

## Comparison of dentoalveolar height and central incisor inclination in maxilla and mandible among different facial growth pattern individual in vertical plane in cosmopolitan samples of Malwa region of Madhya Pradesh

Agraj Sharma,\*<sup>1</sup> Ashish Garg,<sup>2</sup> Sunita Marothiya,<sup>3</sup> Rakesh Thukral,<sup>4</sup> Amit Tripathi<sup>5</sup>

<sup>1</sup>Post Graduate Student, <sup>2</sup>Professor & Head, <sup>3</sup>Senior Lecturer <sup>4</sup>Professor, <sup>5</sup>Senior Lecturer, <sup>1-5</sup>Dept. of Orthodontics and Dentofacial Orthopedics <sup>1-5</sup>Sri Aurobindo College of Dentistry, Indore Madhya Pradesh India

\*Corresponding Author: Agraj Sharma

Email: agraj00@gmail.com

### Abstract

**Introduction:** In the field of Orthodontics and Dentofacial Orthopedics, in-depth knowledge of incisor inclination & dentoalveolar height in different facial growth patterns is essential to reach ideal treatment for every patient.

**Objectives:** Assess and compare anterior and posterior dentoalveolar height and incisor inclination in maxilla and mandible in different facial growth pattern in vertical plane.

**Materials and Methods:** In this study, lateral cephalogram of total 90 patients were traced. The sample was divided into horizontal, average and vertical growth pattern based on Jarabak's ratio. The maxillary and mandibular incisor inclination and dentoalveolar height of anterior and posterior region were evaluated and analysed statistically.

**Results:** This study revealed that incisor inclination and dentoalveolar height showed statistically significant difference among different growth patterns. Incisor inclination and anterior dentoalveolar height in maxilla and mandible were increased in vertical growth pattern. Posterior dentoalveolar heights were also more in maxilla and mandible but the result was not statistically significant.

**Conclusion:** This study showed that there is a statistically significant relationship between incisor inclination, dentoalveolar height and facial growth pattern of an individual.

**Keywords:** Facial growth patterns, Incisor inclination, Dentoalveolar height, Jarabak's ratio.

### Introduction

In the field of Orthodontics, skeletal growth has been given more importance than any other aspect of craniofacial development.<sup>1</sup> Establishment of an accurate diagnosis and treatment plan depends on clinician's knowledge about patient's skeletal growth pattern which provides advantage in treatment.<sup>2</sup> The variations in craniofacial morphology in vertical plane are the reasons for many dentoalveolar compensations and for orthodontic treatment; changes in these relationships may be required.<sup>1</sup> Hence, knowing the incisal inclination along with dentoalveolar height and skeletal growth pattern of an individual is of utmost importance in routine orthodontic practice.

Dentoalveolar compensation may occur as a mean to mark the anteroposterior and vertical discrepancies so as to obtain normal occlusal relationship.<sup>3</sup> There are two components of this dentoalveolar compensation. First component is dentoalveolar height i.e. vertical development of basal bone and dentition and second component is incisal inclination.<sup>4</sup>

In orthodontic treatment planning, inclination of maxillary and mandibular incisors is of utmost importance as they affect the smile esthetics and thus overall beauty of the face by having their influence in upper and lower lip position.<sup>5</sup> More inclination of incisor leads to more protrusive lips which gives an unaesthetic profile.

Moreover, excessive proclination of mandibular incisor may leads to gingival recession, bone dehiscence and bone fenestration. More proclined lower incisors at the end of orthodontic treatment is one of the most important factors

which contributes to relapse. Various factors which can affect the inclination can be age of patient, mandibular symphyseal depth, inclination of alveolar bone and strength of perioral muscles.<sup>6</sup> Forces from tongue and perioral muscles can significantly affect the inclination of incisor, this has been widely accepted by orthodontists since long time.<sup>7</sup>

Anterior dentoalveolar height is the perpendicular distance between the incisal edge of maxillary or mandibular incisor to the palatal plane in maxilla and mandible plane in case of mandible whereas posterior dentoalveolar height is the perpendicular distance between mesio-buccal cusp of first molar to palatal plane in maxilla and mandibular plane in mandible. Knowing these dentoalveolar heights greatly affects the treatment approach in an orthodontic patient. For example, deep bite in an individual may be due to increased anterior dentoalveolar height or decreased posterior dentoalveolar height. Thus, the treatment planning should be different in each of these situations.<sup>8</sup>

Various studies have been done in past to compare relationship of incisor inclination and dentoalveolar height in various skeletal malocclusions but very few studies are available in literature which report comparison of these parameters in different growth patterns. Thus, the aim of this study was to compare dentoalveolar height and central incisor inclination in maxilla and mandible amongst different facial growth pattern individuals in vertical plane.

### Procedure performed

The present study consists of 180 pre-treatments lateral cephalogram of the patients undergoing orthodontic treatment in the Department of Orthodontics and Dentofacial Orthopedics, out of 180 only 90 lateral cephalogram met the inclusion criteria which were divided into three categories depending upon the growth pattern which was based on Jarabak's ratio.

The inclusion criteria included adult non-growing patients of age 18-40 years, no history of previous orthodontic treatment, facial trauma and presence of any congenital anomaly. And the exclusion criteria were growing patients, any history of previous orthodontic treatment, facial trauma, and presence of congenital anomaly.

The cephalometric landmarks used in our study were Sella, Nasion, ANS, PNS, Menton, Gonion shown in Figure 1. and cephalometric parameters used were maxillary incisor inclination, mandibular incisor inclination, maxillary anterior dentoalveolar height, maxillary posterior dentoalveolar height, mandibular anterior dentoalveolar height, 6. mandibular posterior dentoalveolar height shown in Figure 2.

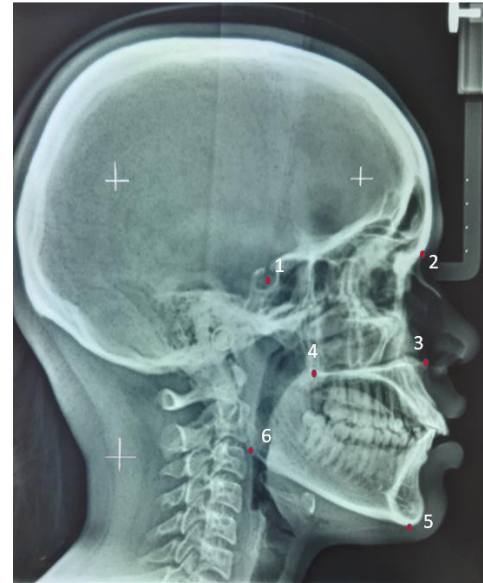
### Statistical analysis

The data collected was entered in Microsoft Excel and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS, IBM version 22.0). The level of significance was fixed at 5% and  $p \leq 0.05$  was considered statistically significant. After checking the normality of the data one-way ANOVA for intra group comparison and t-test for the comparison of two groups was applied. Results of all parameters with continuous measurement were presented as Mean  $\pm$  SD.

### Results

The present study was carried out to compare dentoalveolar height and central incisor inclination in maxilla and mandible among different facial growth pattern individual in vertical plane. The results are based on cephalometric analysis of 90 patients.

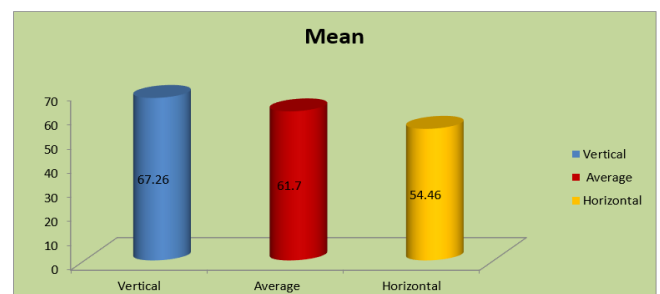
Independent samples t-test was used to compare maxillary and mandibular incisor inclination and dentoalveolar heights of all three groups, Statistically significant difference was found in maxillary and mandibular incisor inclination in hyperdivergent, normodivergent and hypodivergent groups as P value was 0.01 and 0.03 Graph 1 & 2. There was also statistically significant difference in maxillary and mandibular anterior dentoalveolar height in hyperdivergent, normodivergent and hypodivergent groups as P value was 0.01 and 0.03 respectively, graph 3 & 4. Maxillary and mandibular posterior dentoalveolar height was also more in hyperdivergent group as compare to normodivergent and hypodivergent but the result was not significant. Graph 5 and Graph 6.



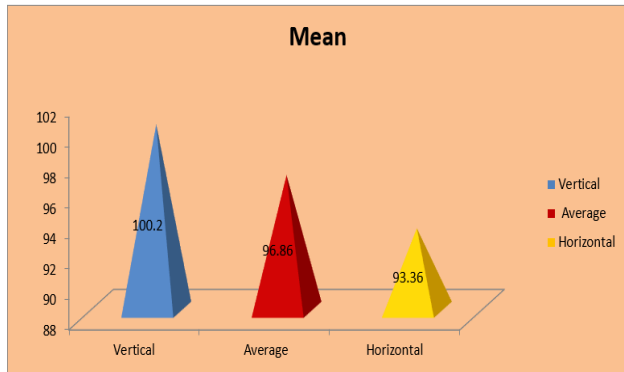
**Fig 1:** Cephalometric landmarks used (1. Sella, 2. Nasion, 3. ANS, 4. PNS, 5. Menton, 6. Gonion)



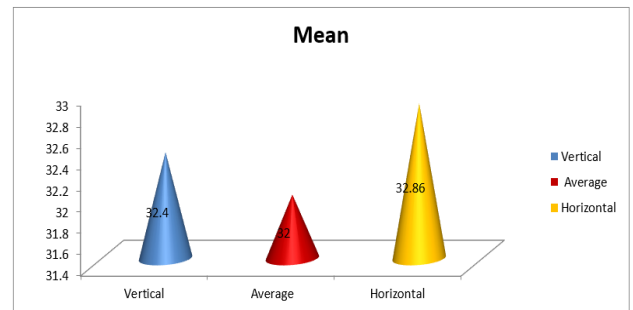
**Fig 2:** Cephalometric parameter: used (1. Maxillary incisor inclination, 2. Mandibular incisor inclination, 3. Maxillary anterior dentoalveolar height, 4. Maxillary posterior dentoalveolar height, 5. Mandibular anterior dentoalveolar height, 6. Mandibular posterior dentoalveolar height.)



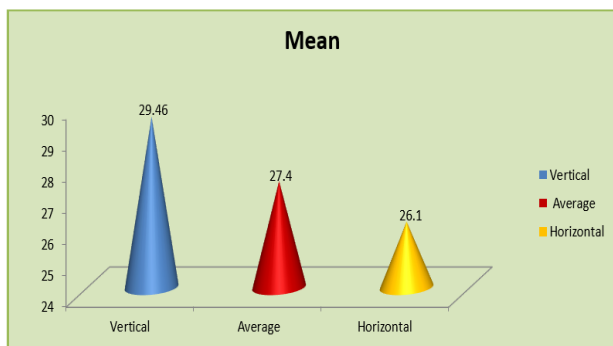
**Graph 1:** Maxillary incisor inclination



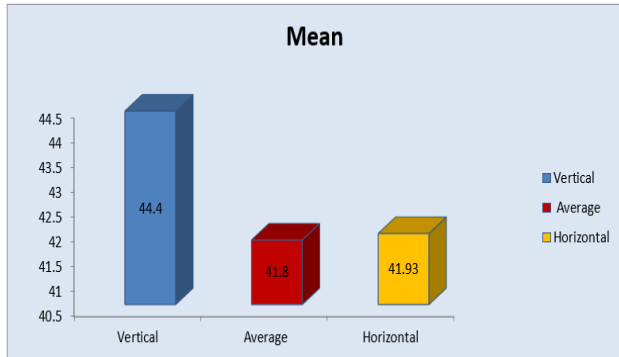
Graph 2: Mandibular incisor inclination



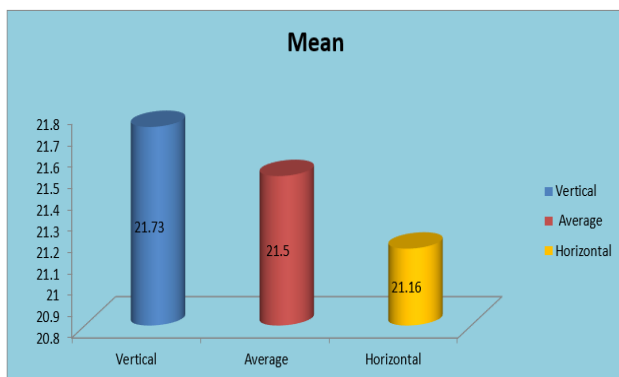
Graph 6: Mandibular posterior dentoalveolar height



Graph 3: Maxillary anterior dentoalveolar height



Graph 4: Mandibular anterior dentoalveolar height



Graph 5: Maxillary posterior dentoalveolar height

**Discussion**

Dentoalveolar compensation is a natural phenomenon in human dentition, in which maxillary and mandibular posteriors teeth compensate according to various skeletal discrepancy.<sup>4,9-10</sup> This shows that vertical facial type can be related to dentoalveolar and morphological pattern of both upper and lower jaw. Incisor inclination and position holds an important aspect in treatment planning, according to which judgment for a case to go with extraction or non-extraction is taken in orthodontic treatment.

There are many studies<sup>2,3,6,9,11-22</sup> which shows the comparison of incisor inclination and dentoalveolar height in different facial pattern but none has shown all the parameters in a single study. Also, there are very few studies which have been carried out in central region population of India.

This study is designed to compare central incisor inclination and dentoalveolar height in maxilla and mandible among individuals with different growth patterns, viz., vertical, average and horizontal growing individuals. The sample included subjects of age 18-40 years as the majority of facial growth is usually completed by this age. The subjects were selected from those individuals who had their lateral cephalometric radiographs taken for treatment purpose.

In our study, it was observed that maxillary and mandibular central incisor inclination was greater for vertical growers as compared to average and horizontal growers. Similar results were obtained by Hernandez et al.<sup>19</sup> 2013 in which they have obtained 90 lateral cephalogram of European population and linked them with different vertical facial and skeletal malocclusion patterns and concluded that, lower incisor was more proclined in doliofacial pattern (vertical) as compare to brachyfacial pattern (horizontal).

Also, a study conducted by Hurtodo et al.<sup>22</sup> on Mexican population, found similar results. They did the lower incisor inclination comparison on different vertical facial biotype and concluded that there was a significant difference in inclination of lower incisor between doliofacial and brachyfacial pattern. Lower incisor was more inclined in doliofacial pattern as compare to brachyfacial, but both the above studies<sup>19,23</sup> did not take upper central incisor inclination into consideration. Amjad et al.<sup>6</sup> found that there was significant correlation between incisor inclination and vertical facial pattern of an individual. In hyperdivergent patients, the inclination of maxillary as well as mandibular

incisors is more as compared to that in hypodivergent group, which was in accordance to our study.

On the other hand, a study done by Nuria Molina Berlanga et al. In 2013 on Spanish population on mandibular incisor inclination in class I patients with long face and short face found no statistically significant lower incisor inclination in class I patients, which was in contrast to our result which showed positive statistical difference in mandibular incisor inclination in different growth patterns individuals. Furthermore, Cecile Gutermann et al.<sup>24</sup> in 2014 concluded that lower incisor is retroclined in hyperdivergent growth pattern. This result differed/ the result was different from our study.

In our study, posterior dentoalveolar height was found to be increased in vertical grower, as compare to average and horizontal grower in maxilla, whereas in mandible it was slightly increased in horizontal growers, as compare to vertical and average grower, but these findings were not statistically significant in both maxillary and mandibular arches, which was in agreement with results stated by Ghulam Rasool et al.<sup>25</sup> in 2016. Enoki et al.<sup>13</sup> showed anterior dentoalveolar height was significantly different in short, normal, long lower facial height but no effect on posterior dentoalveolar height. Our results were in contrast with widespread belief that patients with vertical growth pattern have more posterior dentoalveolar height and horizontal growers have less posterior dentoalveolar height.

Betzenberger et al.<sup>26</sup> 1999 reported in their study that there is decreased posterior dentoalveolar height in upper and lower arch in vertical growers, also Fields<sup>27</sup> in 1984, found that dentoalveolar height is more in long face syndrome as compare to short face. In contract to both studies,<sup>26-27</sup> our study showed no statistically significant finding.

In our study, anterior dentoalveolar height was more in vertical grower compared to average and horizontal grower in maxilla and mandible which was statistically significant. Similar finding were shown by Kruitert R et al.<sup>15</sup> Ishikawa et al.<sup>9</sup>

Ghulam Rasool et al.<sup>25</sup> and Zafar Ul Islam et al.<sup>17</sup> in 2016 concluded with their studies that anterior dentoalveolar height of maxilla and mandible was significantly more in vertical grower. Result of this study was in agreement with our results.

This study compared central incisor inclination and dentoalveolar height of maxilla and mandibular anterior and posterior region in different growth patterns, which has an important clinical implication in orthodontic treatment planning. Incisor inclination changes according to different jaw divergence. In hyperdivergent patients incisor are more proclined hence extraction can be planned to relieve crowded arches. As anterior dentoalveolar height is increased in vertical grower as compare to average and horizontal grower so due consideration is needed in treatment planning of such individuals. Intrusion can be planned in such cases to relieve deep bite during treatment process, as increased display of incisor can be challenging to the predicted treatment planning. Also, data associated

with our result is added in central Indian region as sufficient data is lacking on this aspect. The limitation of our study is that we have compared our parameters in vertical plane only. We should have included comparison of our parameter in sagittal plane. Furthermore, instead of manual technique more sensitive technique i.e. computerized software can be used to produce accurate data.

### Conclusion

1. Different facial pattern have an impact on incisal inclination. In maxillary and mandibular arch incisor inclination with respect to palatal plane and mandibular plane respectively is more in vertical grower as compared to average and horizontal grower and finding is statistically significant.
2. Posterior dentoalveolar height showed no significant changes in different vertical facial patterns.
3. Anterior dentoalveolar height showed Statistically significant increased in vertical grower as compare to horizontal and average growers in maxillary and mandibular arch.

### Source of Funding

None.

### Conflict of Interest

None.

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