



Evaluation of techniques used for disimpaction and uprighting of mandibular second molars: a systematic review

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Abstract

The second molars developed, like all the other teeth, by the dental lamina which starts to form at the level of stomodeo between the VI and VII weeks of intrauterine life. These teeth, and in particular second mandibular molars may develop some eruptive path alterations that determine their impaction or inclusion against the first molar crown. This is a rare situation with a prevalence between 0 and 2.3% but if it isn't correctly treated it will provoke the loss these important teeth. For this reason, the aim of our work was: at the first, to realize a detached review on international literature to evaluate all the diagnostic techniques used for intercepting early these eruptive alterations and, on the other hand, to compare the treatment alternatives to indicate the most efficacy and effective to reestablish completely the occlusion and the whole functions of stomatognathic apparatus.

Introduction

The second molars developed, like all the other teeth, by the dental lamina which starts to form at the level of stomodeo between the VI and VII weeks of intrauterine life. In the distal part is highlighted an offshoot known as accessory dental lamina where there is the formation of the permanent teeth that do not have predecessors in the deciduous dentition. In particular, these are represented by the first molar such that formed around the IV gestational month, the second and third molars whose formation begins only after birth.¹ The buds of the permanent molars, including those of the second molars, are located distally to the roots of the preceding teeth. In the mandibular arch molar eruption is ensured by the remodeling processes of mandible: the resorption on the anterior edge and the apposition on posterior margin, which regulate the length growing of mandibular body. During the intraosseous eruptive phase, the permanent molars may experience eruptive pathway anomalies resulting in the impaction or inclusion of the second molars.¹

The inclusion is an abnormality of tooth eruption that can affect any dental element both deciduous and permanent manifested, according to epidemiological estimates, in about 20% of the population with a higher prevalence in male subjects.^{2,3} In the permanent dentition, the inclusion phenomenon affects more frequently the maxillary and mandibular third molars, followed by the upper canine, the lower canine and the mandibular second premolars.^{4,5} The prevalence of inclusion of the first and second mandibular molars is relatively low compared with the other dental elements, by varying, according to different authors, between 0.01% - 0.06% for the first molars and 0 to 2.3% for seconds.^{6,7,8} Over the years, however, it observed a slight increase in the prevalence of inclusion of the mandibular second molar.^{7,9,10} The dental occlusion can be further distinguished, according to the different position / inclination, mesial, distal, or vertical. Several studies show that the mesial inclination is the most frequently encountered form. Also the forms of unilateral inclusion would be more common in bilateral with the right side more affected than the left.^{11,12,13,14}

Failure eruption of a dental element in the oral cavity is an anomaly of the development of the terminal phase, which recognizes etiological factors related to dental germ, the tooth already formed and the surrounding tissues and finally to factors of a general nature.¹⁵

Methods

In the recent years, several dentistry works have been published on international literature about the incidence of second mandibular molars impaction and in particular on its treatment planning. So a detached research of international literature on the diagnosis and all the possible treatment methods for these dental anomalies has been performed using the principal medical databases: PubMed (Medline), Lilacs and Scopus. The keywords used were: *dental anomalies*, *tooth development*, *second molars impaction* and *mandibular molars uprighting*; to identify all articles reporting on the topic until October 2016. No restrictions of time and languages have been fixed. The results have been filtered and valued following our

eligibility criteria and then organized following the PRISMA method. The search identified 12,620 abstracts, which were reviewed manually and each article of interest was marked for further review. The full text of the marked studies was retrieved and studies that satisfied our eligibility criteria were included in this review. At the end only 43 full articles have been selected.

Discussion

DIAGNOSIS:

The elements needed to make a diagnosis of inclusion as many authors teach us are the medical history, clinical and radiological.¹⁵

The radiographic findings are essential for a correct treatment planning, should enable the detection of the morphological and spatial characteristics of the impacted tooth (location, angle, position, crown-root morphology), its relationship with the adjacent anatomical structures (eg. mandibular canal), the presence of pathological conditions associated (cysts, odontomas, supernumerary), the space available and obtainable for the proper alignment in the arch.

The orthopantomographic radiography is the essential first level investigation as well as providing diagnostic certainty, definition of location and inclination of the impacted tooth, in particular on the frontal plane, identification of the crown-root morphology, the relationship with adjacent anatomical structures and the possible presence of associated pathological conditions. The orthopantomographic radiography assumes an important role as regards the early detection of a suspicious future inclusion of the lower second molar. In fact, on orthopantomographic it's possible to perform linear and angular measurements useful for defining the quantity of retro-molar area that is, the distance beneath the mandibular first molar to the anterior border of the mandibular ascending branch; as well as the inclination of the second mandibular molar by the construction of the angle formed by the longitudinal axes of the first and second molars. In a study by the University of Rome, La Sapienza, it was highlighted the importance of early interception of the second molars impaction with a careful analysis of orthopantomographic radiographs. This method involves measuring of the angle formed between the first and second permanent molars and the distance between the first molar and the anterior edge of the mandibular branch.¹⁶ It was observed that in case of second mandibular molar impaction, the value of the angle formed between the long axis of the first and second

mandibular molars mesial-inclined ranges between 13° and 75°.¹⁶ In a proper article⁷, Evans confirms same angular values between 15° and 65°. Gandolfini demonstrated in his study that dental pantomogram represents a useful inclusion predictor stating that for reducing the risk of second mandibular molar inclusion the previous angle has not to exceed the value of 20°, because of on the other way the dental crown will impact on the distal side of the preceding tooth.¹⁷ The study showed that all patients with inclusion of the second mandibular molar showed a reduced distance between the distal marginal ridge of the lower first molar and the anterior border of the mandibular branch average of 9.20 mm to 12.80 mm in the control group.¹⁶

If conventional I level dental radiographies don't allow to make an accurate diagnosis and a specific treatment planning, it will be indicated to require a radiographic investigation of second level such as CT with dedicated Dentascan program.

TREATMENT

There are multiple treatment techniques to solve the inclusions of the second mandibular molars. Some of these techniques are aimed at stimulating the spontaneous eruption of the teeth, others, however, they are employed to perform a real disimpaction of the tooth and where necessary, considering that the inclination mesial is the most frequent form, uprighting of the molar. The uprighting techniques are widely used, not only in the cases of the seventh inclusion, but also in cases where the seventh lower is presented in the arch inclined mesially (very frequent cause premature loss of the sixth) and then finding great also reflected in adult patients undergoing preprosthetic to orthodontics. The choice of therapeutic modality to be implemented depends on the evaluation of several factors such as: the etiological causes, the presence of any associated pathological conditions, including the position, the depth of inclusion, the crown-root morphology of the tooth, reports that it shrinks with the continuous anatomical structures and with the adjacent teeth, and especially the existence or not of the eruptive potential, related to the presence of a patulous apex and a ligament trophically active.

Uprighting lower molar with miniscrews¹⁸

In the last decade, many authors have published excellent examples of uprighting of the molars with the use of mini screws for orthodontic anchorage. The methods with miniscrews are simplified and devoid of the classic defects such as extrusion control and unwanted movement of the anchorage unit, as it also

shorts the treatment time. Therefore, there is a discrete part of the literature that indicates the use of skeletal anchorage as the best solution for uprighting of the lower molars respect to all the methods. The article by Lee in 2007 analyzes the uprighting systems miniscrews dividing them into systems "pulling force from distal side" when the miniscrew is placed distally and systems "pushing force from mesial side" when the miniscrew is placed at the mesial tooth straightening.¹⁹

In 2002 Park publishes an interesting case reports claiming that with such microimplants the second molars can be easily rectified with no side effects in the anterior teeth and without the use of brackets and at the same time you can get the intrusion of the molar without having to resort to occlusal grinding.²⁰ It follows the article by Giancotti, where a similar method is illustrated and in which the author states that the retromolar positioning of the implant has significant biomechanical advantages, as it allows the application of distal force to the center of resistance of the molar and it has good vertical control during the phase of disimpaction.²¹

In many cases, there is not sufficient space for the insertion of a distal miniscrew. So various authors have proposed biomechanical alternative systems, which require the use of mini screws positioned mesially to the molar to be straightened. In 2005, Yun et al suggest a clinical method with miniscrew positioned mesially.²²

Conclusion(s)

The prevalence of inclusion of the first and second mandibular molars is relatively low compared with the other dental elements, by varying, according to different authors, between 0.01% - 0.06% for the first molars and 0 to 2.3% for seconds. However, over the years it has been observed a slight increase in the prevalence of inclusion of the mandibular second molar. The mesial inclination is the most commonly encountered form in cases of retention / inclusion of the second molar. Frequent is also the demand for uprighting in cases of preprosthetic orthodontics, where the second molar is mesial-tilted (often due to premature loss of the first permanent molar). The advent of mini screws has definitely ruled out the component of reaction forces to orthodontic movements, by improving the anchorage. Obviously, the choice of a correct treatment plan is based on a correct initial diagnosis and careful radiographic study, considering really important the analysis of the orthopantomographic radiography in prediction of the

second mandibular molars impaction.

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