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Review Article

Role of impacted teeth in dental arch crowding

Mohamed Ali Sawas[1]*, Linah Essam Arabi[2], Samirah Hashim Jabir[3], Reem Nawaf AlSaadi[4], Mohammed Ahmed Al Nassir[5], Mohammed Abdullah Alraqibah[6], Ammar Khalid Alhazmi[7], Muad Mohammed Assiry[8], Hassan Ali Albrahim[8], Hassan Shawkat Bukhari[8], Mohammed Abdulmohsen Alyousif[9]

[1]North Jeddah Specialist Dental Center, King Abdullah Medical Complex, Jeddah, Saudi Arabia
[2]College of Dentistry, Batterjee Medical College, Jeddah, Saudi Arabia
[3]General Dentist, Ministry of Health, Hail, Saudi Arabia
[4]General Dentist, Ministry of Health, Riyadh, Saudi Arabia
[5]General Dentist, King Fahad Hospital, Al Ahsa, Saudi Arabia
[6]College of Dentistry, Qassim University, Qassim, Saudi Arabia
[7]College of Dentistry, Umm Al-Qura University, Mecca, Saudi Arabia
[8]College of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia
[9]College of Dentistry, Majmaah University, Al-Zulfi, Saudi Arabia

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***Correspondence:**
Dr. Mohamed Ali Sawas,
E-mail: sawas-1978@hotmail.com

ABSTRACT

Estimates show that the prevalence of mandibular dental anterior crowding is high and might be up to 40%. The etiology of the condition has been multifactorial and evidence regarding the impact of mandibular third molars is still controversial. We discussed the potential role that impacted teeth (particularly mandibular third molars) might have in developing dental arch crowding. Evidence from different original studies and reviews regarding the impact of lower third molars on dental crowding was controversial. However, most of these studies showed that the correlation between these events was insignificant and additional studies might be needed for further validation. We have also identified many factors that can lead to dental arch crowding among the relevant studies in the literature. These factors might include general factors (including gender and age), skeletal factors (including malocclusion and growth of jaws) and dental factors (including primary tooth loss and tooth crown size), all of which were extensively discussed in the current study. Accordingly, further attention should also be paid to studying these factors.

Keywords: Arch crowding, Mandibular third molars, Incisor crowding, Teeth crowding

INTRODUCTION

Estimates show that the prevalence of mandibular dental anterior crowding is high and might be up to 40%. The etiology of the condition has been multifactorial and evidence regarding the impact of mandibular third molars is still controversial.[1] However, evidence indicates that early childhood and adolescence (13-26 years of age) are the most common age groups when crowding is most frequently encountered.[2] This might partially provide evidence regarding the potential impact of the lower third molar eruption. Accordingly, evidence showed that following orthodontic treatment, many orthodontists usually refer their patients to maxillofacial or oral surgeons to remove their lower third molars, thinking that it would intervene against late incisor crowding and potential relapse.

However, it should be noted that such surgical approaches are usually associated with high costs, in addition to the high rates of secondary complications, like infection,

bleeding, edema and mandibular or lingual nerve injuries.[3] Moreover, many recent investigations indicated that performing lower third molars extraction was useless to intervene against mandibular dental anterior crowding development.[3-5] On the other hand, some evidence suggested that reduced postoperative morbidities might favor conducting these procedures for adolescents. Accordingly, evidence regarding the impact of this approach was controversial.[5] Therefore, we aimed to perform an extensive literature review to collect all the relevant studies regarding the role of impacted teeth (especially mandibular third molars) on dental arch crowding.

METHODS

This literature review was based on an extensive literature search in Medline, Cochrane and EMBASE databases on which was performed 3 December 2021 using the medical subject headings (MeSH) or a combination of all possible related terms, according to the database. To avoid missing poetential studies, a further manual search for papers was done through Google Scholar, while the reference lists of the initially included papers. Studies discussing role of impacted teeth in dental arch crowding were screened for useful information, with no limitations posed on date, language, age of participants or publication type.

DISCUSSION

Many studies in the literature were published to investigate the association between teeth impaction and the development of crowding. In this context, many teeth were investigated to study their correlation with developing crowding at different locations. The most commonly studied teeth included mandibular third molars and their correlation with anterior mandibular dental crowding development. All of these events and the potential associated factors that can affect this correlation will be adequately discussed in the current section based on evidence from previous relevant studies in the literature.[6]

Overall, most of the included studies in the literature that investigated the impact of mandibular third molars and anterior mandibular dental crowding did not find a significant correlation between these two parameters.[1,4,7-14] On the other hand, only some studies reported a potential association between lower third molars and mandibular anterior crowding. For instance, a previous study by Niedzielska indicated a significant association between the Ganss ratio and mandibular anterior crowding. Besides, the authors concluded that angulation of the lower third molars had a significant impact on developing mandibular anterior crowding. Therefore, these findings indicate that the Ganss ratio can determine the removal of the lower third molar.[9,15] Similar findings were also reported in another investigation by Hasegawa et al.[7] Accordingly, based on this evidence, it had been concluded that only the lateral segments can be significantly affected by impacted lower third molars.[5,13] It had been furtherly shown that lower molar incisors can significantly influence the arch length discrepancy within the premolar segment of the upper jaw.[10,16] Moreover, Lindauer et al concluded that after removing lower molar incisors, a significant change in the lower dental arch transversal width was observed between the first molars and first premolars.[4] A long-term reduction in arch length was another reported factor among different studies.[9,14] It had been furtherly shown that a linear correlation between age and incisor crowding was noticed among untreated adults.[1] The vertical growth of the mandible significantly determined the incisor crowding rates.[1,17]

Harradine et al further demonstrated that a significant dependence on growth factors was also reported.[18] Besides, the risk of crowding appeared to be more frequently associated with males than females.[1] Finally, Little's index of irregularity had been indicated, which showed a significant difference between the two genders.[13] Studies also showed that African American patients had lower rates of crowding than Caucasian patients.[1] Moreover, studies indicated that third molar angulation was significantly correlated with lower first premolar among female patients.[13] On the other hand, in males, it was associated with angulation of the lower second premolar. An increase in incisor crowding was reported to be significantly associated with the presence of 1st and 2nd molars.[9] In a previous study by Kaplan, it had been concluded that the amount of treatment before crowding was significantly associated with the frequency of relapses.[19] Another study by Ades et al estimated that incisor irregularity could be significantly improved on a long-term basis by 40% when premolar extraction was performed.[20]

In a previous retrospective investigation, Richardson et al reported that more teeth crowding were significantly associated with patients that had impacted lower third molars.[21] The previous retrospective investigation by Ades et al included 97 orthodontically treated patients for lower third molars, which were divided into four groups including extracted ≥10 years earlier, congenitally absent, erupted into function and impacted.[20] However, the authors reported that no significant differences were noticed between these groups in terms of crowding. Harradine et al also conducted a prospective investigation and included 164 orthodontically treated patients for lower third molars and divided them into two groups including non-extracted and extracted.[18] The authors also did not find any significant difference between both groups. Buschang et al also conducted a large cross-sectional investigation which reported that tooth crowding was not significantly associated with erupted 3rd molars based on a sample of patients randomly chosen from the Third National Health and Nutrition Examination Survey.[1] Another cross-sectional investigation was also conducted by Sidlauskas et al in which the authors included 91 orthodontically treated

patients for mandibular third molars and divided them into three groups including agenesis non-erupted and erupted groups. Again, no significant differences were noticed regarding the development of crowding between the three groups.[10] Finally, the previous study by Okazai furtherly concluded that the total interproximal force was not significantly impacted by erupting third molars.[22] Accordingly, findings from all of these studies indicated that the association between impacted mandibular third molars and the development of crowding was not significant.[23,24] However, evidence from some previously limited investigations indicated the significance of this association. Accordingly, further studies with larger samples and proper methodology and designs were needed to validate the current evidence adequately. These findings have been furtherly indicated in two previous reviews, which indicated that the association between developing crowding and impacted mandibular third molars was not significant and that further studies were still required.[25,26] Moreover, a previous meta-analysis by Cheng et al reported that there was a significant difference between agenesis third molar group and erupted third molar extraction group in terms of Little's irregularity index ($p=0.02$).[27] However, no significant differences were noticed between the two groups regarding intermolar width and arch length. Besides, the authors reported that there were no significant differences in any of these outcomes between the agenesis third molar group and impacted third molar extraction group. Accordingly, the authors concluded that to prevent and alleviate long-term incisor irregularity, it was recommended to remove mandibular third molars. Following these reviews, a more recent longitudinal investigation was published to investigate similar outcomes. Zigante et al concluded that the presence of mandibular third molars was not significantly associated with the amount of occurrence of mandibular late incisor crowding.[28]

Since there was no sufficient evidence to support the association between dental arch crowing and impacted teeth, we will gather the most significant factors that were reported in the literature to be associated with crowding. Different factors were reported in the literature to affect the irregularity of mandibular incisors. These included general factors (including gender and age), skeletal factors (including malocclusion and growth of jaws) and dental factors (including primary tooth loss and tooth crown size). In addition, many previous studies indicated that the formation of the third molar could be significantly impacted by the early loss of mandible deciduous 1st and 2nd molars.[29-31] Accordingly, it can be suggested that the early loss of congenital absence of some permanent or deciduous teeth can significantly alter the formation stage and emergence time of other teeth. In this context, a previous study indicated that the development and growth of all teeth were usually connected, although the formation and interruption timing of these teeth was not usually the same.[30] In another context, it had been suggested that the stability of lower incisors can be significantly impacted by the presence of diseases affecting the periodontium. In this context, it had been demonstrated that the presence of periodontal diseases and bone loss might lead to the movement of teeth under pressure, which was normally resisted under normal circumstances.[32] Furthermore, a previous study reported that age was the most significantly correlated factor with the development of periodontal diseases because of the usual changes that can potentially lead to natural resorption of bone.[2]

Evidence indicated that age was one of the most common general factors that can contribute to the development of dental arch crowding. In this context, a previous study by Bishara et al concluded that age was significantly correlated with mandibular teeth size and length.[2] It had been furtherly shown that total discrepancy and anterior total tooth size-arch length of the mandible increase while the total arch length and intercanine arch width decreased in both genders.[2] Another study reported that the lower anterior group had >58% dental crowding events during the third molar eruption.[33] As a result of increased bone resorption and reduced density of alveolar bone, it had been reported that the arch length decreased and the dental arch became narrower with time. That's why it had been suggested that increasing age was significantly associated with dental crowding and mandibular dental arch dimensions.[34] The study by Shigenobua et al also identified other etiological factors that might be associated with dental crowding.[35] These included the position of the opposite teeth, the soft tissue pressure, the time of permanent tooth eruption and deciduous teeth loss and the position of permanent tooth germs.

In another context, anatomical evidence showed that dental arches were wider and longer among males than females. However, there was no significant difference between both genders regarding mandibular intercanine width.[2] In addition to the reported factors (gender, age and the presence or absence of 1st and 2nd molars), a previous study reported that race might also be another associated factor.[1] In this context, it had been reported that African individuals were more frequently subjected to developing teeth crowding than Asian and white individuals.[1] Another significant factor of developing crowding was jaws growth. This had been indicated among different previous investigations.[10] For instance, a previous study by Shigenobua indicated the significant impact of soft tissues on dental crowding.[35] They reported that increased cheeks pressure was significantly associated with the development of crowding. Lower dental arch changes were also correlated with the presence of malocclusion. In this context, a previous study by Ades et al concluded that the position of lower incisors was significantly impacted by intermolar and intercanine changes, overjet and overbite.[20] Accordingly, previous studies suggested that the position of the lower incisors can be best stabilized by correct molars occlusion.[33,36] These were the most commonly reported factors in the literature that might significantly lead to

dental arch crowding. As previously suggested, further evidence regarding the impact of mandibular third molars needed further reporting and investigations.

CONCLUSION

Evidence from different original studies and reviews regarding the impact of lower third molars on dental crowding is controversial. However, most of these studies show that the correlation between these events is insignificant, and additional studies might be needed for further validation. We have also identified many factors that can lead to dental arch crowding among the relevant studies in the literature. These factors might include general factors (including gender and age), skeletal factors (including malocclusion and growth of jaws) and dental factors (including primary tooth loss and tooth crown size), all of which were extensively discussed in the current study. Accordingly, further attention should also be paid to studying these factors.

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