed dentition; impacted tooth; anodontia.

Tratamento da impactação de inciviso central superior permanente: relato de caso.

RESUMO

O método 2x4 consiste na colagem de quatro braquetes nos dentes anteriores (superiores ou inferiores), acompanhados por dois tubos nos molares, que podem ser fixados diretamente ou inseridos em bandas ortodônticas. Essa técnica permite uma correção eficiente de más oclusões durante a dentição mista, como o alinhamento de dentes permanentes mal posicionados, correção de mordida cruzada anterior, controle de inclinação e rotação dentária, além da redução do overbite. Quando realizado com conhecimento teórico e prático adequado, o método é eficaz e ágil, mas pode gerar complicações se mal executado. Um cuidado essencial é monitorar a posição das raízes dos incisivos laterais superiores permanentes para evitar contato com a coroa do canino superior permanente em erupção, prevenindo reabsorções radiculares. Este relato de caso descreve o diagnóstico e tratamento de uma paciente do sexo feminino, 11 anos, com impactação do incisivo central superior permanente (11), uma anomalia comum na dentição mista. Inicialmente, procedeu-se à ulectomia e ao tracionamento do dente incluso com fios de níquel-titânio e botão de colagem. O método 2x4 foi utilizado para alinhar e nivelar os dentes anteriores, favorecendo o reposicionamento do elemento impactado no arco. O tratamento foi concluído com sucesso, restabelecendo a estética e a função, e evidenciando a eficácia do método 2x4 como abordagem conservadora e eficiente na correção da mordida cruzada anterior e no tracionamento de incisivos impactados.

Palavras-chave: dentição mista; dente impactado; agenesia dentária.

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INTRODUCTION

Dental eruption, a physiological process, begins with the formation of a tooth within the jawbone and its subsequent movement towards the oral cavity, ultimately emerging through the gums. The timing and sequence of eruption vary considerably among individuals; however, understanding the typical eruption pattern is essential for identifying anomalies. These anomalies may involve the number, shape, size, or position of the teeth. One such anomaly related to number is the impaction of the maxillary central incisors, which can often be identified during the mixed dentition stage.[1]

A maxillary incisor is considered impacted when the contralateral incisor has erupted more than six months earlier and the opposing mandibular incisor has erupted over a year before. Impaction can also be suspected when there is a deviation from the normal eruption sequence of permanent teeth.[1-4] This condition is easily noticed by parents when the child is around 7 to 9 years old, as it affects both dental and facial esthetics and can negatively impact the child's social life and self-esteem.[5-7]

Studies on the prevalence of this condition take into account factors such as gender, age, ethnicity, nutritional status, and underlying etiologies, which contribute to variability in the data. Nevertheless, the prevalence is relatively high, estimated between 1.4% and 2%[3,8] reinforcing the clinical impact.

The etiology of impacted maxillary central incisors is multifactorial, involving both local and systemic factors. Local and environmental causes include supernumerary teeth, odontomas, cysts, trauma to the primary dentition, coronal or root dilaceration, premature loss of primary teeth, and a history of cleft lip and/or palate. Systemic factors include endocrine deficiencies, cleidocranial dysplasia, craniofacial dysostosis and associated syndromes. [1,2,4,9-11,13]

Due to this diverse etiology, accurate diagnosis requires a thorough anamnesis. A detailed dental history should include reports of trauma to the primary dentition, specifying when, how, and how severe the incident was. A comprehensive medical history is also essential to identify any systemic health issues. During the clinical oral examination, attention should be paid to the prolonged retention of primary teeth, tooth inclination or rotation in the region of the suspected impaction, and potential space loss. Palpation and visual inspection for swelling in the lip or palate may also help

localize the impacted tooth.[1]

Complementary imaging exams are essential, including periapical radiography, occlusal, panoramic and cone beam computed tomography (CBCT). Radiography helps with identification, localization and position of impacted teeth, and in detecting possible obstructions to eruption. Cephalometric radiographs are particularly useful for evaluating the vertical position and buccolingual inclination of the tooth. CBCT provides detailed three-dimensional views of adjacent structures, which greatly aids in treatment planning.[1]

Treatment planning depends on the chosen modality (orthodontic, orthopedic or surgical, isolated or combined) and the method to be adopted. The main methods include: (a) surgical exposure followed by orthodontic traction; (b) surgical repositioning of tooth; (c) extraction of impacted teeth with subsequent prosthetic rehabilitation[2,4]; (d) space creation using fixed or removable appliances (e.g., the 2x4 appliance)[1,4]; and (e) removal of any eruption barriers followed by observation of spontaneous eruption over a minimum period of three months.[1,5] Among these approaches, the combination of surgical exposure with orthodontic traction has proved effective and is considered the first therapeutic choice. [1,2,5-7,11-13]

CASE REPORT

An 11-year-old female patient was referred to the Orthodontic Clinic of the Faculty of Dentistry of Araçatuba – UNESP, with the chief complaint that her “tooth hadn’t come in yet.” The patient was in good general health, with no history of systemic diseases or use of medications.

1. Clinical facial examination

In the facial clinical examination, the frontal view revealed balanced facial thirds, classifying the patient as mesofacial. The frontal view also demonstrated symmetry between the right and left sides and an adequate lip seal (Figure 1A). In the profile view, the patient exhibited a harmonious facial outline, with well-defined nasolabial angle, lip contour, labiomental sulcus, and chin profile, classifying her profile as straight to slightly

convex (Figure 1B). During the smile assessment, the absence of tooth 11 was evident, causing a negative esthetic impact (Figure 1C).

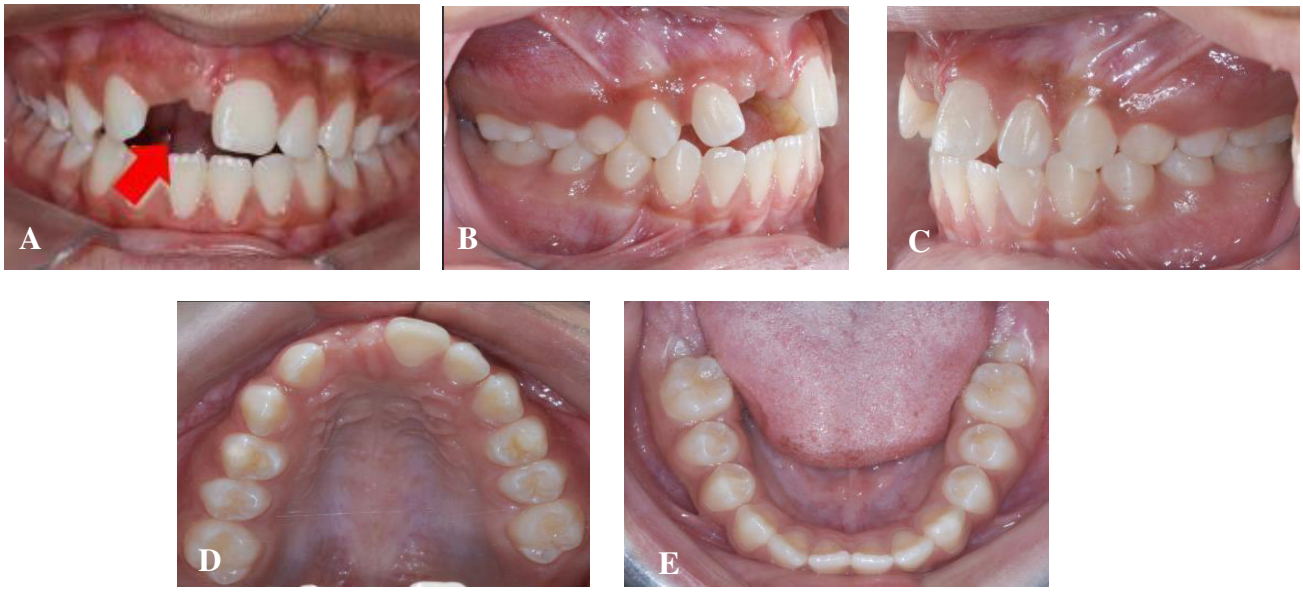
Figure 1- Extraoral photographs in frontal, profile, and smiling views.

Source: authors.

2. Clinical intrabucal examination

The frontal intraoral view showed a mild anterior open bite and adequate transverse relationships, with the absence of tooth 11 clearly noted (Figure 2A). The right and left lateral views revealed a Class I relationship of the first permanent molars, premolars, and canines (Figures 2B and 2C). Occlusal views of both arches showed wide, parabolic-shaped dental arches in permanent dentition (Figures 2D and 2E).

Figure 2- Intraoral views of the



patient.

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3. Clinical diagnosis

The clinical diagnosis was Angle Class I malocclusion with absence of right upper permanent central incision (11). Differential diagnoses included impaction or agenesis. Complementary exams were requested to confirm the diagnosis and aid in treatment planning.

4. Complementary exams

The following complementary exams were obtained: panoramic radiograph (Figure 3A), periapical radiograph of the upper incisors (Figure 3B), lateral cephalometric radiograph (Figure 4), and cone beam computed tomography (CBCT) (Figure 5). These revealed an ectopic position of tooth 11, clearly visible in the panoramic and periapical radiographs as well as the CBCT 3D reconstruction. No other dental anomalies were observed..

Figure 3- A. Panoramic radiograph; B. Periapical radiograph.

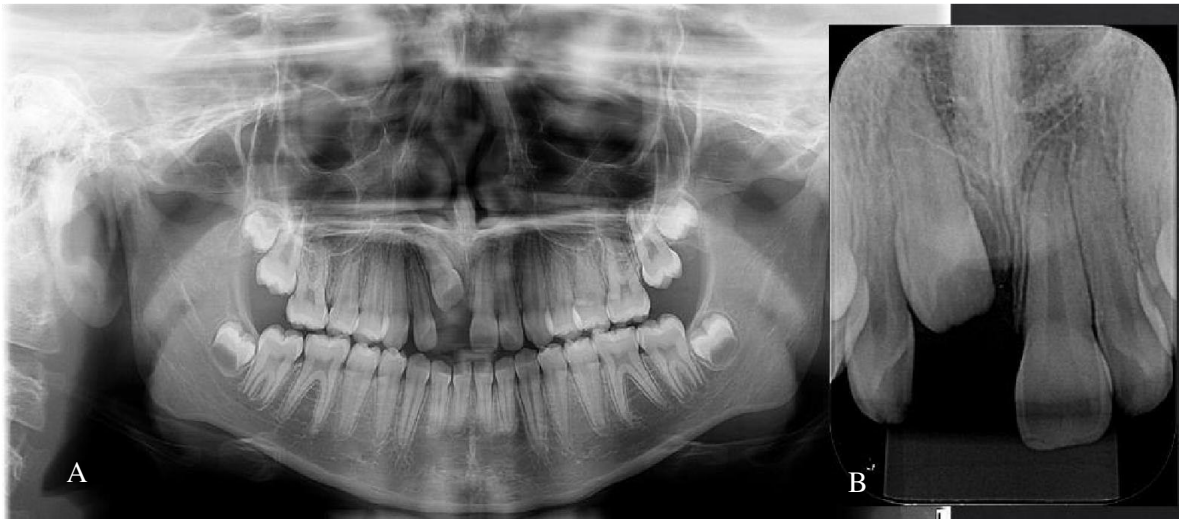

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Figure 4 - Lateral cephalometric radiograph.

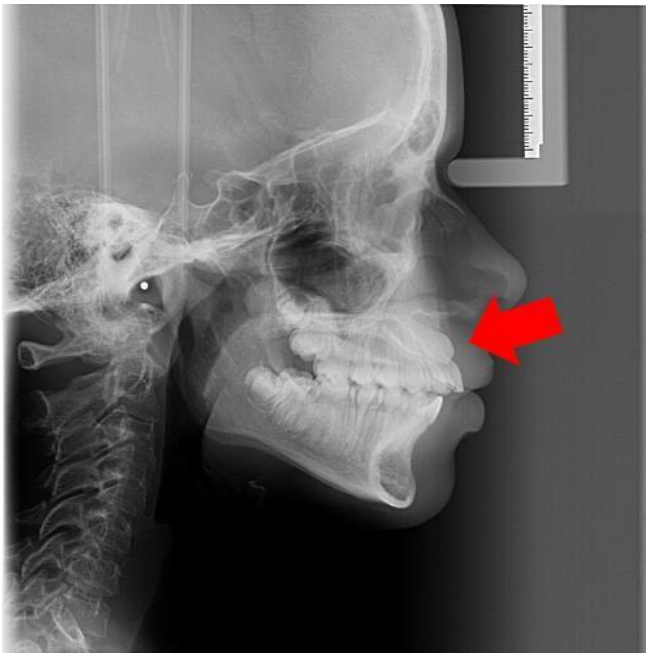

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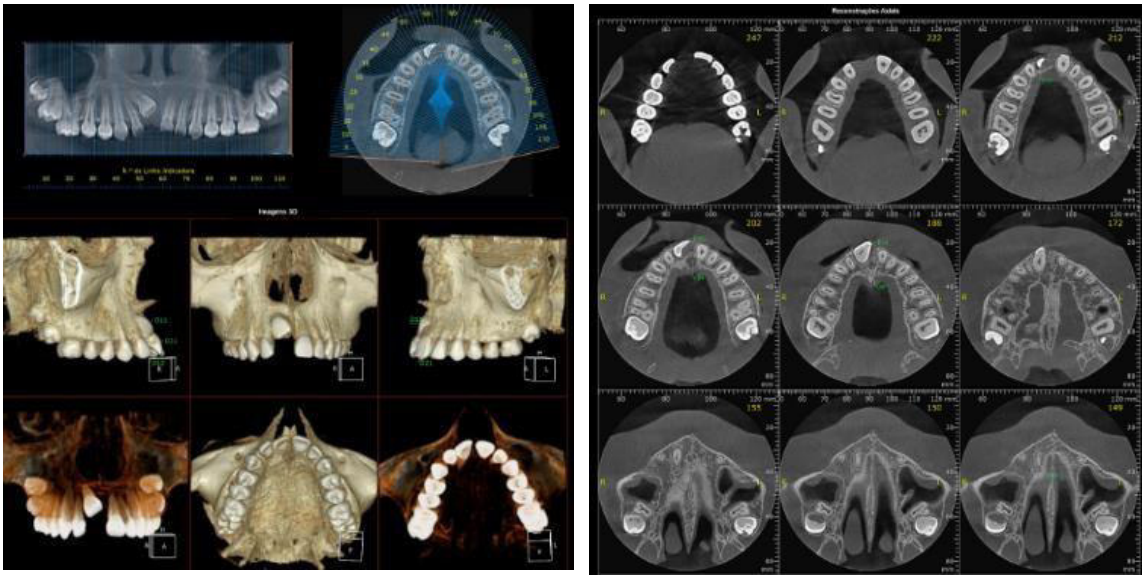
Figure 5 - Cone beam computed tomography (CBCT).



Source: authors.

5. Treatment Objectives

The treatment objectives included alignment and leveling of the teeth, as well as the traction and correct positioning of tooth 11.

6. Treatment options

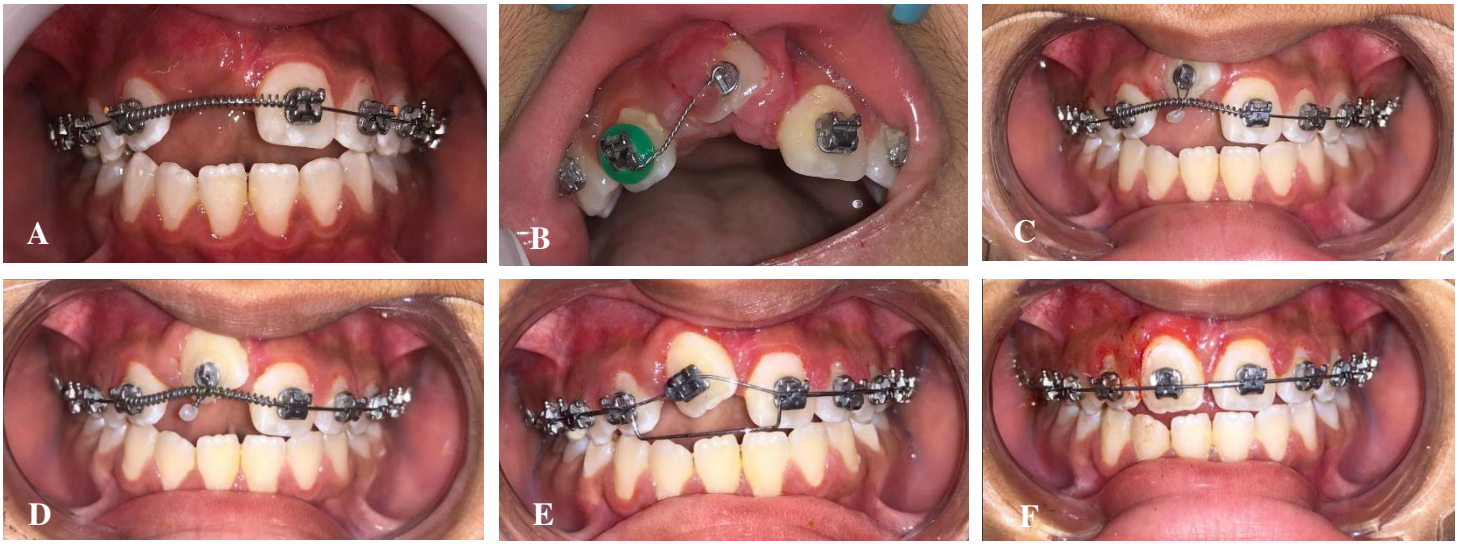
Two treatment options were presented to the patient and her guardians: A) Ulectomy and exposure of the crown of tooth 11, followed by observation for 180 days for potential spontaneous eruption; B) Ulectomy and exposure of the crown, followed by orthodontic traction — the option ultimately chosen.

7. Treatment description

Treatment was conducted using a self-ligating fixed metal orthodontic appliance (SLI model, Roth prescription, Morelli – Sorocaba, Brazil; REF. 10.14.900). The goal of the first stage of treatment was to align the teeth and regain space for tooth 11. A 0.012" nickel-titanium archwire (Orthometric – Marília, Brazil) was used along with a 2 mm activated open coil spring (Morelli – Sorocaba, Brazil) (Figure 6A). The second stage of treatment began with the surgical exposure of tooth 11 and the bonding of an orthodontic attachment to enable traction (Figure 6B). At this point, clinical attention

was directed toward two main objectives: performing an effective traction method for tooth 11 and maintaining the correct position of teeth 12 and 21. To initiate traction, a 0.008-inch ligature wire was used to connect the bonded attachment on tooth 11 to the leveling archwire, which was deflected by 1.5 mm. Anchorage control was achieved with the aid of an open-coil spring positioned between teeth 12 and 21, as shown in Figures 6C and 6D. As treatment progressed, the leveling wire was gradually inserted into the slot of the bracket on tooth 11. To support anchorage during this stage, a U-shaped bend (bypass) was incorporated between the mesial aspect of tooth 12 and the distal aspect of tooth 21 (Figure 6E). In the subsequent stage, the leveling wire was fully engaged into the bracket of tooth 11, completing the traction sequence (Figure 6F). Each figure represents a monthly interval between the clinical steps.

Figure 6 - Clinical progression of the treatment.



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The treatment objectives were successfully achieved, and the patient expressed satisfaction with the final result (Figure 7).

Figure 7 - Final treatment outcome.

Source: authors.

DISCUSSION

The main treatment modality for impacted maxillary incisors is a combination of surgical exposure and orthodontic traction. A commonly followed protocol begins with maxillary expansion to create adequate space, followed by a waiting period of approximately 90 days to observe any spontaneous eruption of the impacted tooth. This expansion can be achieved using removable or fixed appliances, such as the Hyrax or Haas expanders, palatal plates with expansion screws, or even 2x4 fixed appliances.[1]

Once space is recovered, the next stage involves surgical exposure. Among the various surgical methods, the closed eruption technique is considered the gold standard. In this approach, a mucoperiosteal flap is raised over the impacted tooth, and an orthodontic attachment is bonded to the crown. The flap is then repositioned and sutured back to its original location. [1,14,15] This technique is preferred because it closely mimics natural eruption, yields favorable aesthetic and periodontal outcomes, causes minimal discomfort, lowers the risk of infection, and reduces treatment time.[12] Conversely, the open eruption technique is rarely indicated due to challenges in maintaining hygiene and the aesthetic drawbacks associated with soft tissue loss and crown lengthening of the incisor.[1]

The bonded attachment, often referred to as a button, is fixed to the impacted tooth using resin following etching with 37% phosphoric acid and application of an adhesive system. Alternatively, some techniques involve drilling from the buccal to the

palatal surface to insert traction mechanisms, with subsequent restoration of the tooth. However, this method is not preferred due to the increased risk of enamel damage or tooth fracture.

Orthodontic traction may be performed using either removable or fixed appliances. When using a removable appliance, the prosthetist positions a hook-shaped wire within the space of the unerupted tooth. An elastic band connects this wire to the bonded attachment, and the patient is instructed to replace the elastic daily. As the elastic generates extrusive forces to bring the tooth into alignment, anchorage control is necessary to avoid undesirable mesialization or intrusion of adjacent teeth. This is often achieved with the aid of clasps incorporated into the removable appliance.

In cases using fixed appliances, orthodontic traction is accomplished through archwires passing through the brackets of the maxillary anterior teeth. An open-coil spring is placed between the adjacent teeth to recover space and prevent mesial movement. An elastic band or a flexible wire is then used to apply traction to the impacted tooth. When elastics are used, they must be changed daily by the patient until the tooth reaches the occlusal plane. When using flexible wire, it is activated by deflection. Due to its elasticity, the wire attempts to return to its original straight form, thereby applying a continuous extrusive force to the tooth. These wires are generally replaced every 21 days until proper alignment is achieved.

It is important to emphasize that one of the potential consequences of incisor impaction and orthodontic traction is root resorption.[15] A study by Ho et al.[13] demonstrated that the higher the crown of the impacted tooth is located relative to the alveolar ridge, the greater the degree of root resorption observed—meaning the extent of tooth movement correlates with the risk of resorption. Another common complication is an unfavorable aesthetic appearance at the cervical region of the tractioned tooth, which may necessitate supplementary periodontal surgery for optimal outcomes.

FINAL CONSIDERATIONS

In conclusion, thorough anamnesis, clinical examination, and analysis of

complementary diagnostic exams are essential for accurate diagnosis and effective treatment planning. The combination of surgical exposure and orthodontic traction remains the most effective approach, as it promotes superior aesthetic and periodontal outcomes for patients with impacted maxillary incisors.

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