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The Effect of Minor Dental Anomalies on Developing Class II Malocclusion and its Cephalometric Correlation in South Indian Children: A Pilot Study

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ABSTRACT

Background: Class II malocclusion is commonly present along with a variety of skeletal and dental malformations. The aim of the present study was to examine whether a putative relationship exists between developing class II malocclusion and various dental anomalies, in comparison with that of Class I malocclusion. The study also aims to compare the cephalometric parameters of patients with developing class II malocclusion with that of Class I malocclusion. The study sample included 40 children between age group of 12-16yrs among 440 school children screened in our department. The sample was divided into two groups according to molar relationship. Group 1 of 30 children with class II molar relation and group 2 of 10 children with class I molar relation. Cephalometric parameters were analyzed on the lateral cephalograms for both the groups. Study models and OPG were analyzed for the presence of different developmental dental anomalies in both the groups. Dental anomalies such as mesiodens, rotations, canine ectopia, canine impaction and third molar agenesis were recorded. The study concluded that rotation of teeth forms the major contributor in the occurrence of class II malocclusion, when compared with other dental anomalies. Mesiodens forms the minor contributor in the occurrence of class II malocclusion.

Keywords: Class II malocclusion, Rotations, Canine Ectopia, Canine Impactions and Third molar agenesis.

INTRODUCTION

Class II malocclusion is commonly present along with a variety of congenital tooth anomalies. It has been repeatedly suggested that heredity plays an important role in the genesis of class II malocclusion. Class II is further classified into division 1 and division 2, on the basis of alignment of maxillary incisors. A specific entity class II division 2 deep bite malocclusion may actually be polygenic and additive in nature, through combined expression of genetically determined anatomical components[1]. Abnormalities such as missing teeth, peg-shaped laterals, transpositions, supernumeraries and impactions are most likely connected with defects in certain genes that are associated with tooth development. Mutations in the Otlx2 gene found in the oral epithelium at sites of future tooth formation before morphological manifestations, are associated with tooth abnormalities as observed in Rieger syndrome[2]. A seprate entity, skeletal class II patterns arise from not only sagittal but also from vertical discrepancies. A thorough knowledge of the salient features of Class II malocclusion helps the clinician in arriving at a proper diagnosis and treatment plan. Orthodontic patients have higher incidence of associated dental anomalies compared to the general population. Judicial use of radiographic imaging along with the routine clinical examination

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is essential for early detection of these anomalies.The aim of the present study was to examine whether a putative relationship exists between developing class II malocclusion and various dental anomalies, in comparisonwhen they occur with Class I malocclusion. The study also aims to compare the cephalometric parameters of patients with developing class II malocclusion with that of Class I malocclusion.

MATERIALS AND METHOD

The study sample included 40 children between age group of 12-16 years among 440 school children screened in our department. Pretreatment records of these children such as lateral cephalograms, study models and orthopantamographs (OPG) were collected. The sample was divided into two groups according to molar relationship

- GROUP 1 (Study group) 30 children with class II molar relation.

- GROUP 2 (Control group) 10 children with class I molar relation.

Cephalometric parameters were analyzed on the lateral cephalograms of both the groups. Study models and OPG were analyzed for the presence of different developmental dental anomalies in both the groups. Dental anomalies like rotations, mesiodens, canine ectopia, canine impaction and 3rd molar agenesis were recorded. Results were tabulated and subjected to statistical analysis. An unpaired 't test' was used to compare the cephalometric parameters & chi-square test was used to compare the dental anomalies between the study and control groups.

RESULTS

- ANB, Mandibular plane angle, Angle of convexity and AB plane angle are significantly higher where as Facial angle is significantly lower in developing class II malocclusion when compared to Class I.

- Upper incisor to NA, Occlusal plane angle, Lower incisor to Occlusal plane, LI to Mandibular plane and UI to A-POG line are significantly higher in developing class II malocclusion when compared to Class I.

- ANB, MPA, Angle of convexity, AB plane angle UI to NA Occlusal plane angle, LI to Occlusal plane, LI to Mandibular plane and UI to A-POG line are significantly higher in developing class II malocclusion when compared to class I.

- There is high incidence of rotation, Canine ectopia, Canine impaction and 3rd molar agenesis in class II malocclusion when compared to class I except for the presence of mesiodens.

DISCUSSION

The number of congenital dental anomalies become more pronounced with age as some type of anomalies become more recognizable and are diagnosed later, such as canine impaction and agenesis of third molar[3]. Another recent study concluded that maxillary palatal canine impaction, tooth agenesis and maxillary lateral incisor microdontia are developmental dental anomalies closely associated with class II div 2 malocclusion[4].

The maxillary canine is the most variably positioned tooth in the human dentition. Rohrer reported the incidence of permanent canine impaction to be 20 times higher in the maxilla than in the mandible[5]. Hitchen and Rayne found that palatal impaction accounts for 85%and labial impaction 15%[6,7]. A high percentage of impacted maxillary canines was found in patients with a class II division 2 malocclusion. In a previous study 33.5% of the sample exhibited impacted canines[3]. Various investigators have discussed the difference in the aetiology of palatal and labial impaction and the possibility of palatal canine impaction most likely represents a congenital tooth anomaly in class II malocclusions. In the present study 16.66% of canine impactions were reported, which is exactly half to that reported in the study by Basdra et al[3].

The aetiology of ectopic maxillary canines appears to be multifactorial and the cases of ectopia different.The maxillary canine is present superior to the deciduous canine, angulated medially, with its crown lying distal and buccal to the lateral incisor. The canine follows a mesial path until the crown reaches the distal aspect of the lateral incisor root. The erupting canine is gradually uprighted to a more vertical position and is guided by the lateral incisor root, until it is fully erupted[8].

Table 1: Comparison of means of cephalometric parameters (skeletal) between study group & control group.

Cephalometric parameters	Control group (n=10)	Study group (n=30)	p value
SNA	81.8	82.3	0.638
SNB	79.2	77.3	0.026
ANB	2.60	5.13	0.000 *
MPA	20.20	26.63	0.02*
Facial angle	86.2	83.5	0.006*
Angle of convexity	2.20	10.97	0.000*
AB angle	- 3.90	-11.00	0.000*
Y-axis	60.90	60.20	0.632

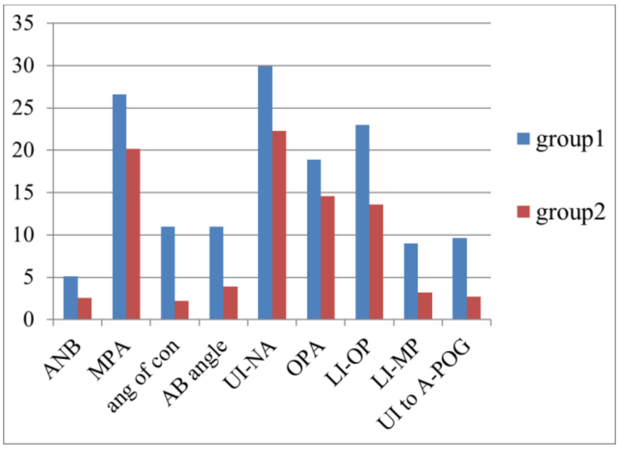
Table 2: Comparision of means of cephalometric parameters (dental) between study group & control group.

Cephalometric parameters	Control group (n=10)	Study group (n=30)	p value
UI to NA	22.30	29.93	0.044*
LI to NB	26.10	29.20	0.199
IIA	129.60	121.03	0.268
OPA	14.60	18.93	0.015*
Cant of OP	8.60	11.13	0.179
LI to OP	13.60	22.97	0.003*
LI to MP	3.20	9.00	0.001*
UI to A-POG	2.700	9.617	0.001*

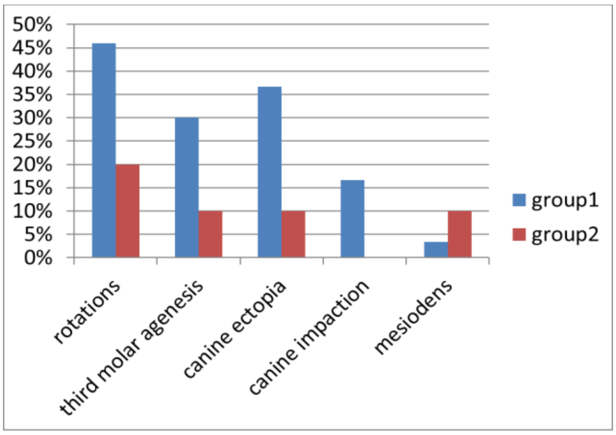
Maxillary canine ectopia occurs as the result of divergence from the normal path of eruption of the tooth. sometimes there is buccal displacement of canines with no crowding. The cause is genetic, and the condition has been called "primary tooth germ displacement," meaning development of the tooth bud in the aberrant position or orientation, because of an abnormal genetic pattern.[9] Canine ectopia has also been associated with reduced space [10,11]and abnormal dento skeletal features [12,13]. It has been suggested that labial ectopia is more commonly related to insufficient arch length, whereas palatal ectopia is associated with other dental anomalies[10,14]. Dental deviations occur in more than

Table 3: Presence of different dental anomalies in study group & control group.

Type of dental anomaly	Control group (n=10)	Study group (n=30)	p
Rotation	20%	46.6%	0.1
3rd molar agenesis	10%	30%	0.2
Canine ectopia	10%	36.66%	0.1
Canine impaction	0	16.66%	0.1
Mesiodens	10%	3.33%	0.4



Graph 1: Comparision of means of cephalometric parameters between study and control groups.



Graph 2: Comparision of means of dental anomalies between study and control groups,

two-thirds of all cases with ectopic canines and most often in cases with palatally located canines. It is important to predict ectopic eruption of maxillary canines because early prediction can provide optimal treatment and prevent resorption of the permanent incisors[15].

The critical age for the diagnosis of agenesis of the third molar is 14 years or older[16]. Agenesis of the third molars was found in 30% of study group in the present study, which is comparable to 22.7% as reported in a previous study[17]. A study on skeletal malocclusions, suggest that agenesis of the third molar does not depend on vertical patterns of the skeletal malocclusions, but does depend on sagittal skeletal malocclusions[17]. In a systematic review and metaanalysis by Carter et al. among 92 studies, containing 100 effect sizes and 63,314 subjects, for systematic review and metaregression. The worldwide rate of agenesis was found to be 22.63%[18].

An interesting fact in the present study was the low occurrence of supernumerary tooth such as a mesiodens in Class II malocclusion, which accounted for only 3.33% of the study sample. A controlled study of associated dental anomalies which included among others, agenesis of the second premolars, small size of lateral maxillary incisors, supernumerary teeth, infraocclusion of primary molars, and palatal displacement of maxillary canines, found that, except for supernumerary teeth, all other tooth anomalies examined showed significant reciprocal associations suggesting a common genetic origin. The study also suggested that supernumerary teeth appear to be a separate aetiological entity with respect to all other tooth anomalies examined [14].

Tooth rotation is defined as noticeable mesiolingual or distolingual intra-alveolar displacement of the tooth around its longitudinal axis. The prevalence of tooth rotation is 2.1 to 5.1% in the untreated population[19].Rotation of teeth can result from number of factors like— space availability for tooth alignment, tooth eruption order, and functional influences exerted by the tongue and lips, consonant with a multifactorial model in the origin of tooth malpositions. Maxillary molar rotations due to early extraction of deciduous molars leading to Class II division 2 type of occlusion is a routine clinical scenario. Subjects with Class II malocclusion in the mixed dentition present with mesial upper molar rotation in about 84% of the cases. The correction of molar rotation may provide between 1 and 2mm of gain in arch perimeter and of improvement in molar relationships per side in 5 out 6 Class II patients[20]

Vallera and Nelson reported that the information obtained from cephalometric analyses facilitates the treatment decisions of orthodontists[21]. A recent study compared cephalometric features between class I and class II div 1 malocclusion and concluded that mandibles of class II patients were smaller in size posteriorly positioned and rotated when compared to class I patients[22]. These findings correlate with similar findings discussed in the presnt study. Pancherz et al, evaluated the cephalometric parameters between Class II division 1 and division 2 and concluded that mandibular retrognathism was a common clinical entity in both divisions of class II malocclusion. In class II, as there is normal or increased maxillary arch width and narrowing of mandibular arch width, there are high chances for occurrence of crowding in the lower arch[23].

Following cephalometric analysis, skeletal parameters such as ANB, MPA, Angle of convexity and AB plane angle are significantly higher in the study group when compared to the control group. This indicated an orthognathic maxilla and a retrognathic mandible along with a more forward rotation of the mandible and reduced lower anterior facial height resulting in a skeletal deepbite, which correlates with a recent study which concluds that class II div 2 patients showed orthognathic maxilla and retrognathic mandible, skeletal deep bite, marked horizontal growth pattern with forwardly rotated mandibular base[24].

Following cephalometric analysis, dental parameters such as UI to NA, Occlusal plane angle, LI to Occlusal plane, LI to Mandibular plane and UI to A-pog line are significantly higher in the study group when compared to the control group. This indicates the proclination of the maxillary incisors with slight labial inclination of mandibular incisors. This protrusion can be explained as a dentoalveolar compensation to maintain normal inter-arch relationship, in patients with class II malocclusion.

The dental anomalies like rotations, canine impaction, canine ectopia, third molar agenesis were found to be more common in the study group when compared to the control group. This may be due to the smaller size of the mandible in class II malocclusion thus affecting the normal tooth alignment. Presence of these dental anomalies may further complicate the Orthodontic management of developing Class II malocclusion and prolongs the treatment duration.

Though the sample selected in the present pilot study was small, further studies in future with larger samples are required to assess the relationship of congenital dental anomalies on developing Class II and it's other divisions in young children.

CONCLUSION

Rotation of both anterior and posterior teeth forms the major contributor in the occurrence of class II malocclusion in south Indian children, when compared with other dental anomalies including canine ectopia, canine impaction, third molar agenesis, and mesiodens.

Mesiodens forms the minor contributor in the occurrence of class II malocclusion and does not have much impact on worsening of class I malocclusion.

The cephalometric analysis in the present study confirms a retrognathic mandible and decreased lower anterior facial height in almost all Class II cases, when compared to Class I cases. The dental parameters indicate marked proclination of maxillary incisors with slight labial inclination of mandibular incisors.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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