

ORIGINAL ARTICLE

ANTERIOR ARCH CROWDING —A POSSIBLE PREDICTOR FOR MANDIBULAR THIRD MOLAR IMPACTION

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Background: Impaction of the 3rd molar is a high incident problem occurring in up to 73% of young adults in Europe. Appropriate follow-up routines and optimal timing for surgical removal of the 3rd molars can be established in patients judged to be at increased risk of impaction. The purpose of this study was to identify risk factors for mandibular 3rd molar impaction in adolescent orthodontic patients and to establish anterior arch crowding as a predictive model for mandibular 3rd molar impaction. **Methods:** Pre-treatment Orthopantomogram (OPG) of 158 orthodontic patients with the evidence of anterior arch crowding on pre-treatment study models were evaluated for mandibular third molar position. **Results:** Out of 158 patients, 45 were male and 113 were female. Ninety-seven (61%) of the patients showed anterior arch crowding with a space discrepancy of 5–10 mm calculated on the pretreatment study models. Fifty-seven patients showed 107 third molar impactions. Anterior arch crowding in these patients was ranging from 7–10 mm. Out of 107 impacted third molars 73 were Mesioangular 14 were Distoangular 6 were Vertical and 14 were Horizontal. **Conclusion:** If the arch size is smaller as compared to the tooth size the evidence of lack of space would be there in anterior segment as crowding and in posterior segment as 3rd molar impaction.

Keywords: Mandibular third molar impaction; anterior arch crowding

INTRODUCTION

Impaction of the 3rd molar is a high incident problem occurring in up to 73% of young adults in Europe.¹ Literature suggest that many theories have been proposed owing to high incidence of mandibular third molar impaction. Delayed timing of eruption and being the last tooth in the dental arch are well known factors but if impactions can be predicted at an early stage than they can be better managed. One explanation for the high impaction rate of mandibular third molars might be insufficient development of the retromolar space.²⁻⁴ Mandibular ramus increases in size by resorption at its anterior and deposition at its posterior surface, if this remodelling resorption at the anterior aspect of the mandibular ramus is limited, the mandibular third molars don't get enough space to erupt.⁵⁻⁶

The variation in ramus resorption is correlated with the direction of condylar growth⁵, which in turn affects morphology and position of the adult mandible.⁶ Condylar growth in a predominantly vertical direction is associated with reduced resorption at the anterior aspect of the ramus and forward growth rotation of the mandible, whereas more backward-directed growth at the condyles is associated with increased resorption and posterior growth rotation.^{6,7} The molars tend to erupt more forward during the functional phase in patients with anterior growth rotation, partly compensating for the limited amount of resorption at the anterior border of the ramus.⁵ Because morphologic parameters at adolescence might predict the remaining type of

mandibular growth rotation, they could also be useful in predicting impaction of mandibular molars.⁸

Mandibular third molars can get impacted if their path of eruption is unfavourable especially if the tooth bud is mesially angulated during the initial stages of calcification and root development.⁹⁻¹² Longitudinal evaluations show that the average subject with no history of orthodontic treatment experiences up righting of the mandibular third molars during early adolescence.¹¹⁻¹² However, individual variations in change can be large, and a few third molars might experience increased mesial angulation during early¹² and late¹¹ adolescence. The combined rate of mesial and horizontal impactions of about 46%¹³ suggests that unsatisfactory up righting is a common cause of impaction.

It is unclear whether the angulation of the mandibular third molar at adolescence is of predictive value for successful eruption at complete root development.^{14,15} There are indications that excessive initial mesial angulation and minimal up righting during follow-up might increase the likelihood of impaction.⁹⁻¹⁴ One study suggested that in most cases a space of about 1 mm can be observed between the developing third molar and the second molar.⁹ The space appears to close rather rapidly, and the predictive value of the size of the space for impaction is unclear.¹⁴

Studies performed on primitive skulls indicate that third-molar impaction was relatively infrequent in primitive populations.¹⁶⁻¹⁸ This has been attributed to mesial drift of the posterior teeth due to excessive

interproximal attrition, thereby increasing retromolar space. Similarly, third-molar impaction is rarely observed after second-molar extraction.^{19,20}

The purpose of this study was to identify risk factors for mandibular third-molar impaction in adolescent orthodontic patients and to establish anterior arch crowding as a predictive model for mandibular third-molar impaction. The results might be of considerable clinical significance. Appropriate follow-up routines and optimal timing for surgical removal of the third molars can be established in patients judged to be at increased risk of impaction

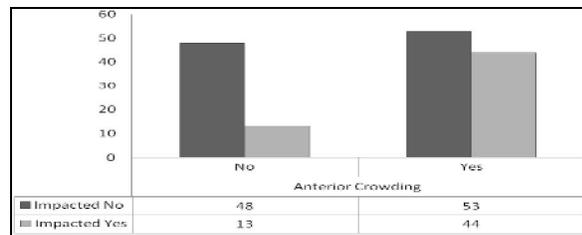
MATERIAL AND METHODS

Orthopantomograms (OPG) taken before orthodontic treatment of 158 patients with evidence of anterior arch crowding were evaluated for mandibular 3rd molar position. All 158 patients with age ranging 15–25 yrs who had been treated at Department of Orthodontics, Jinnah Medical and Dental College were included in the study. Patients with dento-facial deformities and severe facial asymmetries were excluded from the study. Impaction was scored ‘present’ if at least one mandibular 3rd molar was diagnosed as impacted on OPG.

Pretreatment study models were also evaluated to calculate the crowding in the anterior segment. Space analysis was a critical step in orthodontic diagnosis decisions when determining whether extractions are necessary to accommodate a crowded dentition. Carey’s analysis was used to find the space discrepancy in the dental arch prior to start the orthodontic treatment. The space discrepancy was calculated by comparing the total mesio-distal widths of teeth in dental arch to space available in that arch.

RESULTS

Out of 158 patients, 45 male and 113 female, mean age was calculated as 17.5 years with a range of 15–25 yrs, 97 patients (61%) showed anterior arch crowding with a space discrepancy of 5 mm to 10 mm calculated on the pre-treatment study models (Table-1). Fifty-seven patients showed 107 third molar impactions. Anterior arch crowding in these patients was ranging from 7 to 10 mm (Figure-1). Out of 107 impacted third molars 73 were Mesioangular, 14 were Distoangular, 6 were Vertical, and 14 were Horizontal (Table-2).



Pearson $\chi^2=9.39$, $df(1)$, $p=0.0021$

Figure-1: Anterior arch crowding .x. Mandibular third molar impaction

Table-1: Population parameters

Descriptive Statistics		No.	%	Mean
	N	158		17.46±4.75
Gender	Male	41	25.94	17.95±4.59
	Female	117	74.05	17.29±4.81
Characteristics	Impacted	57	36.07	
	Missing	24	15.18	
	Crown Completion	65	41.13	
	Root Completion	60	37.97	
	Erupted	32	20.25	
	Anterior Arch Crowding	97	61.39	

Table-2: Angulation of impacted third molars

	Lower Right		Lower Left		Total	
	No.	%	No.	%	No.	%
Mesioangular	37	34.5	36	33.6	73	68.2
Distoangular	8	7.4	6	5.6	14	13.1
Vertical	3	2.8	3	2.8	6	5.6
Horizontal	7	6.5	7	6.5	14	13.1
Total	55	100	52	100	107	100

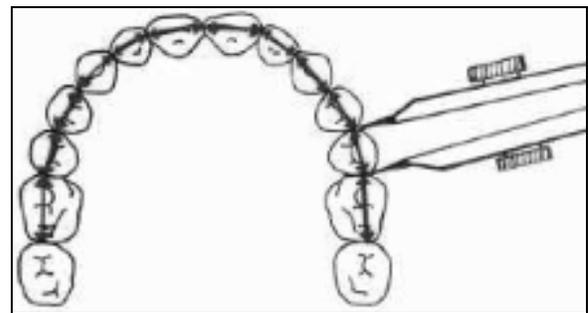


Figure-2: Measuring mesio-distal width of teeth

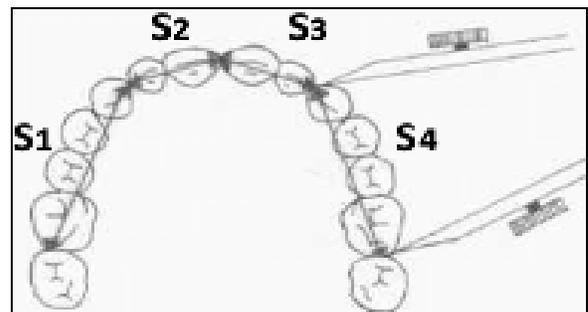


Figure-3: Measuring total arch width (S1+S2+S3+S4)

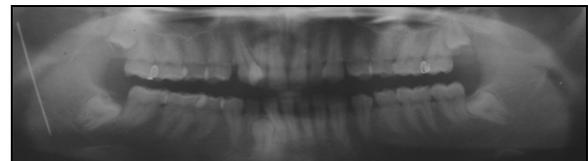


Figure-4: OPG showing anterior arch crowding and impacted mandibular third molars

DISCUSSION

Dental crowding is caused by disparity in the relationship between tooth size and jaw size which results in imbrication and rotation of teeth. Three conditions which may predispose the dental arches to crowding are excessively large teeth, excessively small bony bases of the jaws, and a combination of large teeth and small jaws.²¹

This study demonstrated that 61% patients showed anterior arch crowding with a space discrepancy of 5 mm to 10 mm calculated on the pre-treatment study models. If there is increased anterior arch crowding there is greater chance of having third molar impaction. Pre-treatment assessment of patients' radiograph and study models can be helpful in predicting the third molar impactions.

Impactions are reported to be associated with complications ranging from simple caries, root resorption, localised periodontal problems, pericoronitis and infection to cysts, and neoplastic lesions.^{22,23} These pathologic processes, along with possible association between eruption of lower 3rd molar and increases in lower incisor crowding are the rationales given for the extraction of the 3rd molar by surgical procedures.²⁴

Bishara *et al*^{24,25} evaluated the changes in lower incisors between 12 and 25 years of age, and then reevaluated the same subjects, at 45 years of age. Their findings indicated that there was an increase in the tooth size-arch length discrepancy with age. The average changes amounted to 2.7 mm in males and 3.5 mm in females. These changes were attributed to a consistent decrease in arch length that occurred with age. Similar findings have been observed on untreated normal subjects by Lundstrom²⁶ and Sinclair and Little²⁷.

To predict the final position of 3rd molars two variables that need to be determined at 8–10 years of age are predicting the future availability of space for 3rd molars, and predicting the changes in angulation of 3rd molars. If there is anterior arch tooth size discrepancy there is a greater possibility of posterior segment arch size discrepancy also and thus resulting in third molar impaction. However, anterior arch crowding is a multifactorial phenomenon, so based on the above fact decision to extract or enucleate third molar cannot be taken and other factors should also be taken into account.

CONCLUSION

If the arch size is smaller compared to the tooth size, the evidence of lack of space would be there in anterior segment as crowding and in posterior segment as 3rd molar impaction.

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