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Research Paper

Maxillary Third Molar Eruption and its Relationship to Inclination of Maxillary First Molars - a Computed Tomography Study

Medical Science

KEYWORDS : Third Molar, Eruption, Axial Inclination, Computerized Tomography

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ABSTRACT

Objective: To analyze the relationship between sagittal inclination of the maxillary first molars and eruption or impaction of third molars using computed tomography scanograms.

Material and methods: The sample consisted of 20 subjects aged between 15 to 48 years who were divided into 2 groups consisting of 10 subjects with erupted/erupting maxillary third molars in one group and 10 subjects with impacted third molars in the second group. The sagittal inclinations of maxillary first molars to the palatal plane were measured in two groups. The data obtained was subjected to statistical analysis.

Results: The first molars were more mesially inclined in group A as compared to group B. Effect of age on sagittal inclination revealed increase in the sagittal inclination of first molar as the age increased.

Conclusion: The sagittal inclination of the first molar can be a predictor of the eruption or impaction of the adjacent third molar. Thus the vertical position of the maxillary first molar in the sagittal plane is suggestive of the eruption of the third molar.

INTRODUCTION

An impacted tooth is one that fails to erupt into the dental arch within the expected time. Teeth most often become impacted because of inadequate dental arch length and space in which to erupt. The most commonly seen impacted teeth are the maxillary and mandibular third molars and they account for 98% of all impacted teeth [1]. In mandible impaction of third molar is most often due to inadequate retromolar space. If the remodeling resorption at the anterior aspect of the mandibular ramus is limited, the eruption of mandibular third molar might be blocked [2]. Similarly lack of compensatory periosteal apposition at the posterior outline of the maxillary tuberosities could prevent eruption of the maxillary third molars [3].

Maxillary third molar usually starts its development at the cervical neck of second molar and with the occlusal surface facing posteriorly. The posteriorly tilted tooth gradually uprights during further crown and root formation and ends up with its axis being almost vertical. Being the last tooth to erupt in the maxilla, third molar has to adapt to the existing space which is limited by the presence of second molar, the maxillary sinus and the anatomy of the pterygoid fossae. As the third molar tooth germ has certain adaptability in its initial phases of development the anatomy of the region will often dictate the morphology of the third molar [4].

The relationship between third molars and crowding has been debated for many years. Posterior crowding is thought to have an inhibitory effect on the eruption of the second and third molars and may cause relapse after orthodontic treatment, regardless of whether or not premolars have been extracted [5].

Third molar removal is the most frequent oral surgical intervention. Therefore the assessment of germ position and prognosis of third molar eruption is of general interest for patient management [6].

Prediction of maxillary third molar eruption could be helpful in orthodontics because it helps in diagnosis, treatment planning, and prognosis of orthodontic therapy as orthodontist may come across few problems like late incisor crowding in adults, relapse of anterior segment crowding after orthodontic therapy, difficulty in distalisation of first and second molars [especially in Class II Division I adult non extraction cases] and difficulty during Lefort osteotomy [as third molar causes obstruction to the mandibular movements as it impinges on the coronoid process] are the reasons for which orthodontists' suggest early removal of third molars [7].

Therefore, erupting or erupted third molars play an important role in diagnosis, treatment planning, and prognosis of orthodontic therapy and prediction of impaction or eruption of third molars becomes an integral part of our routine clinical diagnosis.

Many investigators have studied third molar impaction in the mandible, but studies showing maxillary third molar impaction are very few in numbers [8,9]. Therefore, the present research was undertaken to predict the eruption or impaction of maxillary third molars by determining the sagittal inclination of maxillary first molars using computed tomography scanograms.

MATERIAL AND METHODS

This study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, A.B. Shetty Memorial Institute of Dental Sciences, Mangalore, to evaluate the relationship between eruption or impaction of maxillary third molars and sagittal inclination of maxillary first molar.

The samples included 20 subjects who were divided into 2 groups with 10 subjects in each group. In both groups the patient's age ranged from 15 to 48 years. In Group A there were 6 males and 4 females and the subjects had complete normal dentition with erupting or erupted third molars whereas Group B had 5 males and 5 females and the subjects had impacted right and left third molars.

The criterion used for selection of subjects:

Subjects with normal permanent dentition without the anomalies of number, shape, volume or position were included in the study. Subjects with unilateral impaction of the third molars, crowding, any pathology or tumors in the molar region, congenital missing of teeth or extracted teeth and molar replacements with prosthetic reconstruction were excluded from the study.

The criteria used for impaction

Third molar with complete root formation and its highest part found beneath the cervical line of second molar was considered as impaction.

Technique

Computed tomography scans [CT scans] were obtained with a high speed CT system [Siemens] using the helical [spiral] scan-

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ning mode with 1mm scanning slice thickness and 0.6mm inter slice width. The image analysis was done using 2-D multiplanar reconstructions. Patients in supine position were scanned from the occlusal plane to the nasal surface of palatal process of maxilla. The reference plane used was the palatal plane, which was defined on the scout view by the nasal surface of the palatal process of the maxilla. CT scans were obtained with the sagittal reconstructions of first, second and third molar areas. [figure -1, 2, 3]

The sagittal inclination of first molars was measured by the postero inferior angle formed by the molar axis [intercuspid groove – bifurcation] and the palatal plane, represented by a horizontal line. Statistical analysis was done to compare mean angular values between the two groups using Mann Whitney U test. Coefficient of correlation [Spearman test] was used to estimate the relationship with age.

Results

Results showed that in group A [with erupting or erupted third molars] both right and left maxillary first molars were found to be more mesially inclined compared to Group B [with third molar impaction] [P = 0.001]. There was no statistic difference found in relation to the side either right or left in both groups [P = 0.01]. **[Table -1]**

Relation of first molar sagital inclination with respect to age revealed that there was an increase in the sagital inclination of first molar in older age as compared to younger age subjects in Group A as compared to group B. **[Table -2]**

Spearman correlation coefficients were calculated to assess the relationship of the sagittal inclination of first molar with age. A good correlation is seen in the first group with erupting/ erupted third molars [r=0.573]. A poor correlation is seen in the second group [r=0.474]. **[Table -3, 4].** The mean age of the patient was found not significant in 2 groups of subjects [p=.427].]. **[Table -5].**

DISCUSSION

In the present study, spiral computed tomography scanograms were used to determine the relationship between eruption of maxillary third molars and sagittal inclination of maxillary first molars between two groups with erupted and impacted third molars. The development of spiral CT scanning combined with 3-dimensional [3D] techniques produces high quality 3D images that can be useful for diagnosis and treatment planning in orthodontics. The impacted teeth and their relationships to adjacent teeth or other anatomical structures can be precisely determined with 3-D CT techniques [10]. This process is less time consuming and produces less measurement errors when compared with conventional radiographs [11]. Measurements taken from panoramic radiographs are not reliable because of distortions and magnifications, especially in the molar and retromolar region [12]. Whereas lateral cephalograms make the differentiation between right and left very difficult because of super imposition [12]. The other advantage of the CT scan over conventional radiography are that the soft ware used to process the CT image data are rapid, detailed and allow 2 and 3-D visualization of the proposed sites on a 1: 1 ratio [i.e., life sized] [13]. Therefore CT scans were used in our study to overcome the disadvantages associated with conventional radiographs.

We used palatal plane as a reference plane to measure all angles. Fayad et al in a study in 2004 have used this plane as it can be easily observed on the scout view and thereby gives minimal measurement errors. Since it is more reliable than the occlusal plane, it can also be used in measuring inclination of the facial axis of the clinical crowns, which is modified by age and treatment.

Our study showed that in subjects with erupted third molars the sagittal inclination of both first molars was more compared to subjects with impacted third molars. This finding is in agreement with Fayad et al study. From this finding and according to the previous study it can be concluded that both first and second molars found to be more mesially oriented before complete eruption of the third molar into the oral cavity.

Assessment of patient's age with respect to the inclination of maxillary first molars revealed that there was an increase in the sagittal inclination of the first molars as the age increased. This was similar to the findings reported by the researchers such as Harris and Ferrario [14]. Harris in his investigation, measured mesial and buccal drift for teeth posterior to canine in adult patients aged between 20 to 55 years. He attributed drift to an anteriorly directed component of force. Bjork conducted an implant study at the age of puberty and documented an anteriorly directed eruption of the maxillary molars in cases with anterior growth rotation of the maxilla, thereby contributing to an increase in the retromolar space [3]. A study was designed by Ganss et al in 1993, to give an assessment of the probability of maxillary third molar eruption depending on the space available at an early age. In this study, significantly more maxillary third molars had erupted if the space/width ratio measured on rotational tomogram was more than 1, that is the tooth crown was as wide as or less wide than the space available in the retro molar region. [14].

Limitations of our study are that maxillary second molars are not included because the sagittal inclinations of maxillary second molars were difficult to measure because of the anatomy and position of the second molar in the arch and small sample size assessed. Therefore further studies involving large samples are essential.

CONCLUSION

It was concluded that the maxillary first molars were more mesially inclined in subjects with erupting/erupted maxillary third molars as compared to subjects with impacted third molars. This indicates that more mesially inclined maxillary first and second molars provide sufficient space for the eruption of third molars. Distally inclined maxillary first and second molars will provide restricted antero posterior space for the eruption of third molar thereby leading to subsequent impaction of the third molar.

Table 1: Measured inclinations of maxillary first molars [in degrees] in Group A

No.	Right side	Left side	Age [in years]
1.	92	91.5	16
2.	93.3	89	18
3.	91	92	20
4.	92.7	90.6	22
5.	91	91	26
6.	90.5	93	29
7.	98	95	32
8.	93	90	35
9.	91	95.2	39
10.	93.5	94.6	47

Table 2: Measured inclinations of maxillary first molars [in degrees] in Group B

No.	Right side	Left side	Age [in years]
1.	81	82.4	17
2.	82.7	82	20
3.	85	84.2	23

4.	84.5	84	27
5.	87	86	31
6.	83.3	82.9	37
7.	85.7	85	38
8.	82.2	83.6	41
9.	81.6	81	46
10.	85	83	48

Table 3: Group statistics

Group No.	No.	Mean	Std dev	Z
Age 1. 2.	10 10	29.8000 27.3000	7.28469 7.31893	.79500 P=.427ns

Table 4: Mean angular values between two groups

Group No.	No.	Mean	SD	Z
Right 1. 2.	10 10	84.1000 92.9000	2.02978 2.27986	3.76400 P=.001vhs
Left 1. 2.	10 10	83.6700 92.6800	1.84935 2.61398	3.78500 P=.oo1 vhs

Table 5: Spearman coefficient of Correlation:

Group No.		Right	left
1. Spearmans rho age	r p N	.573 .083 10	.195 .589 10
RIGHT	r p N		.623 .054 10
2. Spearmans rho age	r p N	.474 .166 10	.610 .061 10
RIGHT	r p N		.450 .192 10

Figure 1: Reference plane used in the study [Palatal plane]

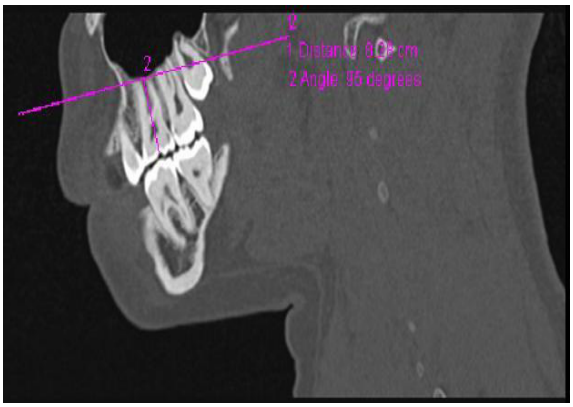


Figure 2: Measurement of maxillary first molar inclination [Group A]

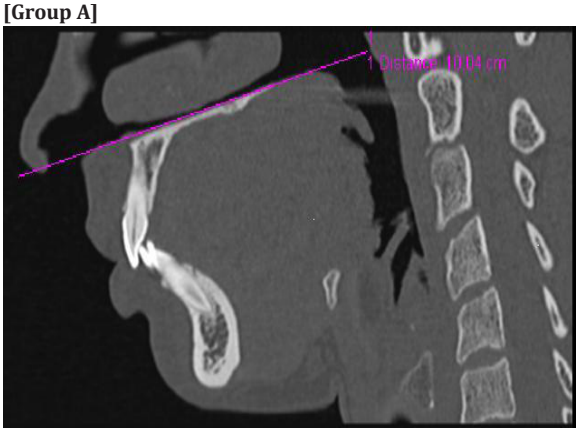
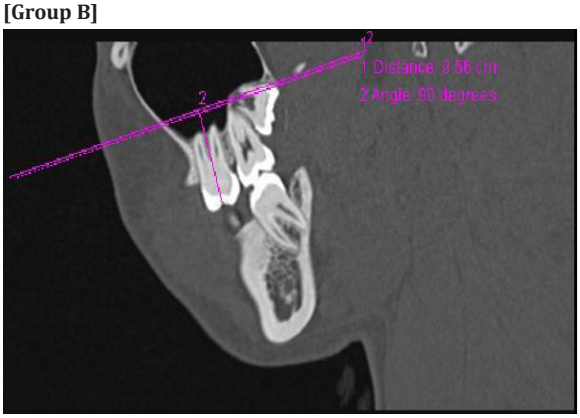


Figure 3: Measurement of maxillary first molar inclination [Group B]



REFERENCE

1. Hattab F, Rawashdeh M, Fahmi M. Impaction status of third molars in jonardian students. Oral Surg Oral Med Oral Pathol 1995;79:24-9. | 2. Bjork A, Jensen E, Palling M. Mandibular growth and 3rd molar impaction. Act Odont Scand. 1956; 14: 231-71. | 3. Bjork A. Facial development and tooth eruption: An implant study at the age of puberty. Am J Orthod 1972; 62: 339-383. | 4. Richardson M. Third molar genesis. Angle Orthod1980:50:121-128. | 5. Takashi Kajii, Tohru Imai L. Presence of 3rd molar germs in Orthodontic patients in Japan. Am J Orthod DO 2001; 119:245 –50. | 6. Bruce Ra, Fredrickson GC, Small GS. Age of patients and morbidity associated with mandibular third molar surgery. Am Dent Assoc 1980; 101:24-5. | 7. Handelman CS. Reservations on third molar enucleation. Am J Orthod. 1976; 64:100-1. | 8. Rickets RM, Turley P, Chaconas S, Schulhof RJ. Third molar enucleation: Diagnosis and Techniques. J Calif Dental Assoc. 1976; 4:52-7. | 9. Richardson ME. Some aspects of lower third molar eruption. Angle Orthod 1974; 44: 141-5. | 10. Yuxue Chen, peijia Duan, Yukun Meng, and Yangxi Chen. Three dimensional spiral computed tomographic imaging: a new approach to the diagnosis and treatment planning of impacted teeth. Am J Orthod Dent Orthop. 2006; 130: 112-6 | 11. Jackie Badawi Fayad, Julia Cohen Levy. Eruption of third molars: Relationship to inclination of adjacent molars. Am J Orthod Dent Orthop. 2004; 125: 200-2. | 12. Freedman GS, Putman CE, Potter GD. Critical review of tomography in radiology and nuclear medicine, CRC. Crit Rev Clin Radiol Nucl Med 1975; 6:253-94. | 13. Hirschfelder U. The spiral CT imaging technique – The experience for orthodontic examinations. Fortschr Kieferorthop 1992 ; 53:247-53. | 14. Edward F. Harris. A longitudinal study of arch size and form in untreated adults. Am J Orthod Dent Orthop 1997; 111:419-27. | 15. C. Ganss, W. Hochban, A.M. Kielbassa. Prognosis of third molar eruption. Oral Surg. Oral Med Oral Pathol 1993; 76:688-93. |