Original Research

Comparison of Incisors Inclination in Hyperdivergent and Hypodivergent Patients of Province 5, Nepal

Dr. Hemant Kumar Halwai[1], Dr. Sandeep Kumar Gupta[2], Dr. Raju Shrestha[3]

[1]Professor, Department of Orthodontics and Dentofacial   Orthopedics, Universal College of Medical Sciences College of Dental Surgery, Bhairahawa, Nepal
[2]Lecturer, Department of Orthodontics and Dentofacial   Orthopedics, Universal College of Medical Sciences College of Dental Surgery, Bhairahawa, Nepal
[3]Lecturer, Department of Orthodontics and Dentofacial   Orthopedics, Universal College of Medical Sciences College of Dental Surgery, Bhairahawa, Nepal

ABSTRACT:
Background: Multiple extraoral and intraoral forces and factors could impact their inclination and position of incisors. The aim of the present study was to compare the maxillary and mandibular incisors inclination in hyperdivergent and hypodivergent patients. **Materials and methods:** The study included pre-treatment lateral cephalograms of 90 patients (45 hyperdivergent, 45 hypodivergent) having skeletal class I with cervical vertebrae maturation stage 5 or 6. Mean age of the sample (60 females, 30 males) was 20 ± 3 years. Facial divergence was determined by mandibular plane angle (SN-MP). Hyperdivergent patients had SN-MP > 36˚, whereas hypodivergent patients had SN-MP < 28˚. Maxillary incisor inclination was determined by Upper incisor – palatal plane angle (U1-PP) and mandibular incisor inclination was determined by incisor mandibular plane angle (IMPA). **Results:** In hyperdivergent group, mean inclination of maxillary incisor was $119.82˚ \pm 7.35˚$ whereas in hypodivergent group, it was $114.20˚ \pm 3.4˚$. Statistically significant difference was present in both maxillary incisor inclination (P= 0.000011) and mandibular incisor inclination (P= 0.000737) between hyperdivergent and hypodivergent groups. **Conclusion:** It is concluded that vertical facial pattern has a significant impact on incisors inclination. Both maxillary and mandibular incisor inclination were greater in hyperdivergent patients as compared to hypodivergent patients.
Keywords: Incisor inclination, Hyperdivergent, Hypodivergent, Mandibular incisor, Maxillary incisor

INTRODUCTION

For proper diagnosis and treatment planning in orthodontics, thorough knowledge of both skeletal and dental components in all 3 dimensions: sagittal, vertical and transverse, is essential.[1] Among several parameters that are considered during orthodontic treatment planning, maxillary incisor inclination is of prime importance due to its profound effect on smile esthetics.[2,3] Maxillary and mandibular incisors position and inclination influence the upper and lower lip positions.[4] Mandibular incisor inclination is also important because their excessive proclination may result in gingival recession, bony dehiscence[5] and/or post-treatment relapse.[2] The assessment of radiological characteristics of the mandible has become an essential part in orthodontic diagnosis and treatment planning. Commonly, two reasons are stated for the importance of evaluating mandibular morphology. First, the mandible is predominantly responsible for facial appearance, and its growth pattern has an indisputable impact on facial development. Second, the anatomical shape of a mandible and specifically its symphyseal characteristics are thought to reflect past growth behavior and future tendencies.[6] Literature suggested that a notable relationship exists between the strength of perioral musculature and inclination of maxillary and mandibular incisors.[7] Studies have compared the strength of perioral musculature in hyperdivergent and

hypodivergent patients and concluded that hypodivergent patients have stronger perioral musculature as compared to hyperdivergent patients.[8] Short face individuals showed higher biting force[9] and higher levels of electromyographic (EMG) activity[10] of masticatory muscles than the long face individuals. Hurtado[2] and Hernandez[3] showed that mandibular incisors are significantly more proclined in dolicofacial patients as compared to the brachyfacial patients. Berlanga[11] found no significant differences in mandibular incisor inclination between long face and short face class I patients. In contrast to the above mentioned studies, Guterman[5] concluded that lower incisors are more retroclined in subjects with divergent jaws and obtuse gonial angle.

The aim of the study is to compare the maxillary and mandibular incisor inclination in hypodivergent and hyperdivergent patients of Province 5, Nepal. We hypothesized that because hyperdivergent patient have weaker perioral musculature as compared to the hypodivergent patients so maxillary and mandibular incisor inclination should be greater in hyperdivergent patients than hypodivergent patients. The resulting information will not only increase our knowledge of incisor inclination with respect to the vertical facial pattern but also helpful in treatment planning and finishing.

MATERIALS AN METHODS
This was a cross-sectional comparative study. Sampling technique was non-probability purposive. Sample was divided into 2 groups: hyperdivergent and hypodivergent patients. Total sample size was 90 out of which there was 45 hyperdivergent, and 45 hypodivergent patients.

For this study, data was collected from pre-treatment lateral cephalograms of 90 patients who came to the department of orthodontics and dentofacial orthopedics, UCMS College of Dental Surgery over a period of 2 months *from october 2020 to November 2020.* In this regard ethical clearance was taken from Institutional Review committee of Universal college of medical sciences, Bhairahawa, Nepal *(UCMS/IRC/076/20).* Inclusion criteria was lateral cephalograms of the patients having skeletal class I (ANB=0-4˚), lateral cephalograms of the hyperdivergent patients patients having SN-MP > 36˚ whereas hypodivergent patients having SN-MP < 28˚.Similarily exclusion criteria was patients who underwent previous orthodontic treatment or maxillofacial surgery, patients with craniofacial syndromes or had a history of facial trauma and patients with missing upper and lower incisor. Facial divergence was determined by mandibular plane angle (SN-MP) used in Steiner's analysis.[5] Age range of the sample was 15 years to 31 years. Each lateral cephalogram was traced on 8 x 10 inch standard translucent acetate tracing paper, over a standard illuminated view box with a fine-point lead pencil (0.5 mm) and following measurements were done as defined in Table 1. All the data was recorded on the performa.

SPSS version 20 was used to analyze the data. Frequency and percentage were calculated for qualitative variable i.e. gender. Descriptive statistics were calculated in terms of mean and standard deviation for quantitative variables like age, UI-PP and IMPA for both hyperdivergent and hypodivergent groups.

Independent samples t-test was used to compare maxillary and mandibular incisor inclination of both the groups. P value ≤0.05 was considered as statistically significant.

RESULTS
Among 90 lateral cephalograms included in the study, 58 (64.4%) were of females and 32 (35.6%) were of males. Mean age of the sample was 20 years with standard deviation of ±3 years.

TABLE 1: DEFINITIONS OF CEPHALOMETRIC ANALYSIS

Measurements	Inference	Definition
ANB (0-4˚)	Skeletal class I	Angle formed by the between points A and B to nasion
SN-MP (32˚± 4˚)	Facial divergence	Angle formed between SN plane and mandibular plane (Go-Gn)
UI-PP (108˚±5˚)	Mxillary incisor inclination	Angle formed between upper incisor long axis and palatal plane (ANS-PNS)
IMPA (90˚±5˚)	Mandibular incisor inclination	Angle formed between lower incisor long axis and mandibular plane (Go-Gn)

Table 2: descriptive statistics for hyperdivergent and hypodivergent groups

	Groups	Mean	SD
Age	Hyperdivergent	19.49	2.59
	Hypodivergent	21.04	3.21
U1– PP	Hyperdivergent	119.82	7.35
	Hypodivergent	114.20	3.40
IMPA	Hyperdivergent	97.64	8.58
	Hypodivergent	92.18	6.01

Table 3: comparison of maxillary and mandibular incisor inclination in hyperdivergent and hypodivergent patients

	UI -PP		IMPA	
t	4.65		3.498	
df	88		88	
Significance - 2 tailed	0.000011*		0.000737*	
mean	5.622		5.467	
Std difference	1.208		1.563	
95% confidence interval of the difference	Lower	Upper	lower	upper
	3.221	8.023	2.361	8.572

* P value is < 0.05

Table 2 showed descriptive statistics of quantitative variables for both hyperdivergent and hypodivergent groups. Mean inclination of maxillary incisors in hyperdivergent group was 119.82° ± 7.35° whereas in hypodivergent group, it was 114.20° ± 3.4°. Mean inclination of mandibular incisor in hyperdivergent and hypodivergent groups was 97.64° ± 8.58° and 92.18° ± 6.01° respectively. Independent samples t-test was used to compare maxillary and mandibular incisor inclination of both the groups, shown in Table 3. Statistically significant difference was found in the maxillary incisor inclination in hyperdivergent and hypodivergent groups as P value was 0.000011. There was also statistically significant difference in mandibular incisor inclination in hyperdivergent and hypodivergent groups as P value was 0.000737.

DISCUSSION
The present study demonstrates a statistically significant difference in incisors inclination between hyperdivergent and hypodivergent groups. Both maxillary and mandibular incisors were found more proclined in hyperdivergent group than hypodivergent group. Results of the current study are supported by a previous study done by Hurtado et al[2] in Mexico. Similar to the present study, they included skeletal class I adult patients but they compared only mandibular incisor inclination in different vertical facial biotypes. Their results showed that statistically significant differences were present in mandibular incisor inclination among dolicofacial (hyperdivergent) and brachyfacial (hypodivergent) subjects, dolicofacial subjects had greater incisor inclination than brachyfacial subjects.

Hernandez[3] stated that in Class II there are a lower incisor proclination, higher in dolicofacial patterns, based on the analysis of the anterior cranial base, IMPA, Frankfurt plane, McHorris analysis and oclusal plane. In Class III, there is a lower incisor retroclination, more evident in brachifacial patterns, based on the analysis of the anterior cranial base, IMPA, and occlusal plane. The McHorris analysis, and the inferior incisor inclination with respect to the anterior cranial base, the Frankfurt plane, and the occlusal plane, respectively, all maintain a directly proportional relation. These results are also in accordance to the findings of the present study: mandibular incisors were found more proclined in hyperdivergent patients whereas upright in hypodivergent patients.

Berlanga et al[11] carried a study in Spain to determine lower incisor dentoalveolar compensation and symphysis dimensions between a Class I and a Class III sample group with different vertical patterns. They found no statistically significant difference in mandibular incisor inclination in class I patients with long face and short face. Their results differ from findings of present study, as statistically significant differences were found in mandibular incisor inclination in hyperdivergent and hypodivergent patients with skeletal class I in the present study. Racial differences in dentofacial and soft tissue morphology, as proved by multiple studies, might be the reason for dissimilarity of the results.

Gutermann et al[5] conducted a study to reassess the inclination of lower incisors and evaluate possible associations with gender, age, symphyseal parameters, and skeletal pattern. They found that lower incisor inclination is not associated with most symphyseal distances, except symphyseal depth; lower incisor angulation, however, is linked to the subject's sex, age, and skeletal vertical pattern and when appraising dentofacial development, the factors that influence the natural inclination of lower incisors should be taken into account. They found a negative correlation between lower incisor inclination and facial divergence. They concluded that lower incisors are more retroclined in hyperdivergent subjects. These results are in contrast to our findings: lower incisors were found more proclined in hyperdivergent patients in the present study. The dissimilarity of results could be because they have chosen growing patients (8 to 16 years of age) for their study, in contrast to this, only adult patients (16 to 30) years of age) with CVM stage 5 or 6 were included in the present study because most substantial craniofacial growth has been achieved by that time and effect of vertical growth on incisor inclination is fully expressed.

CONCLUSIONS
It was concluded that vertical facial pattern has a significant impact on incisors inclination. Both maxillary and mandibular incisor inclination were significantly greater in hyperdivergent patients as compared to hypodivergent patients.

REFERENCES
1. Ritt C, Mittero P. Geometric morphometrics of different malocclusions in lateral skull radiographs Geometrische Morphometrie verschiedener Malokklusionen im ¨ntgenseitenbild Fernro. 2017;11–20.
2. Hurtado RM, Eugenia M, Serna V, Ii EU. Lower incisor inclination in relation to facial biotype Inclinación del incisivo inferior respecto al biotipo facial en pacientes clase I esqueletal. Rev Mex Ortod. 2016;4(3):e157–62.
3. Hernández-sayago E, Espinar-escalona E. Lower incisor position in different malocclusions and facial patterns.
4. Bourzgui F, Alami S, Sebbar M, Derkaoui T, Hamza M, Serhier Z, et al. Effect of orthodontic treatment on lip position. Int Orthod. 2013;11(3):303–13.
5. Gütermann C, Peltomäki T, Markic G, Hänggi M, Schätzle M, Signorelli L, et al. The inclination of mandibular incisors revisited. Angle Orthod. 2014;84(1):109–19.
6. Ricketts CM. Cephalometric synthesis. Am J Orthod Dentofac Orthop. 1960;46:647–73.
7. Posen AL. The influence of maximum perioral and tongue force on the incisor teeth. Angle Orthod. 1972;42:285–309.
8. Nanda R. Esthetics and biomechanics in orthodontics. 2nd ed. Elsevier Saunders; 2015.
9. Proffit WR, Fields HW SD. Contemporary Orthodontics. 5th ed. Elsevier Mosby; 2013.
10. Custodio W, Gomes SGF, Faot F, Garcia RCMR, Del Bel Cury AA. Occlusal force, electromyographic activity of masticatory muscles and mandibular flexure of subjects with different facial types. J Appl Oral Sci. 2011;19(4):343–9.
11. Molina-Berlanga N, Llopis-Perez J, Flores-Mir C, Puigdollers A. Lower incisor dentoalveolar compensation and symphysis dimensions among Class i and III malocclusion patients with different facial vertical skeletal patterns. Angle Orthod. 2013;83(6):948–55.