

Third molars in orthodontics and its controversies.

Dr. A. Arif Yezdani, MDS, FWFO, Professor & Director, Department of Orthodontics and Dentofacial Orthopedics, Bharath Institute of Higher Education and Research, Sree Balaji Dental College and Hospital, Narayanapuram, Pallikaranai, Chennai-600100, Tamilnadu, India.

Dr. Krithika Ashokan, MDS, Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, SRM Kattankulathur Dental College and Hospital, SRM Nagar, Potheri, Kancheepuram district, Kattankalathur 603203, Tamilnadu, India.

Corresponding Author: Dr. A. Arif Yezdani, MDS, FWFO, Professor & Director, Department of Orthodontics and Dentofacial Orthopedics, Bharath Institute of Higher Education and Research, Sree Balaji Dental College and Hospital, Narayanapuram, Pallikaranai, Chennai-600100, Tamilnadu, India.

Type of Publication: Review Paper

Conflicts of Interest: Nil

Abstract

Presence or absence of third molars is genetically predetermined and that the etiology for the eruption or impaction of third molars appears to be multifactorial. Literature review reveals numerous theories and postulates regarding the third molars. However, its role in orthodontic therapy is unclear and evasive. Thus the aim of this study was to present a contemporary mini-review of literature so as to extrapolate if third molars do really have an impact on orthodontic treatment. Internationally peer reviewed and indexed referenced articles dealing with third molar eruption and impaction and their effects on orthodontic diagnosis and treatment planning were segregated and perused. Evidence gleaned was inconclusive as to whether third molars are the main causative factors of anterior crowding or that prophylactic extractions may ameliorate impactions. However, it was deemed mandatory that impacted third molars be extracted or extraction of the same be advocated as a routine protocol procedure prior to orthognathic surgery. It was also undeniable that certain pertinent risk factors played a

vital role in its eruption and impaction. This mini review has attempted to look into a few pertinent issues regarding third molar eruption/impaction and its impact on orthodontic treatment planning. Clear scientific evidence is still lacking in pinpointing the role of third molars in mandibular anterior crowding or whether extractions of premolars or molars would prevent impactions. Exhaustive systematic review would definitely help us in finding answers to these elusive issues in the near future.

Keywords: third molars, malocclusion, incisor crowding

Introduction

Multifactorial factors contribute to eruption or impaction of third molars and their presence or absence is genetically predetermined. Bowdler et al¹ opined that in the eruption of the third molar individual growth pattern played a vital role. Broadbent² believed that impaction of third molar could be attributed to the mandible not achieving its full growth potential while Begg³ opined that lack of interproximal attrition and insufficient forward movement of teeth observed in modern man in contrast to Australian aborigines was the prime causative factor. Orthodontic

extraction may or may not be positively correlated with third molar root position and angulation. There are also controversies regarding the association between extraction of third molars and mandibular incisor crowding. Third molars erupt between the ages of 18 to 23 in the oral cavity. However, radiographically it can be seen as a developing tooth bud at the age of 5 years and it eventually erupts into the oral cavity between 18-24 years of age presenting the highest rate of impaction.^{4, 5} Third molar impactions are a common entity and their eruption or impaction may or may not affect or influence orthodontic treatment planning. This mini review is based on internationally peer reviewed and indexed referenced articles dealing with third molar impactions and their effects on orthodontic diagnosis and treatment planning. The principles of archial growth of mandible and the influence of third molars on the alignment of teeth and that of orthodontic treatment with extraction of premolars or molars on the development of third molars forms a critical part of this review. The etiology and diagnosis of third molar impaction, the changes in third molar position after extraction of second molars and the correlation between mandibular incisor crowding and third molars have been highlighted in this mini-review and aptly discussed under the following subheadings.

Risk factors for impaction

Ricketts et al^{6, 7} used longitudinal records to estimate the amount of space required for upward and forward development of molars and prediction of amount of mandibular growth and concluded that if 50% of the third molar crown was ahead of the external ridge it had a 50% chance of eruption.

Kaplan⁸ claimed that in contrast to erupted third molars, impacted third molars exhibited greater mandibular growth. Schulhof⁹ projected a computerized prediction of third molar impaction by measuring the distance from the

Xi cephalometric point to the distal surface of the second permanent molar and concluded that if the distance was 30mm there was a less chance of impaction than if it were 25mm. Richardson¹⁰ observed that third molar impaction was more common in acute angled, short and narrow width mandibles and that the growth of the same was considerably reduced. Ades et al¹¹ studied 97 study models and lateral cephalograms and reported that mandibular third molars whether fully erupted or impacted had no significant effect on mandibular growth.

Cappeli¹² studied 60 orthodontically treated cases and found that impaction of third molars was highly associated with a reduced mandibular length, vertical component of mandibular growth and high mesial inclination of the lower third molar crown in the ascending ramus. Contradictory literature also points to the fact that an anteriorly rotated mandible with a vertical direction of condylar growth and a vertical growth pattern is also a good candidate for mandibular third molar eruption.

Artun et al^{13, 14} concluded that a small mandibular plane to sella-nasion angle (MP/SN), reduced retromolar space and mesial and distal angulation of more than 30 degrees of the maxillary third molars to the occlusal plane were predictive of impaction. Hassan¹⁵ concluded that inadequate space in retromolar area was predictive of third molar impaction, after conducting a retrospective cephalometric study on 121 Saudi patients.

Prophylactic extractions and its role in third molar impaction/eruption

Orthodontic extractions are mainly done in cases of arch length-tooth material discrepancy or in proclination and in severe crowding cases. Several studies were done to assess extractions (usually premolars) and the possible sequelae of their effect on third molars. Kaplan⁸ was of the opinion that eruption of third molars was most probable in cases of premolar extractions and that noneruption of the

same was associated with anterior border of the ramus exhibiting insufficient resorption in vertical growers. Richardson¹⁰ investigated retrospectively the cephalograms and study models of a control group of 48 subjects with no mandibular first premolar extractions with an experimental group that had extraction of the same and concluded that in extraction cases increased space was available for third molar eruption.

Williams et al¹⁶ investigated the possibility of third molar eruption with respect to extraction of first premolars or first molars using the Begg technique in 260 subjects and found that a combination of extraction of first premolars and first molars or only first molar extractions had a positive impact on third molar eruption. Rindler¹⁷ investigated the lateral cephalograms and casts of 78 Class II malocclusion subjects who had their second mandibular molars extracted and found that in 21 cases no orthodontic treatment was done whereas in 9 cases activators were used and in 48 cases fixed appliance was used to move the mandibular first molars distally. He concluded that in 77% of the cases second molars were replaced with the third molars.

Haavikko et al¹⁸ analysed the orthopantograms of 110 patients whose mean age was 13.5 years, wherein 50 of the same had their mandibular first premolars extracted. They concluded that uneventful eruption of mandibular third molars was only occasionally observed. Cavanaugh¹⁹ concluded that removal of second molars favoured eruption of third molars. Staggers et al²⁰ concluded that in 33 extraction subjects angulation of third molars was unaffected by extraction of four premolars. Moffitt²¹ evaluated 56 patients out of which 28 had unilateral extraction of maxillary second molars. He concluded that such a procedure favoured maxillary third molar eruption.

Kim et al²² concluded that compared to the non extraction group the four premolar extraction group of 105 patients

had less impacted maxillary and mandibular third molars. Janson et al²³ observed that the unerupted maxillary third molars had less mesiodistal angulations and hence erupted favourably in the upper premolar extraction group of 55 patients whose records were studied in detail.

Jain et al²⁴ studied the influence of first premolar extraction on third molar angulation on panoramic radiographs of patients aged between 11 and 19 years of age and concluded that extractions favoured optimal eruption of third molars. Türköz et al²⁵ observed that in the first premolar extraction group favourable retromolar space reduced the propensity for impaction of third molars an information gleaned subsequent to comparison with and without first premolar extractions in 22 non growing subjects.

Halicioğlu et al²⁶ opined that eruption of third molars was linked to extraction sites and that extraction of first molar favoured its eruption. This conclusion was based on a retrospective study of 294 panoramic radiographs of patients aged 13 to 20 years of age. Bayram et al²⁷ observed retrospectively the panoramic radiographs of subjects with a mean age of 16.6 years of age and concluded that the third molars were less frequently impacted when extraction of four first molars were done.

Third molars – mandibular incisor crowding and its controversies

Role of third molars in secondary mandibular incisor crowding has been a point of debate for many years.

Dewey²⁸ in 1917 suggested that crowding of the mandibular anterior teeth does occur in some cases with eruption of mandibular third molars. Bergström et al²⁹ studied unilateral molar agenesis in 60 subjects and concluded that less crowding was present in the quadrants where molars were absent and where they were present greater crowding was observed. Vego³⁰ observed greater

mandibular incisor crowding with erupting mandibular third molars rather than with congenitally missing ones. On the other hand with congenitally missing third molars greater dental stability post orthodontic treatment was observed by Shenerman³¹ in a study involving 49 subjects. Woodside³² opined that soft tissue pressure and growth was responsible for the distal settling of the mandibular dentition and that the role played by the third molars was just but a passive one. Forsberg³³ studied the relationship between eruption status of third molars and relative space in the dental arches in 75 non orthodontic patients who were divided into 2 groups, one with all extracted third molars and the other with erupted third molars. He observed that crowding was more when the third molars had erupted.

Southard et al³⁴ compared the proximal contact tightness pre and post bilateral third molar extractions to ascertain whether the mesial force exerted by the erupting third molars could have an effect on the dentition. They concluded that prevention of mandibular incisor crowding and relief of interdental pressure could not be accounted for by mere removal of third molars.

Pirttiniemi et al³⁵ opined that prophylactic removal of third molars in patients with a mean age of 23.2 years was no justification for creation of normal dental arches. Karasawa et al³⁶ observed a non-correlation between mandibular incisor crowding and presence of third molars in a cross sectional study of 300 subjects with a mean age of 20.4 years. However, a small correlation was observed in the cases treated orthodontically, but was not statistically significant. Costa et al³⁷ subsequent to a systematic review opined that prophylactic third molar extraction is unjustifiable in clinical treatment decisions.

Discussion

Literature has reported exhaustively on the positive influence extraction of teeth has had on the eruption,

position, angulation, and reduced inclination of third molars.^{38-40,43-46,49} It has been reported that extraction therapy could be beneficial for borderline orthodontic extraction cases with third molar angulations.^{24, 43-45} Furthermore, post-operative complications could be minimized and the surgical procedure facilitated if the molars were in an upright position.

Pre and post the 1990's the author's view has not been consistently the same for the role played by third molars in mandibular incisor crowding. Nevertheless a few previous studies have linked a significant association between prevalence of crowding in mandibular arch to that of third molars.^{28-33, 47} Systematic reviews reported in literature were not in favour of prophylactic extractions, exhorting the fact that for more definitive conclusions to be made more studies have to be done and duly systematically reviewed.^{41-42, 44}

Evidence is still inadequate to advocate non-pathological impacted third molars' prophylactic removal.^{48, 50} Literature report of recent studies deem unjustifiable the prophylactic extraction of third molars.⁴⁹ However, in cases if extractions is deemed as a treatment plan then performing the same before adulthood is recommended to reduce the risk of complications.⁵¹

Certain important clinical issues do warrant third molar extraction when distalization of the first molar is recommended as a treatment modality. However, extraction of third molars may have to be done if they are impacted or as a routine protocol procedure prior to orthognathic surgery. More systematic reviews in the near future would help us glean more information to annul the controversies hovering around the role of third molars in orthodontics.

A pertinent point gleaned from the review showed that if 50% of the third molar crown was ahead of the external ridge it had a 50% chance of eruption in the mandible.

Contrasting evidence was observed with greater mandibular growth being exhibited with both erupted and impacted molars and that third molar impaction was more common in acute angled, short and narrow width mandibles. It was observed that impaction of third molars was highly associated with a reduced mandibular length, vertical component of mandibular growth and high mesial inclination of the lower third molar crown in the ascending ramus with inadequate space in retromolar area. Extraction of premolars or molars or a combination of premolars and molars did provide adequate space for third molar eruption. Some were of the opinion that removal of second molars favoured eruption of third molars. Evidence was for and against the fact that eruption of mandibular third molars could cause crowding of the mandibular anterior teeth. Congenitally missing third molars did contribute to greater dental stability post orthodontic treatment, however, few others opined prophylactic third molar extraction is unjustifiable in clinical treatment decisions.

Conclusion

The role of third molars in orthodontics has been the subject of clinical interest and extensive research for many years. Clear scientific evidence from high quality clinical studies is still lacking. This mini review has attempted to look into a few pertinent issues. However, exhaustive systematic review would help us arrive at concrete conclusions and better understanding of the subject in the near future.

References

1. Bowdler H, Morant GM. A preliminary study of the eruption of the mandibular third molar tooth in man based on measurements obtained from radiographs, with special reference to the problem of predicting cases of ultimate impaction of the tooth. *Biometrika*. 1936;28:378–427.
2. Broadbent BH. The influence of the third molars on the alignment of the teeth. *Am J Orthod Oral Surg*. 1943;29:312–330.
3. Begg PR. Stone Age man's dentition. *Am J Orthod DentofacOrthop*. 1954;40:298–312. Available from: [http://www.journals.elsevierhealth.com/periodicals/ajorth/article/0002-9416\(54\)90103-7/](http://www.journals.elsevierhealth.com/periodicals/ajorth/article/0002-9416(54)90103-7/)
4. Elsey MJ, Rock WP. Influence of orthodontic treatment on development of third molars. *Br J Oral Maxillofac Surg*. 2000;38:350–353.
5. Celikoglu M, Kamak H, Oktay H. Investigation of transmigrated and impacted maxillary and mandibular canine teeth in an orthodontic patient population. *J Oral Maxillofac Surg*. 2010;68:1001–1006.
6. Ricketts RM, Turley P, Chaconas S, Schulhof RJ. Third molar enucleation: diagnosis and technique. *J Calif Dent Assoc*. 1976;4:52–57.
7. Ricketts RM. A principle of arcial growth of the mandible. *Angle Orthod*. 1972;42:368–386.
8. Kaplan RG. Some factors related to mandibular third molar impaction. *Angle Orthod*. 1975;45:153–158.
9. Schulhof RJ. Third molars and orthodontic diagnosis. *J ClinOrthod*. 1976;10:272–281.
10. Richardson ME. The etiology and prediction of mandibular third molar impaction. *Angle Orthod*. 1977;47:165–172.
11. Ades AG, Joondeph DR, Little RM, Chapko MK. A long-term study of the relationship of third molars to changes in the mandibular dental arch. *Am J OrthodDentofacialOrthop*. 1990;97:323–335.
12. Capelli J. Mandibular growth and third molar impaction in extraction cases. *Angle Orthod*. 1991;61:223–229.
13. Artun J, Behbehani F, Thalib L. Prediction of maxillary third molar impaction in adolescent

- orthodontic patients. *Angle Orthod.* 2005;75:904–911.
14. Artun J, Thalib L, Little RM. Third molar angulation during and after treatment of adolescent orthodontic patients. *Eur J Orthod.* 2005;27:590–596.
 15. Hassan AH. Cephalometric characteristics of Class II division 1 malocclusion in a Saudi population living in the western region. *Saudi Dent J.* 2011;23:23–27.
 16. Williams R, Hosila FJ. The effect of different extraction sites upon incisor retraction. *Am J Orthod.* 1976;69:388–410.
 17. Rindler A. Effects on lower third molars after extraction of second molars. *Angle Orthod.* 1977;47:55–58.
 18. Haavikko K, Altonen M, Mattila K. Predicting angulational development and eruption of the lower third molar. *Angle Orthod.* 1978;48:39–48.
 19. Cavanaugh JJ. Third molar changes following second molar extractions. *Angle Orthod.* 1985;55:70–76.
 20. Stagers JA, Germane N, Fortson WM. A comparison of the effects of first premolar extractions on third molar angulation. *Angle Orthod.* 1992;62:135–138.
 21. Moffitt AH. Eruption and function of maxillary third molars after extraction of second molars. *Angle Orthod.* 1998;68:147–152.
 22. Kim TW, Artun J, Behbehani F, Artese F. Prevalence of third molar impaction in orthodontic patients treated nonextraction and with extraction of 4 premolars. *Am J Orthod Dentofacial Orthop.* 2003;123:138–145.
 23. Janson G, Putrick LM, Henriques JF, de Freitas MR, Henriques RP. Maxillary third molar position in Class II malocclusions: the effect of treatment with and without maxillary premolar extractions. *Eur J Orthod.* 2006;28:573–579.
 24. Jain S, Valiathan A. Influence of first premolar extraction on mandibular third molar angulation. *Angle Orthod.* 2009;79:1143–1148.
 25. Türköz C, Ulusoy C. Effect of premolar extraction on mandibular third molar impaction in young adults. *Angle Orthod.* 2013;83:572–577.
 26. Halicioglu K, Toptas O, Akkas I, Celikoglu M. Permanent first molar extraction in adolescents and young adults and its effect on the development of third molar. *Clin Oral Investig.* 2014;18:1489–1494.
 27. Bayram M, Ozer M, Arici S. Effects of first molar extraction on third molar angulation and eruption space. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod.* 2009;107:e14–e20.
 28. Dewey M. Third molars in relation to malocclusion. *Int J Orthod.* 1917;3:529–533.
 29. Bergström K, Jensen R. Responsibility of the third molar for secondary crowding. *Dent Abstr.* 1961;6:544.
 30. Vego L. A longitudinal study of mandibular arch perimeter. *Angle Orthod.* 1962;32:187–192.
 31. Shenerman J. Third molar teeth and their effect upon the lower anterior teeth: a survey of forty-nine orthodontic cases five years after band removal. USA: St. Louis University; 1968.
 32. Woodside D. Round table: extra oral force. *J Clin Orthod.* 1970;4:554–557.
 33. Forsberg CM. Tooth size, spacing, and crowding in relation to eruption or impaction of third molars. *Am J Orthod Dentofacial Orthop.* 1988;94:57–62.
 34. Southard TE, Southard KA, Weeda LW. Mesial force from unerupted third molars. *Am J Orthod Dentofacial Orthop.* 1991;99:220–225.
 35. Pirttiniemi PM, Oikarinen KS, Raustia AM. The effect of removal of all third molars on the dental

- arches in the third decade of life. *Journal of craniomandibular practice*. 1994;12:23–27.
36. Karasawa LH, Rossi AC, Groppo FC, Prado FB, Caria PH. Cross-sectional study of correlation between mandibular incisor crowding and third molars in young Brazilians. *Med Oral Patol Oral Cir Bucal*. 2013;18:e505–e509.
37. Costa MG, Pazzini CA, Pantuzo MC, Jorge ML, Marques LS. Is there justification for prophylactic extraction of third molars? A systematic review. *Braz Oral Res*. 2013;27:183–188.
38. Gaumond G. Second molar germectomy and third molar eruption. 11 cases of lower second molar enucleation. *Angle Orthod*. 1985;55:77–88.
39. Gooris CG, Artun J, Joondeph DR. Eruption of mandibular third molars after second-molar extractions: a radiographic study. *Am J OrthodDentofacialOrthop*. 1990;98:161–167.
40. Orton-Gibbs S, Orton S, Orton H. Eruption of third permanent molars after the extraction of second permanent molars. Part 2: Functional occlusion and periodontal status. *Am J OrthodDentofacialOrthop*. 2001;119:239–244.
41. De-la-Rosa-Gay C, Valmaseda-Castellón E, Gay-Escoda C. Spontaneous third-molar eruption after second-molar extraction in orthodontic patients. *Am J Orthod Dentofacial Orthop*. 2006;129:337–344.
42. Salehi P, Danaie SM. Lower third molar eruption following orthodontic treatment. *East Mediterr Health J*. 2008;14:1452–1458.
43. Livas C, Halazonetis DJ, Booij JW, Katsaros C. Extraction of maxillary first molars improves second and third molar inclinations in Class II Division 1 malocclusion. *Am J Orthod Dentofacial Orthop*. 2011;140:377–382.
44. Gohilot A, Pradhan T, Keluskar KM. Effects of first premolar extraction on maxillary and mandibular third molar angulation after orthodontic therapy. *J Oral Biol Craniofacial Res*. 2012;2:97–104.
45. Mihai AM, Lulache IR, Grigore R, Sanabil AS, Boiangiu S, Ionescu E. Positional changes of the third molar in orthodontically treated patients. *J Med Life*. 2013;6:171–175.
46. Al Kuwari HM, Talakey AA, Al-Sahli RM, Albadr AH. Influence of orthodontic treatment with first premolar extraction on the angulation of the mandibular third molar. *Saudi Med J*. 2013;34:639–643.
47. Lindqvist B, Thilander B. Extraction of third molars in cases of anticipated crowding in the lower jaw. *Am J Orthod*. 1982;81:130–139.
48. Van der Schoot EA, Kuitert RB, van Ginkel FC, Prah-Andersen B. Clinical relevance of third permanent molars in relation to crowding after orthodontic treatment. *J Dent*. 1997;25:167–169.
49. Sidlauskas A, Trakiniene G. Effect of the lower third molars on the lower dental arch crowding. *Stomatologija*. 2006;8:80–84.
50. Hasegawa Y, Terada K, Kageyama I, Tsuchimochi T, Ishikawa F, Nakahara S. Influence of third molar space on angulation and dental arch crowding. *Odontology*. 2013;101:22–28.
51. Phillips C, Gelesko S, Proffit WR, White RP. Recovery after third-molar surgery: the effects of age and sex. *Am J Orthod Dentofacial Orthop*. 2010;138:700.e1–700.8; discussion 700.e1-700.8.