CASE REPORT

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Mandibular second molar impaction treatment using skeletal anchorage

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Abstract

The mandibular second molar impaction is a rare dental anomaly with a very challenging treatment. Although there are some treatment modalities, often the proper option is surgical exposure and orthodontically assisted eruption with a high rate of success depending on the appropriate appliance design, which assures a good control of the tooth movement with minimum side effects. A case report of a severe bilaterally impaction of the mandibular second molar in an adolescent female patient is presented, successfully treated using a miniplate, as skeletal anchorage.

Keywords: mandibular second molar impaction, orthodontically assisted eruption, miniplate.

Introduction

Impaction of the teeth is a developmental dental anomaly and the permanent second molar impaction is un uncommon condition which has low incidence 0.05–2.3% [1–5], the second permanent mandibular molar MM2 (65%) being involved more often than the maxillary second molar (21%) [6, 7].

The etiology of MM2 impaction is very disputed, including systemic and local factors, but recently MM2 impaction demonstrates a genetic trait, possible an autosomal not sex chromosome inheritance [6].

For MM2 impaction, the unilateral impaction is more common than the bilateral impaction, males being more affected than females and the frequency is higher on the right side than on the left side [6–8].

The main systemic and local factors causing MM2 impaction are craniofacial morphology [9], anterior or posterior crowding or arch-length discrepancy [4, 6–8, 10], disturbance in periodontal membrane [11] and disruption in nerve supply [4], failure in eruption mechanism, guidance theory – the MM2 eruption requiring the guidance of the first mandibular molar MM1 roots (excess space between MM1 and MM2 allowing mesial inclination of the developing MM2) [4, 6, 8, 10], uprighting of MM1 using lip bumper [8] or non-extraction treatment *via* E-space preservation with passive lingual arch, with a higher risk if the first permanent mandibular molar-second permanent mandibular molar angulation is 24^0 or greater [12]. The last two causes together with previous sagital orthodontic expansion and incorrectly fitted band on the first molar are also the most important iatrogenic factors [10]. Recently, Rubin RL *et al.* [13] showed that Schwarz appliance or combination of Schwarz and lingual holding arch in the mixed dentition was also correlated significantly with mandibular second molar eruption difficulties.

There are three forms of MM2 impaction, in the literature, regarding axial inclination of MM2: mesially and distally inclined or vertically positioned, the mesial inclination being the most frequent [5–7].

The treatment is often interdisciplinary and very challenging for the orthodontist, an early diagnosis of a disturbance in the eruption process of MM2 is imperative, because it might reduce the risk of impaction or the difficulty of treatment [8, 14]. The later the MM2 impaction is detected the more difficult the treatment will be. A good option of the treatment of MM2 impaction is orthodontically assisted eruption of the second molar after surgical exposure and attachment bonding. The difficulty of the orthodontic treatment is often the anchorage, but modern techniques (the use of miniscrew [15] or skeletal anchorage [16]) try to solve the problem and to reduce the side effects.

The present case report is of orthodontic treatment, using skeletal anchorage, of a bilateral mandibular second molar impaction.

Patient, Methods and Results

A 14 year and 7 month old female patient came in the Orthodontic Department of the Faculty of Dental Medicine, "Carol Davila" University of Medicine and

Pharmacy, Bucharest, with the chief complaint being the upper and lower anterior crowding, with all four canines blocked out.

She had a Class II malocclusion (ANB-6, AoBo-4) with a retrognathic mandible and a high angle vertical pattern (NL, ML – 34.5) and anterior crowding. Intra-orally, a permanent dentition was observed, the distal surface of the mandibular second permanent molar crown being partially visible (Figure 1).

The panoramic X-ray examination revealed the impaction of MM2 with severe mesially inclination especially on the left side, under the MM1 crown, the third molar bud lying over the second molar (Figure 2).

In the upper arch there were also eruption disturbances in the molars region, the third molar having an accentuated mesially inclination which determined not only an abnormal position of the second molars, but also their overeruption (Figure 2). Therefore, the cause of the second molar impaction in this case, might be the deficiency of the mandible and also a genetic influence, due to the number of teeth involved in these developmental dental anomalies and a short mesial root of the second molar, in contrast to normal roots morphology of this tooth [6, 17].

The orthodontic treatment needs upper and lower premolars extraction, because of the anterior crowding. Due to the severe eruption disturbances in the molars region in the mandible, the first aim of the treatment was to try to align the lower second molars, before planning which teeth have to be extracted.

In order to upright the second mandibular molars an assisted orthodontically eruption after surgical exposure was planned and it was also decided to extract third upper and lower molars.

Skeletal anchorage was used, "L" shape anchor plates with 1.7 mm bone screws, which were placed on the anterior border of the mandibular ramus (Figure 3).

The first stage was the surgery stage with miniplates placement, surgical exposure of the second molars, attachment bonding and third molars extraction. The intraoral parts of the anchor plates were adapted in order to allow for an appropriate direction of the second molar traction and not to interfere with the mandible movements and the occlusion.

The attachment (a bondable button) was bonded on the distal part of the occlusal surface of the second molar (Figure 4). The orthodontically assisted eruption was performed using an elastic chain traction between the button and the anchor plate. As the second molar was uprighting, the position of the button was changed towards the mesial part of the occusal surface, in order to obtain an appropriate force direction. The uprighting process of the lower second molar can be seen in Figures 3 and 4 (intraoral photo and panoramic X-ray).

There was also a severe tendency to relapse, because after three months of treatment, the patient lost the traction for three weeks (because the button debonded, on the left side) and the tooth returned to its initial position.

When an acceptable inclination of MM2 was achieved (after approximately eight month of treatment), the fixed appliances treatment was begun, including MM2 (Figure 5). The treatment is in progress and the correct position of MM2 is confirmed by panoramic X-rays (Figure 6).

At this stage of treatment both MM2 are well aligned with the correct inclination of the roots and it can be also noted the bone remodeling between first and second mandibular molars.

Figure 1 – ***Pretreatment intraoral photograph.***

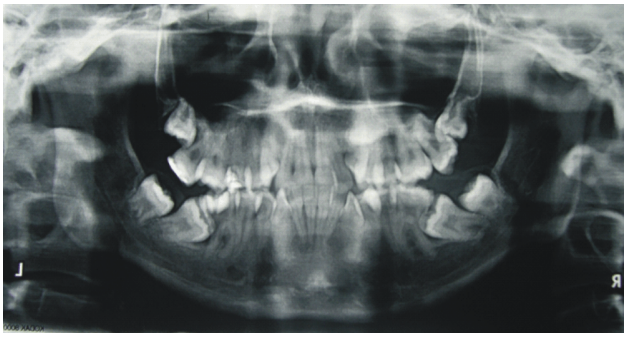

Figure 2 – ***Pretreatment panoramic X-ray.***

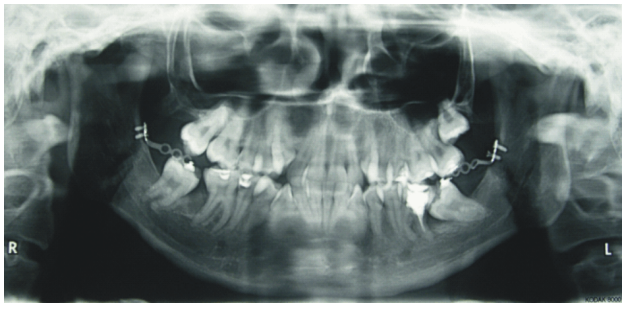

Figure 3 – ***Panoramic X-ray during orthodontically assisted eruption of MM2.***

Figure 4 – ***Intraoral photograph during orthodontically assisted eruption of MM2.***

Figure 5 – ***Intraoral photograph during treatment, after MM2 was included in the appliance.***

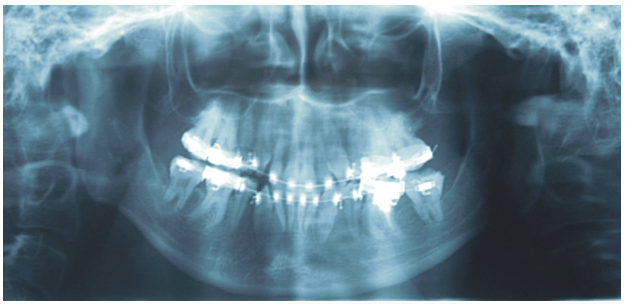

Figure 6 – ***Panoramic X-ray during treatment, with MM2 included in the appliance and uprighted.***

Discussion

There is not much literature about second molar impaction and it is mainly represented by case reports and less by studies. The main conclusion, which can be deduced, shows that the management of second molar impaction is difficult and unpredictable and the results depend on the early diagnosis and early treatment [14]. The proper time for treatment of MM2 impaction is between 11–14 years, during early adolescence, when the roots of the second permanent molar did not complete their development [6, 10]. Magnusson C and Kjellberg H [4], in a study about treatment success of second molar impaction, found that a successful treatment was obtained only in 42% of the cases. They considered a successful treatment if the second permanent molar erupted in a good vertical position with the occlusal surface less then 2 mm to the occlusal plane. In those cases in which the second molar was extracted the treatment was considered successful if the third molar erupted in a good occlusion.

The treatment of the impaction of second mandibular permanent molar often required a multidisciplinary approach, combining at least orthodontic and surgical treatment.

There are some possibilities for the treatment of the MM2 impaction, as:

- The placement of a separator between second and first molars in cases with mild mesial inclination of the second molar, which enables the second molar to self correct its position [8, 10].
- Surgical repositioning or autotransplantation of the second permanent mandibular molar, but with the risk of root resorption, ankylosis or loss of tooth vitality [18–24], when orthodontic treatment is not an option. Johnson JV and Quirk GD [20] stated that the prognosis of surgical repositioning is excellent with proper timing and intervention.
- Extraction of the impacted second molar, with no chance of uprighting, in order to allow for the eruption of the third molar, an unpredictable option, because the third molar may became impacted too [6]. Regarding the last treatment option, Orton-Gibbs S *et al.* [25] recommended a good case selection in order to avoid third molar impaction.
- But, surgical exposure of MM2 followed by orthodontically assisted eruption, with or without extraction of third molar is the best option, with a success rate of 70%. Afterwards the second permanent molar will be left to erupt spontaneously or an orthodontic treatment for active eruption will be initiated. In some cases in which the second permanent molar is partially impacted, there is no need for surgical uncovering of the MM2. For this kind of treatment option, generally, after deciding if the third molar will be extracted or not, the MM2 is uncovered and a bonded attachment is placed on the MM2 crown [26]. The orthodontically assisted eruption of MM2 is performed with different types of removable appliances or fixed appliances with loops, uprighting springs, NiTi coil-springs, NiTi super-elastic wire [27–30].

MM2 uprighting with cantilever arches or uprighting springs is very challenging and needs very good planning of the design of the wire (in accordance with biomechanics consideration) in order to control the second molar movement and to avoid side effects. The main difficulty for orthodontically assisted eruption of MM2 is the anchorage. New possibilities for the skeletal anchorage use (miniscrews [15, 31], miniplates [16]) try to solve this problem, being a predictable technique for those cases with severe mesial inclination of the second molar, reducing the side effects. The great advantage of skeletal anchorage is that it provides the uprighting and depending on the type of skeletal anchorage, extrusion forces on the tooth to be moved, the device being placed distally to the impacted molar [16]. With a low failure rate of bone integration for the miniplates over mini-screws, the miniplates being placed in an upper position related to the impacted tooth generate an optimal extrusion force instead of intrusion force provided by the miniscrews, placed in the cortical bone [16].

In the case presented, after extraction of third molars, the orthodontically assisted eruption of MM2 was done using a miniplate for anchorage, placed in the vertical ramus of the mandible and for molar uprighting, a traction with elastic chain, from a bonded button on the occlusal surface of the second molar to the mini-plate. The movement of the molar was controlled, changing the position of the button, so the force be delivered in a proper direction. Although the placement of a miniplate in this area is considered unstable and with a high rate of failure [16], in this case, this technique allows for uprighting of an impacted second mandibular molar with severe mesial inclination, under the crown of first molar, for which the placement of the attachment on the labial surface of the second molar is

very difficult. With the disadvantages of the high cost, the need for a surgical procedure, the initial discomfort and the risk of infection, the use of the miniplates as skeletal anchorage in the treatment of the second mandibular molar impaction reduced the complexity of the treatment mechanics and it was also a good alternative for this situation, in which the rest of the teeth could not be used for anchorage, due to the necessity of decision making for premolars extraction.

Conclusions

The treatment of the mandibular second molar impaction is very challenging, the treatment success depending on an early and correct diagnostic and an appropriate appliance, which often requires an interdisciplinary approach and which can benefit from the advantages of skeletal anchorage.

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