

THE ROLE OF THIRD MOLAR IN ORTHODONTIC TREATMENT

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ABSTRACT

Third molars are considered to be a vital component in everyday dental practice. The dental literature has touched on many aspects of third molars as it relates to various dental disciplines. A review of dental literature reveals several interactions between third molars and orthodontics. The purpose of this article is to review and summarize various aspects of third molar in relation to orthodontic treatment. Three main areas were recognized in relationship with orthodontics and will be discussed separately. The three areas are; third molar impaction, space available for its eruption, and its role in the crowding of the lower anterior teeth.

Key words: *Third, molar, Orthodontics, Impaction, Crowding*

INTRODUCTION

The process of development and eruption of third molar has been shown to be highly variable. Third molar has the highest incidence of tooth agenesis (20%),¹ and cases with such anomaly were found to have a 13 times higher chance of agenesis of remaining teeth.² This illustrates how the status of third molar would affect the clinical presentation and the treatment planning process of different dental disciplines.

The orthodontic literature demonstrates an interaction between third molars and occlusion. Individuals with agenesis of third molar have been shown to have a smaller mesiodistal width of remaining dentition, thus providing more space in the arch.³ Furthermore, agenesis of third molar germs was reported to depend on the anteroposterior dimensions of the maxilla (not the mandible) in orthodontic patients.⁴

This review article aims to list and discuss findings in orthodontic literature as related to third molar. Three main areas were found to encompass such relationships, namely; third molar impaction, space available for its eruption, and its role in the crowding of lower anterior teeth. Each area will be discussed separately in the following sections.

Third Molar Impaction

Impaction can be defined as a condition in which the tooth is confined within the bone or soft tissue. Incidence of third molar impaction was reported to be

variable from 9.5% in American males⁵ to 39% in Finns.⁶ A more recent study analyzed 3874 radiographs and determined an incidence of 21.9% for the maxilla, and 17.5% for the mandible with no differences in terms of gender.⁷ The age at which the tooth germ starts to appear in radiograph is also variable (7 years up to 12), and it's been shown that when the genesis is delayed beyond 10 years of age, the probability that full complement of third molar will develop is reduced by 50%.⁸

Bjork⁹ examined 243 cases to estimate factors affecting the space available to third molar for eruption. Cases with increased Gonion angle, reduced mandibular length and reduced space distal to permanent second molar were shown to be associated with third molar impaction. Other studies listed continued forward growth of the mandible after completion of maxillary growth,¹⁰ and change from a coarse to a modern refined bite.¹¹ Type of occlusion was also reported as one of the factors predisposing to third molar impaction. It has been found that patients with Class II malocclusion have an increased incidence of third molar impaction. This was found to be valid even in Class II subdivision cases, where Class II side was shown to demonstrate significantly increased angulation of third molar.¹²

With proper clinical observation and diagnosis, third molar can be recommended for extraction when indicated. The extraction decision can still be reached

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in the absence of clinical symptoms or pathological signs. Prophylactic removal was shown to minimize potential complication reported to be associated with third molar impaction. Chiapasco *et al*¹³ advocated germectomy procedure to decrease the risk of operative and post-operative extraction complications. Also, the risk of mandibular angular fracture was shown to be increased (3.4 times) with mandibular third molar impaction.¹⁴ Root resorption of second molar was also correlated with age and mesio-angular third molar impaction.¹⁵ These factors would justify the reported incidence (27%) of prophylactic removal among Swedish patients.¹⁶ Other studies reported that 41.3%, and 40% of third molar extraction procedures were referred solely due to impaction with absence of clinical signs or associated symptoms.^{17,18} These differences in incidence of prophylactic removal can be attributed to the lack of established unified criteria. It has been reported that two-thirds of lower third molars scheduled for extraction did not meet NIH consensus removal criteria^{19,20} Mercier and Precious²¹ reviewed 149 publications, and stated that indications and contraindications of removal of asymptomatic non-pathologic third molars can not be established.

Unlike the controversy around third molar extraction in general practice, third molar extractions have been relatively expected outcome in orthodontics. Usually the call of extraction will address a specific or general need that an orthodontic care requires. A simple example would be cases requiring distalization of first and/or second permanent molar. Other reported favorable effect after third molar extraction is the significant amount of buccal movement of second molar due to the gain in posterior segment arch length.²² In these cases, the second molar was shown to drift posteriorly and laterally after extraction of third molar.²³

In few reported cases, third molar can be disimpacted and aligned within the dental arch. This decision will depend on the severity of the impaction, patient tolerance, and presence or absence of coexisting problems. A technique to achieve such a goal was reported including the combined use of removable/fixed appliances,²⁴ and the use of Nickel Titanium closed-coil spring.²⁵ Third molar can also be transplanted and aligned replacing missing tooth. An impacted lower third molar, which had symptoms of pericoronitis, was reported to be transplanted into the upper left second molar socket.²⁶ Other orthodontic/ surgical techniques were reported to facilitate third molar extraction. These techniques are recommended when there is a close proximity of third molar to the inferior dental

nerve (IDN), to minimize surgical complications.²⁷ The interdisciplinary use of periodontics and orthodontics results in non-surgical removal of impacted mandibular third molars without damage to IDN and iatrogenic periodontal sequelae to the second molars.²⁸

Space Availability for third Molar Eruption

With the identification of many skeletal and dental factors associated with third molar impaction, some studies attempted to develop predictive tools for the possible space available for third molar eruption. Ricketts²⁹ has correlated the distance between Xi point (middle point of ascending ramus) to the distal surface of second molar along the plane of occlusion. He showed that subjects with 30mm of distance (or more) mostly would have sufficient space for third molar eruption. Later on, Olive & Basford³⁰ proposed the space width ratio. It is the distance from the second permanent molar to the ramus divided by the mesiodistal width of the third molar as it appears on the radiograph. A ratio of 120% or less indicates a high probability of impaction. On the other hand, a study evaluated different impaction related variables (age, duration of impaction, level of eruption, and bone condition), where no predictive values could be identified.³¹ Therefore, the authors recommended that developing third molars should be periodically evaluated.

It has been reported that third molars in orthodontic cases treated with extraction were four times more likely to erupt into good position.³² Using Rickett's Xi method, mandibular third molar impaction was found to be low in orthodontic cases treated with first premolar extraction.³³ A recent study also confirmed that premolar extractions had a positive influence on the developing third molar angulations with the third molars being more upright in the first-premolar-extraction group.³⁴ Richardson³⁵ found that 34% of the orthodontic cases treated with non-extraction approach were presented with impaction, and the impaction percentage decreased to 28% in cases treated with premolar extractions. In the later study, the amount of anterior crowding (i.e. space deficiency) before extraction was highlighted as an important factor. However, a study reported that when Class I extraction and non-extraction cases were compared, there were no significant differences in the change of third molar angulations.³⁶ This favorable effect of premolar extraction on third molar position was found to be similar in cases with first and second permanent molar extractions. Orthodontic treatment accomplished with extraction

of the permanent first molars increases the eruption spaces of third molars and decreases their impaction. Furthermore, that favorable effect on the angulation of the third molars was found to be higher in upper arch than that of the lower.³⁷ Another study indicated that mandibular first-molar extraction increases the space for mandibular third-molar eruption and helps the third molars move into better positions.³⁸

In cases with second molar extraction, third molar eruption could occur spontaneously within 3-4 years after second molar extraction.³⁹ The eruption process in the upper arch has been shown to be accelerated with successful occlusal and periodontal status.⁴⁰ This approach would help in relieving crowding in the posterior segment, where it has been demonstrated that extraction of second molars would significantly improve its axial inclination and allow for its mesial movement.⁴¹ However, root parallelism of third molar with first molar was reported to be rarely observed.⁴² Orton-Gibbs *et al*⁴³ reported that maxillary and mandibular third molars erupt in good position after the extraction of second molars. They also showed that, the initial third molar position was not correlated with its final position, and the mesiodistal width of third molars was suitable to replace second molars; where, on average, mandibular third molars were 0.55mm larger and maxillary third molars were 0.7mm smaller than second molars. Criteria for second molar extraction include; lack of space for the developing third molar at age of 12-14 years, acceptable size and angulation of third molar, proper timing (extraction of second molar by the time the crown of third molar is fully formed). Some overlapping of the third and second molars is desirable but not essential.

Lower Anterior Crowding

Late lower anterior crowding is a commonly observed clinical finding that is of concern to both, the clinician and the patient. In order to investigate this phenomenon, it is essential to review literature on the changes in lower anterior alignment that occur with time in both untreated as well as the orthodontically treated individuals. Bishara *et al*^{44,45} found that there was an increase in the tooth-size arch-length discrepancy with age (i.e. decrease in arch length) in untreated subjects. Similar findings were reported by others.^{46,47} Furthermore, Little *et al*⁴⁸ observed that 90% of well-treated cases ended up with incisor crowding. Therefore, it has been concluded that the incidence and severity of mandibular incisor crowding increase during adolescence and adulthood in both normal and

treated individuals. Due to this reason, it was observed that many clinicians consider indefinite retention after orthodontic treatment.⁴⁹

Several studies have been conducted to investigate the role of third molar in lower anterior crowding. Bergstrom and Jensen⁵⁰ compared both sides of the dental arch of individuals with unilateral agenesis of third molar. They found that there was more crowding on the side with third molar but not to an extent that would justify its removal. And when two groups with third molar present and third molar agenesis were compared longitudinally, both of the groups showed a decrease in arch perimeter, but in less noticeable way in the group with agenesis of third molars.^{3,51} In a group of orthodontically treated patients, Fastlicht⁵² found that 86% of the patients ended up with lower anterior crowding of which only 11% of the patients had third molars. Kaplan⁵³ compared individuals with third molars erupted, impacted, and with agenesis. He found that there was no significant difference between the groups in relation to lower anterior crowding. Other studies arrived at conclusion by using the similar methodology.^{54,55}

Many longitudinal studies were designed to test the effect of third molar on lower anterior crowding. Lindqvist and Thilander⁵⁶ prophylactically extracted third molar on one side and followed up the patients for three years to see any changes in teeth alignment. They concluded that both sides expressed similar changes. Southard *et al*⁵⁷ have evaluated the proximal contact tightness to test the potential forces exerted by third molars. They did not find any significant differences between the contact tightness in the side with and without third molar.

From the studies quoted above, it is evident that third molars have a limited effect, if any, on the lower anterior crowding. It has been indicated that third molar appear to be one of many complexly interacting factors which affect dental arch crowding.⁵⁸ Zachrisson stated that direct evidence for significant cause-and-effect relationship between third molar and late anterior crowding is extremely difficult to establish and that most reported studies can not be validated.⁵⁹ He attributed this difficulty to the multiple variables associated with late mandibular arch crowding. One of these variables that often overlooked is the role of continued first molar eruption into adulthood.⁶⁰ Other factors affecting lower anterior crowding include; physiological mesial drift, anterior component of force of occlusion, mesial vectors of musculature contraction,

and amount and direction of late mandibular growth. Therefore, the extraction of third molar for the purpose of only relieving the lower anterior crowding may not be justified.^{19,23}

To sum up, review of the orthodontic literature indicates that, third molars have many interactions with its adjacent structures, arch space, and teeth alignment. The orthodontic literature has also reported some specific techniques and recommendations in relation to third molars. The efficiency of pendulum appliance for molar distalization has been also discussed not only in relation to second, but also to third molar eruption stage.⁶¹ The correction of anterior open bite using maxillary third molar as anchorage was reported recently.⁶² As part of completed treatment plan, there should be a recommendation regarding third molars.⁶³ In case the third molar is retained, it is advisable to document that the patient was informed of potential risk to occlusion, stability and period of monitoring. No orthodontic case is morally completed until the wisdom tooth situation has been safeguarded.⁶⁴

SUMMARY

A review on the subject of third molar in relation to orthodontic practice was presented. Third molar was shown to have a dimensional relationship with adjacent skeletal and dental structures. The decision of third molar extraction must be evaluated carefully during the treatment planning of any case. Lastly, third molars play a limited role in the crowding affecting lower anterior teeth.

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