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Role of Mandibular Third Molars in Mandibular Anterior Crowding in a Pakistani Population

Muhammad Hasnain, Shahzonia Tariq, Monal Fatima, Mohammad Shawaiz Khan, Sana Irfan, Urwah Qaseem

Department of Orthodontics, Dental College HITEC-IMS, Taxila/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To assess the impact of mandibular third molars in the development of lower anterior crowding in patients.
Study Design: Cross-sectional study.
Place and Duration of Study: Department of Orthodontics, Dental College HITEC-Institute of Medical Sciences, Taxila Cantt Pakistan from Aug to Nov 2022.
Methodology: Orthopantomograms and casts of 136 patients aged 15 years or above reporting to the Department of Orthodontics were evaluated. Arch length discrepancy was calculated on dental casts and the mandibular third molar position was evaluated on OPGs. The data was collected, and descriptive statistics were drawn from quantitative data using SPSS version 26. Frequency and percentages were recorded for categorical variables. The chi-square test was applied to find out the relation between mandibular third molars and lower anterior crowding.
Results: Our study included a total records of 136 patients collected, of which 39(28.7%) were males and 97(71.3%) were females. 111(81.6%) records fell in age group 15-24years, 21(15.4%) in age range 25-34 years and 4(2.9%) in age range of 35-44 years. The relationship between crowding and 3rd molar position revealed a statistically significant association between the two, with a *p*-value of 0.031.
Conclusion: Mandibular third molars do contribute to lower anterior crowding.

Keywords: Orthodontic patients, Orthopantomograms, Study casts.

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INTRODUCTION

Mandibular anterior crowding is one of the problems that an orthodontist comes across very frequently in routine clinical practice. Along with its effects on a patient's esthetics and hence psychological status, it is also associated with increased plaque accumulation within the oral cavity and hence has untoward effects on the periodontium.[1] Some of the factors that are suggested by the literature include tooth size-arch length discrepancy, the pattern of the facial growth, soft tissue pressures at rest, during function as well as parafunction, late mandibular growth and rotation, lack of normal attrition in the diet of the modern population, maturation as well as contraction of soft tissues of the periodontium and mesial force that is exerted by erupting mandibular third molars.[2]

In human dentition, third molars emerge at the end of the eruption sequence and are most commonly involved in impaction. Broadbent attributed the impaction of the mandibular third molar to the incomplete growth potential of the mandible that is commonly observed in many individuals and he suggested this fact to be a factor leading to lower incisor crowding.[3] The involvement of this group of teeth in lower anterior crowding has been controversial and hence a debatable topic in Orthodontic literature. It has been theorized that the erupting mandibular third molars exert an anterior force in the lower arch specifically in the anterior region. This anterior force may lead to the development of irregularities in the tooth positions and crowding.[4]

It is a routine practice that a large number of orthodontic patients are referred to oral surgeons by their orthodontists for the extraction of third molars either before or after the completion of orthodontic treatment. This procedure not only puts a financial burden on the patients or the public health insurance but also accompanies the risk of its potential complications such as infection, alveolitis, lingual nerve damage, inferior alveolar nerve dysfunction, associated pain and discomfort, post-operative bleeding and edema.[5]

In the literature, conflicting results have been seen regarding the influence of mandibular third molars in the development of lower incisor crowding. Bergstrom and Jenson.[6] were amongst the first

Correspondence: Dr Muhammad Hasnain, Department of Orthodontics, Dental College HITEC-IMS, Taxila Pakistan
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investigators to assess this relationship. Later on, Richardson concluded in a review article that pressure from the posterior part of the mandibular dental arch and the presence of the lower third molar were among the contributing factors in causing lower anterior crowding.[7] More recently, Husain and Rengalakshmi performed a CBCT-based retrospective study to find out whether this factor contributes to the crowding of the lower anterior segment in which they have found a positive correlation between these two variables.[8]

In Pakistan, limited work has been done on the role of the mandibular third molar as a contributing factor in lower anterior crowding.[9,10] The purpose of this study was to evaluate the influence of mandibular third molars in the development of lower anterior crowding in patients.

METHODOLOGY

This cross-sectional study was conducted at the Department of Orthodontics, Dental College HITEC-IMS, Taxila Cantt. The duration of the study was from August 2022 to November 2022. After obtaining ethical approval (Ref# Dental/HITEC/IRB/32) from the Institutional Review Board, pre-treatment orthopantomograms and study casts of the patients aged 15 years or above reporting to the Department of Orthodontics were obtained. Non-probability-consecutive sampling technique was used. Sample size was calculated by using Open Epi Sample Size Calculator taking Confidence level 80%, margin of error 5%, reported prevalence of crowding 29%[11] .The estimated sample size came out to be 136.

Inclusion Criteria: Patients with age of 15 years or above, complete mandibular dental arch with no evidence of hypodontia, no history of previous orthodontic treatment, absence of dental prosthesis (crowns, bridges or implants) and good quality OPG (orthopantomograms) and dental casts were included in the study.

Exclusion Criteria: Patients with a history of any systemic disease, developmental anomalies or syndromes, history of previous orthodontic treatment and history of third molar extraction were excluded from the study.

Assessment of mandibular third molar position was done on the OPG based on three groups viz Third molar agenesis/impaction: Bilateral third molar agenesis based on OPG after history (no history of third molar extraction) and clinical examination. Impaction was defined as a tooth that fails to erupt within the oral cavity and bone and/or soft tissue cover it completely or partially. Third molar erupted: Bilateral third molar erupted to the occlusal plane of normal size, form and buccolingual alignment in the dental arch. Third molar erupting: Bilateral teeth in the erupting phase, not at the level of the occlusal plane, fully or partially visible, in a straight path (Figure 1).

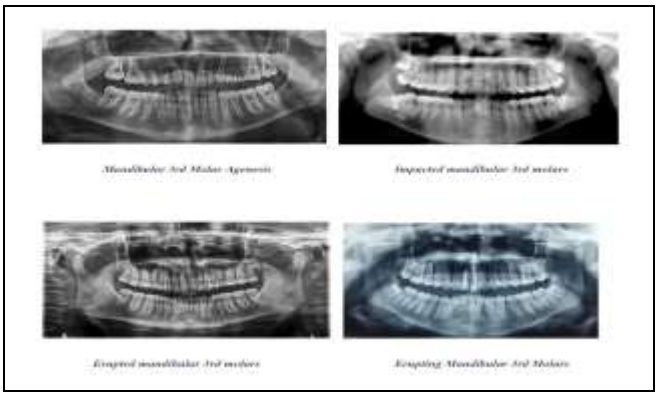

Figure-1: Different situations of Mandibular 3rd molars

After categorizing the 3rd molar class, each case was evaluated for crowding on their dental cast. Arch length of the mandibular anterior region was measured using brass wire. The tooth size of the lower anterior segment was calculated by using a Vernier caliper. Lower anterior crowding for each case was determined by calculating the discrepancy (ALD) between arch length and tooth size. A cut-off ALD of less than 2mm was considered as the absence of crowding however more than 2mm was labelled as the presence of crowding. Based on this calculation, the cases were categorized into two groups, one with the crowding absent and the other with the crowding present (Figure 2).

Figure-2: Crowding groups

The data was collected, and descriptive statistics were drawn from quantitative data using Statistical

Package for the Social Sciences (SPSS) version 26:00. Frequency and percentages were recorded for categorical variables like gender and age groups. The chi-square test was used to find out the association between the mandibular third molar and lower anterior crowding. A *p*-value less than 0.05 was considered to be significant.

RESULTS

Our study included a total records of 136 patients collected, of which 39(28.7%) were males and 97(71.3%) were females. 111(81.6%) records fell in age group 15-24years, 21(15.4%) in age range 25-34 years and 4(2.9%) in age range of 35-44 years (Table-I).

The impacted group of 3rd molar had the highest incidence of the presence of crowding 55(40%) however the crowding was least present in the erupted group 20(14%). The erupting 3rd molar group was lying somewhere in the middle (Table -I).

The relationship between crowding and 3rd molar status, measured by the chi-square test revealed a statistically significant association between the two, with a *p*-value of 0.031 (Table-II).

Table-I: Frequency Distribution of Demographic Characteristics (n=136)

Variables		n(%)
Gender	Male	39(28.7)
	Female	97(71.3)
	Total	136(100)
Age(years)	15-24	111(81.6)
	25-34	21(15.4)
	35-44	4(2.9)
	Total	136(100.0)

Table II: Distribution of Crowding in three groups of 3rd molar position and association between Crowding and Third Molar (n=136)

Crowding	Mandibular 3rd Molar Status			Total n(%)	*p* Value
	Agenesis /Impacted n(%)	Erupted n(%)	Erupting n(%)		
Absent	17 (13%)	16 (12%)	5 (4%)	38 (29%)	0.031
Present	55 (40%)	20 (14%)	23 (17%)	98 (71%)	
Total	72 (53%)	36 (26%)	28 (21%)	136 (100%)	

DISCUSSION

This study demonstrates that mandibular third molars contribute to lower anterior crowding in both genders. In human's permanent dentition, third molars have the most variable eruption timing and pattern. Many patients come with problems associated with mandibular third molars. The most common among these problems is the tooth being partially or totally impacted, the incidence of which varies between 9.5% and 68% among different populations.[12] Since these are the last teeth to erupt, there is a strong likelihood of space deficiency in the arch for their eruption. This results in a large number of referrals for extraction of these teeth.[13]

The prevalence of crowding in the lower incisor segment is estimated to be up to 40%.[14] Two main theories leading to anterior dental arch crowding have been suggested: first explains it to be caused by lingual movement of anterior teeth and the other suggests that it is due to mesial movement of posterior teeth. The former theory takes support from the equilibrium theory of teeth position which states that the final tooth position is determined by a balance between the resting pressures exerted by the soft tissues i.e. lips, cheeks, tongue and periodontium. Any disruption in this equilibrium leads to a change in the positions of the teeth.[15] Richardson7 and Pirttiniemi16 have supported the latter theory by concluding from their studies that third molars while erupting, transmit a force anteriorly down the arch and this concentration of force then leads to malocclusion and rotation of anterior teeth.

This study has focused on the evaluation of the influence of the mandibular third molar in the development of crowding in the mandibular anterior segment. We have found that mandibular third molars contribute to the development of lower anterior crowding. This has been found true for both genders in our study. Our results are in disagreement with those of Azzaldeen,[17] Assali[18] and Zigante *et al*.[19] These contrasting findings might result from genetic variation, geographical differences, and differences in the selection of sample size and variations in methodology. These findings are in correspondence with the studies performed by Husain 8 and Richardson7. Moreover, another explanation was given by Niedzielska who stated that the third molars normally erupt in the dental arch whenever there is sufficient space for them to erupt and in this way, the displacement of other adjacent teeth does not occur.[20] On the other hand, they cause dental crowding when there is space deficiency to accommodate the third molars.

The controversy of mandibular third molar contributing in the development of crowding in the lower anterior region has also led to a debate between orthodontists and oral surgeons as to whether the

prophylactic removal of lower wisdom teeth leads to prevention of crowding in the lower incisor region. Lindauer *et al* conducted a study and found that orthodontists do not blame the third molars as a risk factor in crowding in this segment.[21] that demonstrated to be contradicting to our results. Oral surgeons, on the other hand, have the opinion that these teeth do play a role in this clinical finding, suggesting the prophylactic removal of these teeth to prevent the development of crowding. This fact supports the outcomes of this research sample. Furthermore, corresponding to what we found in our research, another study conducted by Gopalasamy *et al.*, to assess the presence of third molars as an etiological factor in anterior crowding suggests that 18-21 years age group had the most incidence of anterior crowding and on further evaluation, we see that third molars impactions were found to be associated with anterior crowding in many of the patients in this age group.[22]

LIMITATIONS OF STUDY

One of the limitations of the study is the small sample size and single-institute nature of the study which makes it unable to generalize the findings of this study. Secondly, this study did not aim to explore other factors that might contribute to lower anterior crowding which remains a research gap for future investigators. Therefore further multi-center studies are required to assess other factors influencing crowding such as changes in arch length, alterations in tooth size and shape, reduction of inter-canine width, changes in mandibular growth that takes place in adolescence and biomechanical features of inter-dental contacts. Moreover, there was unequal distribution of subjects in the study groups which is mainly because the majority of the patients who report to a dental hospital for orthodontic treatment are females and are in the young age group. Lastly, quadrant wise quantitative evaluation of crowding and its association with the mandibular third molar in the same quadrant could provide an improved understanding of this relationship.

CONCLUSION

Within the limitations of this study, it can be concluded that third molars do contribute to the crowding of the anterior dental arch and there is found to be an association between the cause and source.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MH & ST: Data acquisition, data analysis, critical review, approval of the final version to be published.

MF & MSK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SI & UQ: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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