COMPARISON OF INCISORS INCLINATION IN HYPERDIVERGENT AND HYPODIVERGENT PATIENTS

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ABSTRACT

Aim of the present study was to compare the maxillary and mandibular incisor inclination in hyperdivergent and hypodivergent patients. This cross-sectional comparative study was carried out in department of Orthodontics, Margalla Institute of Health Sciences (MIHS) Rawalpindi from November 2017 to April 2018.

The study included pre-treatment lateral cephalograms of 80 patients (40 hyperdivergent, 40 hypodivergent) having skeletal class I with CVM stage 5 or 6. Mean age of the sample (56 females, 24 males) was 20 ± 3.8 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 UI-PP angle and mandibular incisor inclination was determined by IMPA.

In hyperdivergent group, mean inclination of maxillary incisor was 118.58° ± 7.19° whereas in hypodivergent group, it was 113.60° ± 5.03°. Mean inclination of mandibular incisor in hyperdivergent and hypodivergent groups was 98.38° ± 8.58° and 90.83° ± 6.11° respectively. Statistically significant difference was present in both maxillary incisor inclination (P=0.008) and mandibular incisor inclination (P=0.002) between hyperdivergent and hypodivergent groups.

It was 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.

Key Words: *Incisor inclination, maxillary Incisor, mandibular incisor, Hyperdivergent patients, Hypodivergent patients.*

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.[4-6] Mandibular incisor inclination is also important because their excessive proclination may result in gingival recession, bony dehiscence[7-9] and/or post-treatment relapse.[2,3]

Various physiologic factors could affect the inclination of incisors such as age,[7] inclination of the associated alveolar bone,[3,10,11] cancellous bone thickness,[3,11] depth of the mandibular symphysis,[7,10] and perioral soft tissue structures.[12-14] Incisors inclination also varies among different skeletal malocclusions. In skeletal class II, lower incisors are usually proclined whereas in skeletal class III, upper incisors are typically proclined and lower incisors are retroclined to compensate the underlying skeletal malocclusion.[3,10]

Literature suggested that a notable relationship exists between the strength of perioral musculature and inclination of maxillary and mandibular incisors.[12-15] 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.[16-18] Short face individuals showed higher biting force[15-17] and higher levels of electromyographic (EMG) activity of masticatory muscles[17,18] than the long face individuals.

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Various attempts[2,3,7,19] have been made to compare mandibular incisor inclination in different vertical facial patterns but showed inconsistent results. Hurtado[2] and Hernandez[3] showed that mandibular incisors are significantly more proclined in dolicofacial patients as compared to the brachyfacial patients. Berlanga[19] found no significant differences in mandibular incisor inclination between long face and short face class I patients. In contrast to the above mentioned studies, Gutermann[7] concluded that lower incisors are more retroclined in subjects with divergent jaws and obtuse gonial angle.

To the best of our knowledge, none of the previous studies have compared maxillary incisor inclination with respect to the vertical facial pattern. Therefore, aim of the current study was to compare both maxillary and mandibular incisor inclination in hyperdivergent and hypodivergent patients. 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.

METHODOLOGY

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 80 (40 hyperdivergent, 40 hypodivergent patients) and it was calculated by following formula:

N = z²pq

e²

N: sample size

z: standard value of 1.96 for confidence level set at 95%

p: population variance, 0.23 as determined from a previous study[2]

q: common sigma 10 as determined from a previous study[2]

e: alpha error set at 5%.

In the present study, data was collected from pre-treatment lateral cephalograms of 80 patients who came to the Orthodontics department of Margalla Institute of Health Sciences, Rawalpindi over a period of 6 months *from November 2017 to April 2018.*

Inclusion criteria were

- Lateral cephalograms of the patients having skeletal class I (ANB=0-4°).

- Lateral cephalograms of the patients having CVM stage 5 or 6.

- Hyperdivergent patients having SN-MP > 36° whereas hypodivergent patients having SN-MP < 28°.

Exclusion criteria were

- Patients who underwent previous orthodontic treatment or maxillofacial surgery.

- Patients with craniofacial syndromes or had a history of facial trauma.

- Patients with missing incisor.

- Patients having history of any deleterious oral habits.

Facial divergence was determined by mandibular plane angle (SN-MP) used in Steiner's analysis.[20] Age range of the sample was 16 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 Proforma.

SPSS version 21 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 80 lateral cephalograms included in the study, 56 (70%) were of females and 24 (30%) were of males. Mean age of the sample was 20 years with standard deviation of ±3.8 years. Table 2 showed descriptive statistics of quantitative variables for both hyperdivergent and hypodivergent groups. Mean inclination of maxillary incisors in hyperdivergent group was 118.58° ± 7.19° whereas in hypodivergent group, it was 113.60° ± 5.03°. Mean inclination of mandibular incisor in hyperdivergent and hypodivergent groups was 98.38° ± 8.58° and 90.83° ± 6.11° 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 0.008. There was also statistically significant difference in mandibular incisor inclination in hyperdivergent and hypodivergent groups as P value was 0.002.

DISCUSSION

Multiple studies have shown that incisors incli-

TABLE 1: DEFINITIONS OF CEPHALOMETRIC MEASUREMENTS USED IN THE STUDY

Measurements	Definition
ANB (0-4°) Skeletal class I	Angle formed by the intersection of lines from 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°) Maxillary 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 (N=40)

	Groups	Mean	±(Standard deviation)
Age	Hyperdivergent	21.60	4.32
	Hypodivergent	20.43	3.81
UI-PP	Hyperdivergent	118.58°	7.19°
	Hypodivergent	113.60°	5.03°
IMPA	Hyperdivergent	98.38°	8.58°
	Hypodivergent	90.83°	6.11°

TABLE 3: COMPARISON OF MAXILLARY AND MANDIBULAR INCISOR INCLINATION IN HYPERDIVERGENT AND HYPODIVERGENT PATIENTS

	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
UI-PP	2.718	78	0.008*	4.98	1.831	1.331	8.619
IMPA	3.185	78	0.002*	7.55	2.371	2.830	12.270

* P value is < 0.05

nation and position vary among different skeletal malocclusions[3,10] as well as with different vertical growth patterns[2,3,7,19]. 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 Maxico. 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 and coworkers[3] linked lower incisor inclination with different skeletal malocclusions and vertical facial patterns in European patients. Ninety lateral cephalograms of adult subjects were included and classified by skeletal malocclusion (class I, II and III) and facial patterns (dolicofacial, mesofacial and brachyfacial). They concluded that statistically significant difference was present in lower incisor inclination between dolicofacial and brachyfacial patients, lower incisors were found more proclined in dolicofacial patterns as compared to brachyfacial pattern. 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[19] 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[7] conducted a study to evaluate possible associations of lower incisor inclination with gender, age, symphyseal parameters, and skeletal pattern. 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[21] by that time and effect of vertical growth on incisor inclination is fully expressed. Perioral muscular force also increases with age, lower in children as compared to the adults.[12,13]

Incisors inclinations vary according to facial divergence: hyperdivergent and hypodivergent patients showed different incisors inclination. Hyperdivergent patients have increased incisors inclination hence they might be better candidates for extraction plan to relief the crowding where as hypodivergent patients might be better candidate for dental proclination because they have reduced incisor inclination

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.

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1	Nazish Amjad:	Has done the literature review, collected all the data, full write up of the article done.
2	Amjad Mahmood:	Suggested the research topic, supervised the research, reviewed the article and done the proof reading.
3	Rai Tariq Masood:	Done the statistics of the article, analyzed the results, helped in write up.
4	Rozina Nazir:	Checked the plagiarism and done the proof reading.