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Halterman technique for the treatment of ectopically erupting permanent first molars

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Abstract: *Tooth eruption is a process whereby the forming tooth migrates from its intraosseous location in the jaw to its functional position within the oral cavity. Ectopic eruption is one of the problems that arise during the transitional dentition period.*

In this report, the ectopic eruption case was successfully treated with with Halterman type appliance in 2 months. This case report demonstrates that a could with Halterman type appliance provide many benefits over other traditional treatment modalities and thus could be used for correcting ectopic eruption at an early age.

Keywords: *Ectopic eruption, permanent maxillary first molar, Halterman Appliance*

I. Introduction

The term ectopic eruption includes those cases in which permanent teeth show abnormal eruption pattern. Thus, ectopic eruption reflects the eruption of a tooth in an incorrect position (1). The first permanent molar is considered ectopic when radiographic examination shows superposed image and impaction on the roof of the deciduous second molar. Therefore, this abnormality can be diagnosed by radiographic examination before the eruption of the tooth (1,2).

The causes of ectopic eruption are multifactorial, including a genetic component and local factors. The reported increased prevalence in siblings suggests a genetic component. In fact, a recessive inheritance pattern with reduced penetrance in girls has been suggested as a mode of inheritance (3).

Chapman stated that, for ectopic eruption to occur, the forward movement of the first permanent molar must be in excess of the downward movement. He suggests one or a combination of **three etiological factors(4):**

1) the lack of forward movement of all deciduous teeth and bone containing them,
2) the first permanent molar having moved forward prematurely
3) the early eruption of the first permanent molar.

Chintakanon and Boonpinon reported that important etiological factors were the eruption path of the permanent molars and the size of the mandibular second primary molars. The authors investigated whether the presence of high interproximal carious lesion reduces the prevalence of ectopic eruption and found no correlation (5).

Harrison & Michal reported that inadequate placement of a stainless steel

crown on the second primary molar is an iatrogenic factor of ectopic eruption of first permanentmolars. Once the crown is replaced with a properly adapted one, the situation usually self-corrects. (6)

Ectopic eruption of the maxillary first permanent molar has a prevalence that ranges between 0.75 to 4.3% . It is increased by four-fold in persons with cleft lip and palate . A higher prevalence, 19.8%, has been reported in siblings (6). Some authors report a higher incidence in males (6), while others found no statistically significant difference between sexes (5).

Early diagnosis of ectopic eruption can be made in children between five and seven years old on a periapical or bitewing radiograph when the first permanent molar is positioned more superiorly and mesially. Later in the eruption process, signs of resorption of the second primary molar roots are evident on radiographs. The first clinical sign of ectopic eruption is the inclination of the occlusal plane of the second primary molar. In most cases, the distal aspect will be canted occlusally which may result in an anterior open bite (6). Frequently, there will be delayed eruption of the permanent tooth (6). In some cases, as the permanent tooth erupts, the distal cusps will appear first through the gingiva (7).

Chintakanon and Boonpinon looked at and found no correlation between the degree of resorption of the primary molars and the type of ectopic eruption(5). In a more recent study of 36 ectopically erupted molars,

a grading system was used to classify the degree of resorption (Figure 3). There was a tendency for self-correction in the lowest degrees of resorption but this was notstatistically significant (8).

Fig.1; Elastic Halterman Appliance

Young classified ectopic eruption of thepermanent first molar into two forms: (1) Reversible; and (2) irreversible (called "jump" and "hold"). In the reversible form, the ectopically erupting permanent first molar frees itself spontaneously from a locked position and erupts into occlusion. This reversible pattern occurs in approximately 66% of ectopically erupting permanent first molars.(9)In the irreversible form, the permanent first molar remains in a locked position until

active treatment is provided, or premature exfoliation of a primary second molar occurs. In cases of premature exfoliation of the primary second molar, a significant

loss of the dental arch occurs, and the permanent first molar often tips mesially with some rotation.(5) Bjerklin and Kurol noted that the most permanent molars wouldfree themselves and erupt normally by 7 years of age.(10)

This paper presents a case report with unilateral ectopic permanent maxillary first molar treated with Halterman type appliance.

II. Case Report

A 5-year-old girl came to the private clinic of Pedodontics and Preventive Dentistry for general check-up. The patient was in good general health.

Fig.2a; Pre-operative radiograph right side , indication of ectopic eruption of molars, decided to give 6 months to watch.

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Fig.2b; Pre-operative radiograph left side, indication of ectopic eruption of molars, decided to give 6 months to watch

Extraoral examination revealed no significant findings. Intraoral examination revealed permanent maxillary left first molar locked beneath the adjacent primary second molar [Figure 2a]. There were no tooth mobility and no tenderness to percussion in relation to primary second molar. An intraoral periapical radiograph revealed mesially erupting maxillary left first permanent molar with associated resorption of the primary second molar [Figure 2a,b]. Correlating clinical and radiographic findings, the left maxillary permanent first molar was diagnosed as ectopic eruption. It was decided to place Halterman type appliance on second deciduous left molar extending below the mesial marginal ridge of the first
permanent molar.

Fig.3;Intraoral photo after 6 weeks of wearing the appliance #3 is in a position that the appliance can be removed.

This appliance consists of a band placed on the second primary molar with a large diameter soft wire with a distal hook placed 2 mm distal to the clinical crown of the permanent tooth. A tight loop chained elastic is placed between the distal hook and a button bonded to the permanent molar. The elastic chain creates a distal force on the permanent tooth[Figure 3]. Follow-up is recommended every 3 weeks. If more correction is needed, the tension on the elastic may be increased or the appliance may be removed and the wire repositioned more distally with a three-prong plier. The appliance

Figure 4. Modifi ed Halterman appliance with reverse band and loop extension, 2 spurs, and an occlusal bonded button with chain elastic placed in a slingshot or catapult pattern.

May be removed once the impaction of the first permanent molar is corrected (11).

Placing the occlusal button can be challenging in a young mixed dentition patient because of location and isolation during acid etching and placement of the bonded attachment. To facilitate good retention of the occlusal button, the author[Figure 4] recommends working with 2 chairside assistants and placing a dry foil in the corner of the mouth for saliva control. One clinical assistant should be responsible exclusively for isolation, and the second assistant should facilitate instrument transfer. Light-cured composite is used to retain the occlusal button because of its quicker set in an area that is difficult to isolate. An alternative would be to use glass ionomer cement.

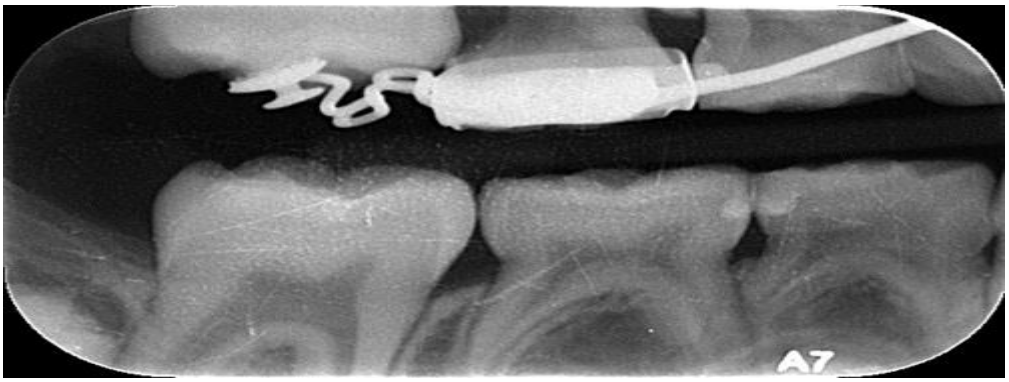

Figure 5; Patient was evaluated after 6 weeks of wearing the halterman and the button on the left side

After appliance placement, the chain elastic is changed at 2- to 3-week intervals. If the impacted permanent molar needs to be moved to the buccal, the chain is applied from the bonded button to the buccal-soldered spur. For a purely distal movement, the elastic can be stretched from the distal buccal spur to the bonded button and back to the distolingual spur in a catapult or slingshot design, as shown in[Figure 5] .

Figures 2a,b to 7 show short- and long-term results with this technique. The impaction is usually corrected within 2 to 4 months , and over correction is recommended . After disimpaction, the chain elastic is removed and the appliance is left on as the permanent first molar erupts. Once the clinician is assured that the permanent first molar impaction remains corrected, the appliance is removed.

Fig. 6a: Final photo occlusal view. **Fig.6b;** : Final photo occlusion

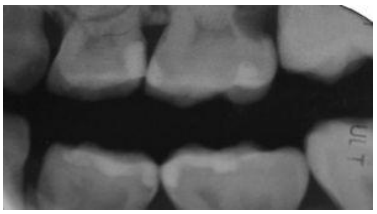

Fig.7: Final photo occlusal view

Because root resorption on the primary second molar has occurred, careful monitoring for premature exfoliation is necessary. Provided there is adequate space and no premature loss of the primary maxillary second molar, there is satisfactory eruption of the permanent dentition (Figure 6a,b,7).

III. Discussion

The purpose of this paper was to report the clinical case of a patient with ectopic eruption of a maxillary first permanent molar, focusing on the main clinical and radiographic features of the case, as well as its treatment(12).

Untreated irreversible ectopic eruption of first permanent molars may cause premature loss of the primary second molar and result in unfavorable occlusion and space deficiency for the second premolar (13). Less frequently abscess formationand pain may occur (1). On the other hand, if the molar is self-correcting, treatment is unnecessary. Delivering treatment when not indicated may be detrimental, cause bacterial infiltration, increase the risk of infection and accelerate the loss of the primary tooth. If an unnecessary treatment is provided, cost and time of the patient and the practitioner are exhausted (4). Therefore, proper diagnosis of the type of eruption is crucial for the delivery of appropriate treatment. Unfortunately, this is a challenging task, as no definitive criteria have been established to accurately predict the outcome. However, a few authors have presented guidelines and recommendations to aid in determining when to intervene(3).

Some authors demonstrated that the ectopic eruption of the maxillary first permanent molars can occur both unilaterally and bilaterally (1,10). Barberia-Leache et al. described a higher frequency for the right side, when the eruption is unilateral (8). The case reported in this paper involved the right side of the arch, in a unilateral pattern. This higher frequency of the right side, when the condition is unilateral, is difficult to explain, but, like in other multifactorial anomalies, there is a variation in the frequency of sides. However, there are also reports showing no difference in distribution between sides (10).

Some studies describe a higher prevalence of ectopic eruption in maxillary molars (3,11,12). Therefore, the case described herein is in accordance with the most common clinical manifestation described in studies, since it involved a maxillary molar.Different factors have been associated with the etiology of this abnormality (2-10), and the negative model discrepancy observed in this case may be associated with the described ectopy.

Traditionally, various techniques such as elastic separators, brass wire, or Halterman appliance have been used for correction of ectopically erupting permanent first molar.[8] In most cases, however, separator or brass wire alone is not effective since the amount of space that could be created is limited. Kennedy and Turley have described different modalities for clinical management of ectopic permanent molars.

They recommended that when primary molar hassuffered excessive resorption and is symptom free, it could be used as abutment tooth for a Halterman type appliance.[9,10] Although Halterman type appliance is effective, but it is bulky, requires additional lab procedures and necessitates preparation of the occlusal surface of permanent first molar.[10] Kennedy recommended modified Halterman appliance, which is a reverse band and loop appliance with a bonded button on the permanent molar and chain elastic for disimpaction. However, the appliance required changing of chain elastic at 2–3 weeks interval. In addition, taking an accurate impression of the hamular notch and good communication with the lab was mandatory with this modified appliance.[2]

In a study conducted on 126 cases of ectopic eruption, Bjerklin and Kurol observed that in approximately 90 % of cases, the type of ectopic eruption could be assessed during the child's 7^{th} year of life(3,10). The remaining 10% were assessed between 8 and 9 years of age. In case of doubt, the authors recommend postponing treatment for a few months (3). Young stated that self-correction can occur between 6 months to 2 years after diagnosis of ectopic eruption (9). Most authors recommend an observation period of 3 to 6 months from diagnosis before intervening (13). On the other hand, initiating treatment early may afford a better chance for proper alignment and positioning of the permanent tooth. Far more potential harm to the primary and permanent molars is risked if clinical treatment is postponed (6).

In 1987, Kennedy and Turley proposed a flow-chart to determine when to initiate treatment, based on factors such as the clinical eruption status of the permanent tooth, its change in position, the amount of ledge of the primary tooth entrapping the permanent molar, the mobility of the primary tooth and the presence of pain and infection . In these guidelines, the treatment recommended depends primarily on the amount of enamel

ledge created by the root resorption of the primary molar (13). However, to date, the amount of resorption of the primary roots has not been shown to have a statistically significant relationship with a specific outcome.

Treatment may be classified into three main categories: minimal intervention, appliance therapy with retention of the primary second molar and appliance therapy with extraction of the second primary molar (15).

Interproximal wedging consists of creating a separation between the mesial surface of the permanent first molar and the distal surface of the second primary molar to allow the permanent molar to free itself from the undercut of the primary tooth. This can be done with an elastic separator, a brass wire or a spring and is indicated as an initial treatment or when the impaction of the permanent molar does not appear severe. These wedging techniques have many advantages: they generally minimize chair time, they do not require impressions or laboratory procedures and they do not damage the permanent teeth (14). Other minimal interventions include gingivectomy to expose of the permanent tooth and disking of the distal surface of the primary second molar.

If the permanent molar is not erupted, the brass wire technique may be used. This technique requires local anesthesia. A brass wire is threaded through the interproximal area and looped around the marginal ridge of the permanent molar. Both ends of the wire are twisted until snug and tucked into the interproximal area to avoid discomfort. The wire must encircle the contact area. A bitewing radiograph is taken to confirm the correct placement of the wire. The patient is seen at regular intervals to tighten the wire. The wire may be removed once it slips through the contact during tightening (12). This technique may result in infection or early loss of the primary molar, therefore careful supervision is recommended (1).

The simplest treatment consists of placing an orthodontic separating elastic between the primary second molar and the permanent first molar. Topical anesthetic may permit more comfortable placement of the elastic (16). Placement with waxed floss instead of pliers may prevent damage to the gingiva. The elastic must be replaced every 7 to 14 days until there is overcorrection of the impaction. Spontaneous loss of the separator indicates correction (17-20).

Evidently, the tooth must have emerged somewhat from the gingiva to allow for proper positioning of the elastic. A triangular helical spring has been described as an adjunct to the elastic separator technique. It is suggested that the space created by the brass wire or the elastic separator is limited and therefore not effective. A spring composed of three helical loops in a triangular shape is thus fabricated and inserted between the permanent first molar and the second primary molar. The wedging spring should be reactivated or replaced every 3 weeks (18,19,20).

Harrison and Michal observed that in minimal lock cases, self-correction occurred more frequently and more quickly after surgical exposure. They also recommend surgical exposure of the first permanent molar if it is positioned very high to avoid the use of any appliance. Self-correction should be observed within 3 to 4 months, if the condition has not improved, appliances are used (6).

One of the limitations of this appliance is that the part of ectopically erupting tooth should be visible so that bonding of the button could be done and the adjacent primary second molar should not be grossly carious. Future studies are required to assess the performance of this appliance in cases of ectopically erupting mandibular permanent molars. (Figure 6a,b,7)

IV. Conclusion

Ectopic molars are usually predictors of a future discrepancy between tooth size and arch length; an orthodontic referral may be indicated .The diagnosis of suspected cases of ectopic eruption of first molars may be performed even before the eruption of these teeth by taking radiographs of the area. In this situation, the periodic follow-up of the patient is greatly important, in order to prevent clinical sequelae resulting from this condition.

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