

**EVALUATION AND COMPARISON OF LIPS, NOSE,
CHIN AND CHIN-THROAT ANGLE IN PATIENTS
WITH DIFFERENT MANDIBULAR DIVERGENCES
- A CEPHALOMETRIC STUDY**

Dissertation submitted to

Maharashtra University of Health Sciences, Nashik

in the Partial Fulfillment of Regulations

for the award of the Degree of

MDS

IN

ORTHODONTICS AND DENTOFACIAL ORTHOPEDICS

BRANCH V

2019-2022

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By

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Under the Guidance of

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Through

**VSPM DENTAL COLLEGE AND RESEARCH CENTRE
HINGNA, NAGPUR**

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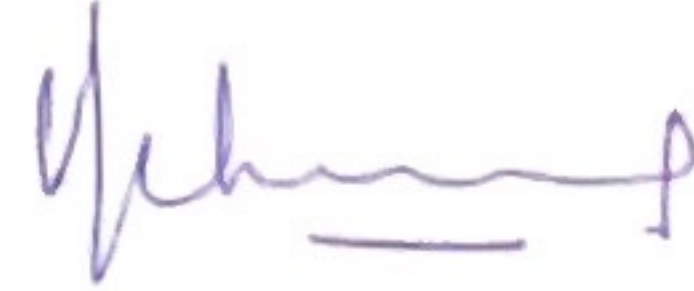
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Her work on the subject has been checked by me from time to time.
I am satisfied regarding the authenticity of her observations, clinical
material and experimentation in this dissertation and it confirms to the
standards of Maharashtra University of Health Sciences, Nashik.

I have great pleasure in forwarding it to Maharashtra University of Health
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Date: 18/03/2022
Place: Nagpur

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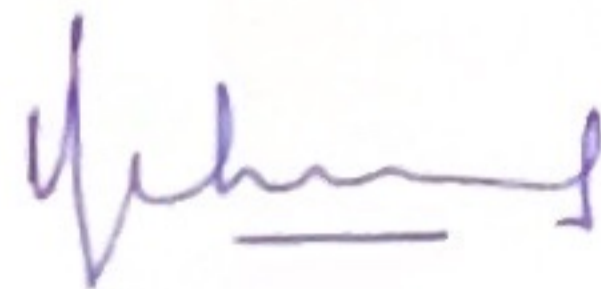
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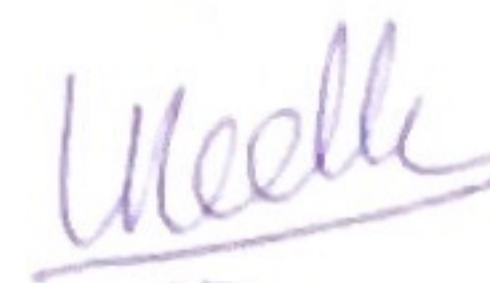
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I hereby declare that the dissertation entitled

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LIST OF ABBREVIATION

ANOVA	-	Analysis of Variance
AP	-	Anterior posterior
Cp	-	Cervical point.
FSTT	-	Facial Soft Tissue Thickness
Gn	-	Gnathion.
Gn'	-	oft tissue Gnathion.
Li	-	labraleinferius.
Ls	-	labrale superius
Me	-	Menton
Me'	-	soft tissue Menton.
Pog	-	Pogonion.
Pog'	-	soft tissue Pogonion.
sn	-	subnasale.
TVL	-	True Vertical Line

INTRODUCTION

The perception or appreciation of beauty is described as esthetics. Esthetics has evolved throughout time to incorporate emotive embellishments such as beauty and attractiveness judgements, as well as the accompanying psychophysiological patterns of arousal.¹ Physical beauty has an impact on people's perceptions of others' personalities, as well as their expectations for success in many areas of adult life² (occupational prestige, personal happiness). Perception is defined as the process of organizing and interpreting patterns of external inputs. A multitude of physical, physiological, psychological, and social variables may affect perception.³ Both psychological and personality factors are influenced by orthodontic therapy. Others found what was aesthetically attractive to some to be unappealing.⁴

Personality development and social interactions are influenced by facial attractiveness.⁵ The lining corresponding to skeletal structures, facial soft tissues (fat,

skin and muscles) can mature in proportion or disproportion to them.⁶ In Orthodontics, facial harmony is defined by the patient's soft tissue profile, which is controlled by morphologic connections and proportions of the nose, lips, and chin. In various kinds of malocclusion, the equilibrium between these three anatomic components may be disrupted, causing face esthetics to suffer. While all dental professionals, including general dentists and other specialty dentists, strive to improve complete oral health rehabilitation, Orthodontists play a key role in enhancing comprehensive facial esthetics with ideal inter-arch tooth-to-bone relationship. Orthodontics is a complicated phenomenon that involves bringing about correct alignment of intraoral tissues to extraoral soft tissue draping, resulting in attractive face esthetics.

Growth-related soft tissue changes, as well as mechanotherapy, add to its importance in orthodontic evaluations. The majority of patients seek orthodontic treatment because they have facial disharmony, such as facial deformity or tooth malalignment, or both. Patients are more interested in visual changes such as advancement in the curl of the lower lip, protrusion of the lips, and unexpected growth or forward dislocation of the chin than in changes in bone or angulations of the teeth as observed on a cephalometric radiograph.

Soft tissue profile is considered to be an important factor to consider when choosing orthodontic treatment. It is extensively examined in orthodontics, primarily through lateral cephalometric radiographs, with the belief that the soft tissue outline largely governs the aesthetics of the face. The soft tissues of the face are thought to be a dynamic structure which can create in tandem with or independently of its skeletal substructure. Until the end of the 1950s, it was widely believed that the integument

profile followed the underlying hard tissue passively, but subsequent research revealed that the soft tissue had its own growth potential.⁷

The location and connection of face structures can be affected by changes in the length, thickness, and tonicity of the soft tissues.⁷ Growth irregularities are often accompanied by distinct patterns of mandibular growth that are generally described as hypodivergent, normodivergent & hyperdivergent.^{8,9} Pogonion may advance in a more forward direction due to forward rotating development patterns, resultant in a prominent chin point, while reverse rotating mandibles drive pogonion backward and lower, resulting in a less noticeable chin.

The soft tissues that cover the face (muscles, fat, and skin) may grow in proportion to or disproportion to the skeletal structures.⁶ Distinctions in soft tissue length, thickness, & tonicity may alter the location of the face structures and their connections, influencing facial esthetics.⁷ Such differences in skeletal and soft tissue composition may lead to a disconnection between the location of the underlying bony structures and the face look, potentially requiring orthognathic and aesthetic surgery. Soft tissue features have received little attention in the orthodontic literature when it comes to determining an appropriate diagnostic and treatment strategy. The majority of face soft tissue research focused on alterations that occurred following orthodontic treatment.^{10,11}

Chin-throat angle is also identified as cervico-mental angle or submental-cervical angle. Although severely forwardly or backwardly directed chins may have an influence on its perception, throat length or extension does not reflect the link between throat and chin.¹²

The relationship between hard tissues (teeth and bone) and their interaction with surrounding soft tissues is the subject of most cephalometric investigations (chin, nose, and lips).^{6,7} The key to an aesthetic & pleasing facial appearance is a proportionate relationship amongst dissimilar facial structures.^{13,14} Such evaluations overlook the impact of the chin-throat connection on the profile &, as a result, treatment, perhaps due to the fact that this connection cannot be changed with orthodontics. Based on clinical and anthropometric normative data,¹⁵ chin-throat assessment is increasingly frequent in plastic surgery, and it may be done directly on patients or on photos utilizing well-defined soft tissue landmarks. The most well-known anthropometric age-related data on face dimensions came from Farkas.¹⁶ The chin's relationship to the rest of the face is defined by many factors:

1. Chin position with relation to facial features, especially the nose or lips (e.g., E-line, Steiner line, Holdaway line) or cranial references (e.g., E-line, Holdaway line, Steiner line) (vertical projections from soft tissue glabella,¹⁷ soft tissue nasion, or other¹⁸). These examinations account for the overwhelming majority of orthodontic examinations.
2. Farkas defined the mento-cervical angle ($83.9^\circ \pm 9.3^\circ$ in females; $78.3^\circ \pm 7.9^\circ$ in males); Legan and Burstone defined the lower face–throat angle ($100^\circ \pm 7^\circ$); Worms et al defined the "lip-chin-throat" angle ($110^\circ \pm 8^\circ$) and the location of the lips in relation to the chin, rather than the form of the chin, is more essential in this evaluation.
3. Evaluation of the chin in the submental area (throat length, chin-throat angle^{17,19,20}). Although protruding or retruding chins might affect chin/throat

perception, throat length or extension, measured in millimetres, does not necessarily represent the chin/throat link. The cervico-mental or submental-cervical angle has been measured as low as 90° and as high as 124°. ²¹⁻²³ According to a recent study²⁴, the most appealing angle is 95 degrees. Because of its diversity, the chin-throat connection necessitates a thorough examination. Indeed, a chin that is sufficiently stretched in the front area may lack harmony due to an increased chin-throat angle.

Facial forms in orthodontics classified into long, average & short faces based on vertical facial dimensions by Sassouni. The primary objectives of the orthodontic treatment is to achieve the vertical facial profile as the vertical facial dimensions are closely related to the optimum facial aesthetics.²⁵ In establishing harmonious an optimal functional occlusion and facial aesthetics, both the hard and soft tissues must be considered.²⁶

The thickness of the soft tissue chin in different mandibular differing patterns has an impact on diagnosis and treatment planning; and a disconnection between the underlying bony structures & soft tissue can impact the facial appearance, potentially requiring orthognathic and cosmetic surgery. Only a few studies have examined and assessed the thickness of the soft tissue chin in various vertical development patterns. Many scientists²⁷⁻³¹ studied soft tissue chin thickness in distinct vertical and sagittal discrepancies. The mandibular divergent patterns affect not only the soft tissue chin, but they can also affect the thickness & length of the upper lip. The absolute length of the upper lip can be evaluated and compared to the position of the maxillary incisor, according to Burstone, but it can also be associated to the length of the chin and lower lip.

The purpose of the study is to evaluate and compare lips, nose, chin thickness and chin throat angle in different mandibular divergence patterns, as the soft-tissue profile plays a crucial role in orthodontic considerations. Treatment may alter into the orthognathic and cosmetic surgery based on disassociation between the facial appearance and the underlying bony structures, hence it is important to study soft tissue thickness.³¹ To investigate the impact of diverse mandibular diverging patterns on soft tissues, researchers examined upper lip thickness, soft tissue chin, and length in individuals with various mandibular divergent patterns.

AIM & OBJECTIVES

AIM:

To evaluate thickness of lips, nose, chin and chin-throat angle in different mandibular divergent patterns.

OBJECTIVES:

1. To compare the thickness of lips, nose, chin and chin-throat angle in normodivergent and hypodivergent patterns.
2. To compare the thickness of lips, nose, chin and chin-throat angle in normodivergent and hyperdivergent patterns.
3. To compare the thickness of lips, nose, chin and chin-throat angle in hypodivergent and hyperdivergent patterns.

REVIEW OF LITERATURE

Feres MFH and coworker (2010)²⁷ grouped three types of facial profile to assess the soft tissue profile for their study. Cephalometric points were marked. Distance and soft tissue presence was evaluated between lips upto chin. The study concluded dolicho facial types to have more in between lips measurement due to presence of incisors.

Naini FB et al³³ in their study performed in 2011 concluded that in treatment planning as compared to upper lip, lower lip should be just posterior to it although mandibular protrusion is up to 2mm and retrusion is upto -4 mm were unnoticeable.

Sachan A et al³⁴ in 2012 concluded that as compared to men, women have more convex facial profile and men have more prominent nose and have thicker soft tissue structure as compared to women.

Kamak H et al³⁵ in 2012 concluded that the thickness of soft tissue is greater in men than women at all sites among skeletal malocclusion by observing stomion, labrale superius and labraleinferius sites.

Prabhu NM et al⁵ in 2012 stated that for improving esthetics while planning the amount of retraction for incisor, thickness difference in male and female lip will have to be considered.

Macari AT et al²⁸ in 2013 concluded that in vertical hyperdivergent patients soft tissue thickness is smaller as compared to the hypodivergent and normodivergent pattern patients and also at Gn and Me soft tissue chin thickness is thinner.

Modarai F et al³⁶ in 2013 concluded that prominence of chin seen in prognathic patient is less attractive than chin and lower lip combined prominence seen in mandibular prognathism. In patients with more prominent chin, a more protrusive lip is preferred.

Abu Arqoub SH²⁸(2013) looked studied the vertical and antero-posterior (AP) segment of the lower face in adults from Jordan. With the use of a software tool, the female and male profiles were distorted in both the directions in the bottom third of the face utilising soft tissue sites sublabiale and subnasale. The most appealing profiles were a Class I female profile with a lowered lower face height and a Class I male profile with a normal lower face height. Gender has just a little impact on beauty perception.

Purmal K et al³⁷ (2013) compared the cephalometric measurements that concluded Malaysian Chinese having maxilla and mandible set more forward than the

Malaysian Indians. The Chinese have bidental and lips protrusion along with more development in posterior height.

Maurya RP et al³⁸ (2014) determined the morphologic relationships and proportions of the nose, lips and chin. They concluded Class-II Division-1 malocclusion having more convex soft-tissue profile, reduced nose length, Shorter procumbent lips and flatter chins when compared to Angle's Class I malocclusion.

CelikogluM et al²⁹ (2015) evaluated the divergence profile of mandible and thinckness of chin. Their study showed more readings in male groups subjects. Surprisingly, menton and gnathion points were recorded to be thin in their study.

Soh J et al³⁹ in 2015 assessed Chinese facial profile using profile photographs & lateral cephalometric radiographs. Bimaxillary and Normal retrusive Chinese female and male profiles were rated to be most attractive whereas profiles with protrusive mandible were rated as least attractive. A flatter male profile was considered most attractive by the orthodontist and a fuller normal Chinese profile by the oral surgeons.

Singh S⁴⁰ (2016) studied the variability of the soft tissue integument in people with distinct ethnic origin. In their study, Maratha population showed acute nasolabial angle, more proclined maxillary incisors, less facial length, less prominent chin, and all soft tissues to be thicker than those of the Caucasian population.

Rasool G et al⁴¹ in 2016 concluded that as compared to normal and horizontal growers, anterior dental height is increased significantly in vertical growers.

Jeelani W et al²⁵ in 2016 has stated that short facial pattern is associated with minimal incisal display, acute nasolabial angle and recumbent upper and lower lips associated with short facial pattern while in the long face pattern it is associated with excessive incisal display, obtuse nasolabial angle and procumbent upper and lower lips.

Bavbek NC⁴² **et al** in 2016 assessed the sagittal soft tissue morphology of patients and concluded that thickening of the cranio facial soft tissues detected from lateral cephalogram is a potential early diagnostic revelation for detecting abnormalities.

Subramaniam S⁴³ **(2016)** evaluated the chin thickness among Indian population located in Tamil Nadu state. In their study, different mandibular profiles were grouped in to three for assessment. They concluded that prominence was highest in case of hypo-divergent profile and that the other two groups showed approximately equivalent findings

Holdaway analysis was used by **Yumuşak FV**⁴⁴ in 2017 to study the soft tissue in various vertical facial patterns. The ‘gnathion’, ‘menton’, ‘stomion’ and ‘inferior sulcus to H line’ showed significant difference in female subjects. Whereas, ‘stomion’ and ‘nose prominence’ assessed in male subjects showed significant result..

Al-Mashhadany SM and coworkers³² in 2017 determined measurements among Iranian individuals. Their study too concluded of males having thicker soft tissue than females.

Haddad RV¹² in 2017 stated that the T- line is a practical tool used for the evaluation of proportionality of face and also in class I occlusion soft tissue throat line bisects the mandible in its middle.

SomaiahS et al⁴⁵ in 2017 stated that soft tissue chin thickness differs between males and females. males show greater chin thickness as compared to female in all the groups except high mandibular divergence.

Cezairli NS⁴⁶ in 2017 concluded that the differences in soft tissue thickness among the high mandibular divergent pattern i.e vertical patterns were investigated for the Sto, Menton and Gnathion when both males and females were combined. These measurements were thinner in high mandibular divergent group.

Al-Mashhadany SM and coworkers²⁵ in 2017 concluded that, when high angle and normal angle groups were compared with low angle male group, low angle male group showed thicker soft tissue.

Umale VV et al⁴⁷ in 2017 concluded that with respect to Sushner's S2 line, in class I, both lower and upper lips were more retro-positioned in comparison with class II malocclusion.

Sattar A et al⁴⁸ in 2018 also found male subjects having greater soft tissue thickness over female subjects. The hypo-divergent group had more thickness as compared to other profile.

Khalid A et al⁴⁹ in 2018 concluded that chin thickness in hyperdivergent pattern was least due to stretching of soft tissue at menton after comparing the chin thickness at various points like gnathion, pogonion and menton.

Female and male facial soft tissue thickness (FSTT) & dentoskeletal parameters were measured by **Perovi T⁵⁰** (2018). According to their findings, female patients in Class II Division 1 had thicker facial soft tissue of the chin and mentolabial sulcus; in Class I and Class II Division 2, females had thinner facial soft tissue than males with orthodontic malocclusions. The FSTT scores of participants with a skeletal jaw connection in Class III were not significantly different.

Surani S⁵¹ in 2019 summed up that in vertical grower patients soft tissue nose and chin thickness is thinner. As compared to the females soft tissue chin thickness and nose thickness is greater in males.

Ghorbanyjavadpour F and coworker⁵² in 2019 conducted a multi-variable analysis of cephalometric variables. Soft-tissue profiles and more convex skeletal with more protruded upper lips, less prominent noses with higher ends, smaller interlabial gaps, less protruded lower lips, and more projecting chins were discovered.

In his clinical experiment, **Lee YJ⁵³** (2019) found that doctors must assess lip strain and thickness depend on the skeletal pattern along with dental inclination to achieve perioral muscle activity balance.

Shinde N et al 2019⁵⁴ in their study found no male-female predilections in terms of soft tissue thickness in all three profiles. Unlike other studies, they too found hypo-divergent mandible to have more soft tissue thickness.

Kunnath JT and coworkers⁵⁵ in 2020 conducted an experimental trial to study soft tissue among skeletal class 1 and class 2 patients. Significant discrepancy

was observed in terms of soft tissue thickness wherein the authors concluded to always make a considerable observation for soft tissue when handling malocclusion.

Sodawala J et al⁵⁶ 2020 evaluated growing mandibular pattern in three profiles. This study included lateral cephalogram to assess growing mandibular pattern. They concluded that prominence was highest in case of low angle profile and that the other two groups showed approximately equivalent findings.

Hashmi A 2021⁵⁷ evaluated the chin thickness among Indian population located in Himachal. In their study, different mandibular profiles were grouped in to three for assessment. They concluded that prominence was highest in case of low angle profile and that the other two groups showed approximately equivalent findings.

MATERIALS & METHOD

STUDY DESIGN:

The study design is cross sectional in nature.

STUDY SETTING:

The research was carried out in the Department of Orthodontics & Dentofacial Orthopedics after approval from the Institutional Ethical Committee.

STUDY POPULATION:

Patients seeking orthodontic treatment at the Department of Orthodontics & Dentofacial Orthopedics. The subjects were selected based on the exclusion and inclusion criteria.

METHODS OF SELECTION OF STUDY SUBJECTS:

Inclusion Criteria

1. Subjects within Age group of 16-25 yrs.
2. ANB angle 0-4°
3. Subjects with average, horizontal, vertical growth pattern.
4. Full complement of teeth except third molar.

Exclusion Criteria

1. History of trauma and facial asymmetry.
2. History of prior orthognathic surgery or orthodontic treatment.
3. History of craniofacial anomalies and medically compromised subjects.

Withdrawal Criteria:

1. Patients not willing to take part in the study.
2. Patients who want to leave the study at any point during the study.

SAMPLING TECHNIQUE:

Using convenience sampling technique, 150 untreated subjects with different facial divergence pattern with age ranging from 16 – 25 years were selected from outpatient Department of Orthodontics and Dentofacial Orthopedics. These subjects were wanting to seek orthodontic treatment and also satisfied the inclusion criteria for the study. Subjects were divided into sub-groups based on Tweed's analysis and FMA angles.

FMA angle 23°-28° = Normodivergent

<23° = Hypodivergent

>28° = Hyperdivergent

The parameters of interest were compared across 150 subjects (75 male and 75 female) with different mandibular divergences stated as under:

Group 1: Normodivergent Subject (N = 50)

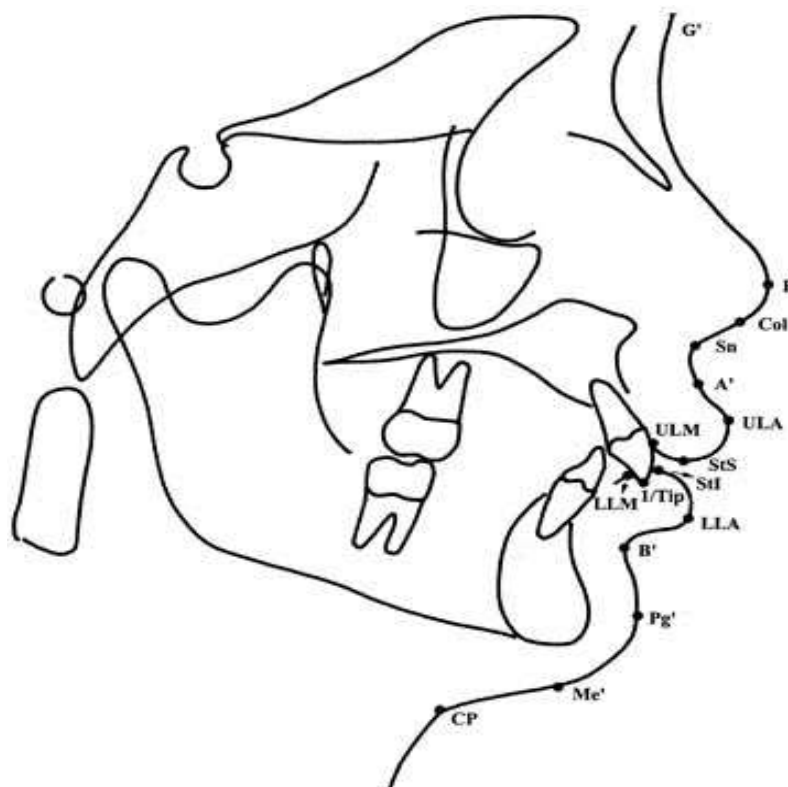
Group 2: Hypodivergence Subject (N = 50)

Group 3: Hyperdivergence Subject (N = 50)

METHODS OF MEASUREMENT:

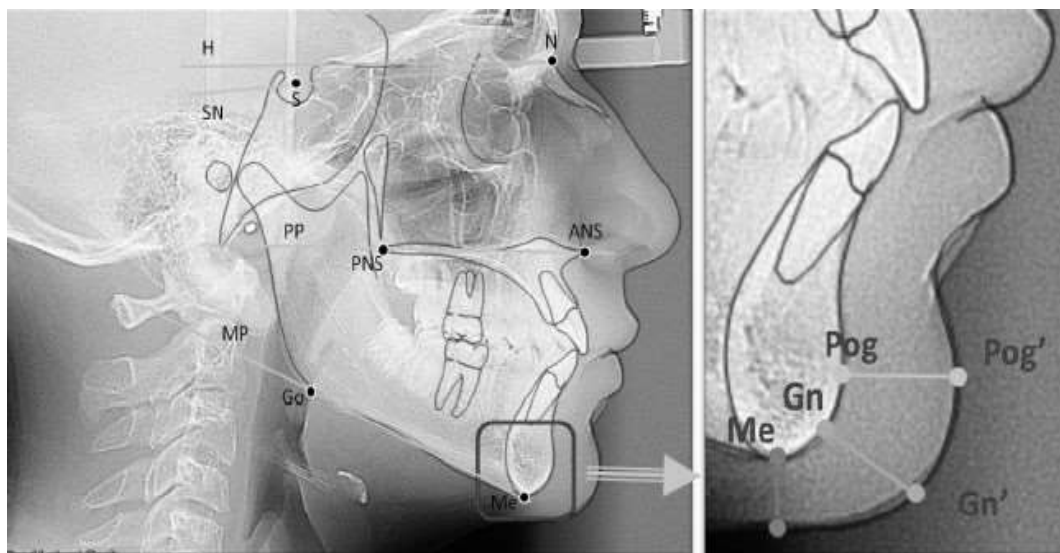
Pre-treatment lateral cephalograms of patients aged 16-25 years were obtained for the study. Good definition of both hard and soft tissue landmarks, molars in maximum intercuspation with lips unstrained in natural head position are checked listed on lateral cephalogram. They were determined horizontal or vertical growers on the basis of divergence of planes at the Department of Orthodontics & Dentofacial Orthopedics. The cephalometric measurements were obtained after tracing the cephalogram.⁴⁴

Reference Points On Cephalogram:



1. Ls- labrale superius. The upper lip's mucocutaneous boundary is indicated by a point.
2. sn- subnasale. It is the point where the upper lip meets the columella (nasal septum) in the midsagittal plane.
3. Pog- Pogonion. It is the anterior point on the chin.
4. Li- labraleinferius. It is the midpoint of the lower lip's lower margin.
5. Me- Menton. The most inferior point on the mandibular symphysis of the mandible.
6. Me' - it is the soft tissue Menton.
7. Gn- Gnathion. The lowest most anterior midline point on the symphysis of the mandible.
8. Pog' - soft tissue Pogonion.
9. Cp - Cervical point. The innermost point between the neck and submental area.
10. Gn' - soft tissue Gnathion.

PARAMETER: Chin Thickness

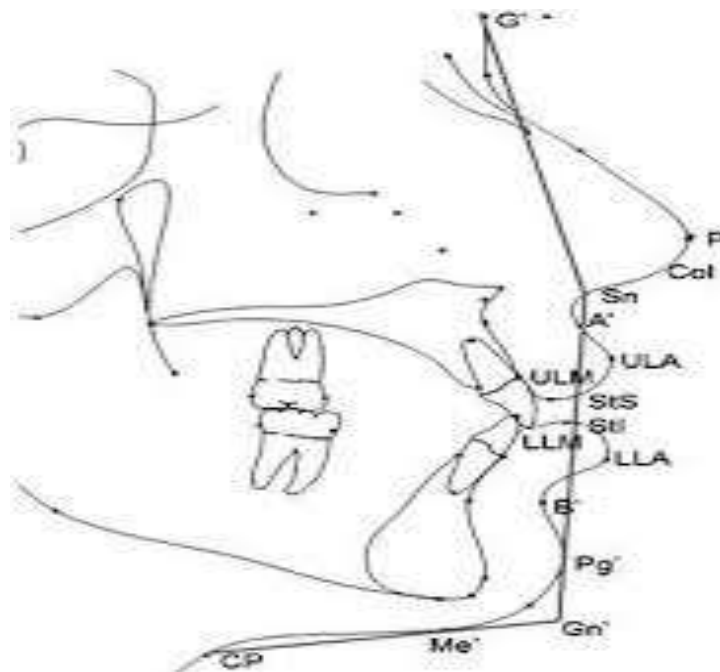


At three different chin levels, chin thickness was measured:^{49,51}

1. Me-Me': the distance between bony menton (Me) & the soft tissue menton(Me').
2. Pog-pog: the distance between the soft tissue pogonion (pog') and bony pogonion (pog).
3. Gn-Gn': the distance between the soft tissue gnathion(Gn') and bony gnathion (Gn).

PARAMETER: Chin-throat angle

It is formed by intersection of lines sn-Gn and from Gn-Cp^{49,51}



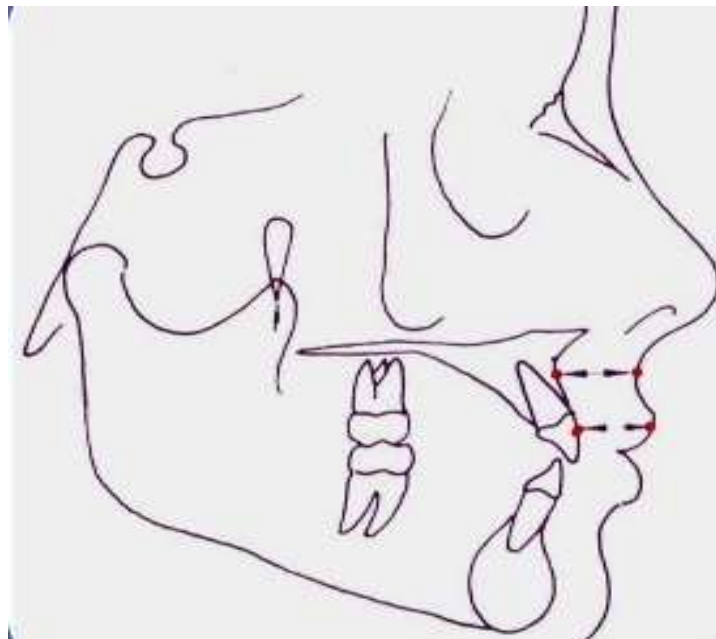
PARAMETER: Soft tissue nose thickness

According to Arnett at el TVL is the most reliable landmark. It is measured by drawing a true vertical line (TVL) passing through subnasale and a perpendicular distance is measured from the tip of the nose to TVL.^{49,51}



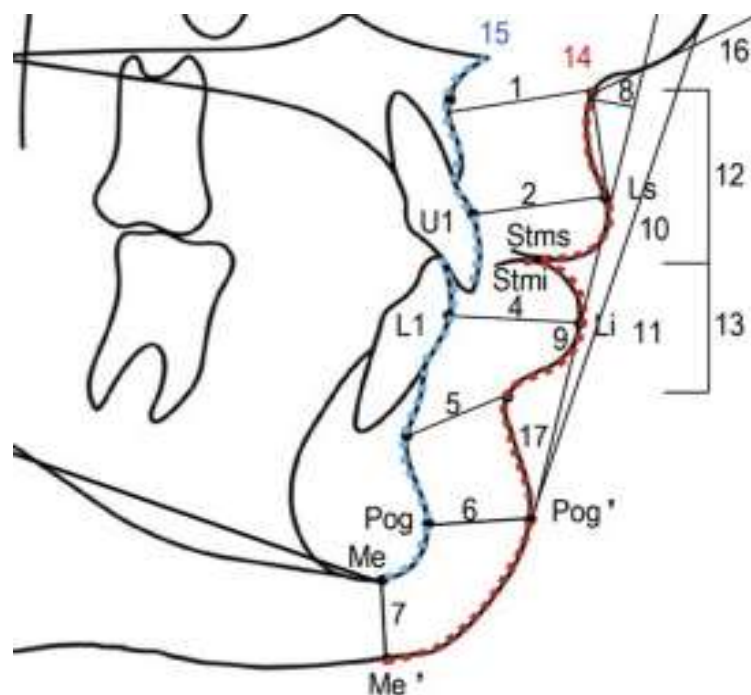
PARAMETER- Upper lip thickness

According to holdaway analysis, upper lip width is determined horizontally from a point 3 mm under point A to outer border of upper lip.⁴⁷



PARAMETER: Lower lip thickness

Linear distance between the mandibular incisor's most conspicuous labial point and the labrale inferius.⁴⁷



SAMPLE SIZE:

The sample size formula used are as follow:

$$n_1 = \frac{(\sigma_1^2 + \sigma_2^2 / k) (Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2}$$

So that 150 subjects were be included in the study and further equally divided in 3 sub-groups.

This is accomplished by comparing the chin thickness and soft tissue nose in adult individuals with distinct mandibular divergence patterns using cephalometric research.⁴⁸

DATA MANAGEMENT AND ANALYSIS PROCEDURE:

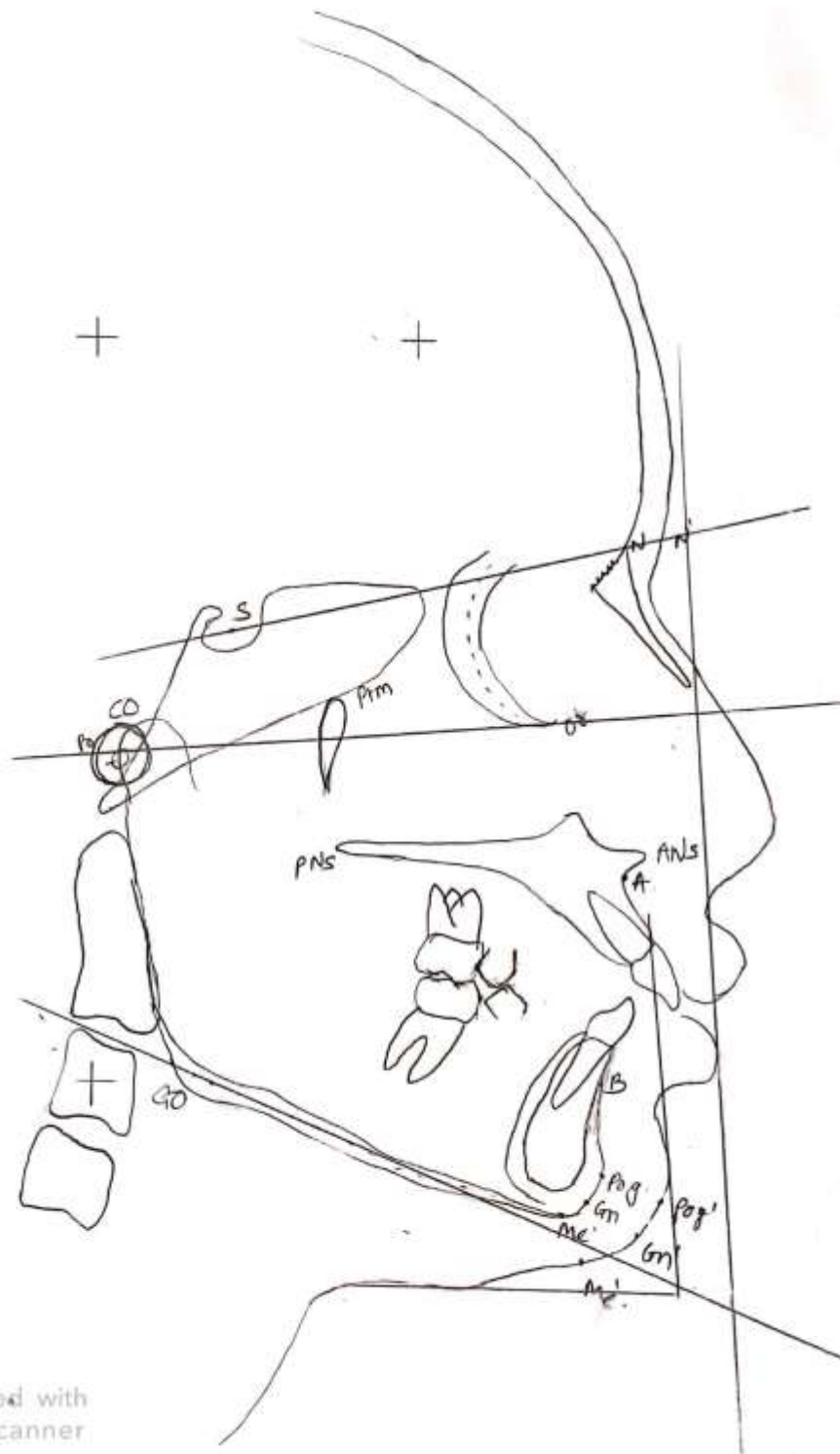
STATISTICAL ANALYSIS –

GraphPad prism 6.0 and SPSS 22.0 were used to analyze the collected data. Both descriptive and inferential statistics utilizing the chi-square test, Tukey test, and one way ANOVA were performed. The data was found to be significant at $p < 0.05$.

Photo Plate

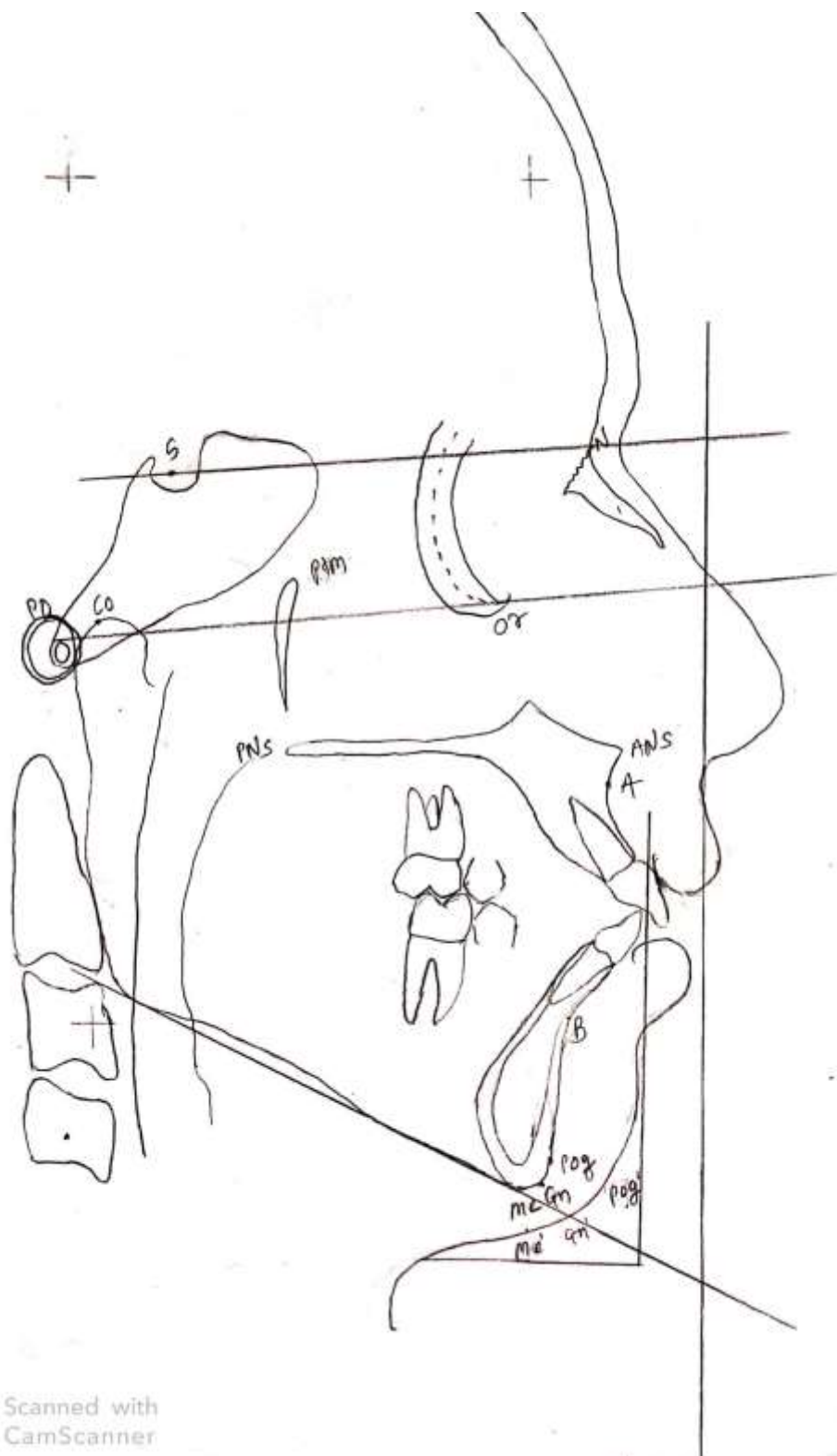


Fig 1: Armamentarium



CS Scanned with CamScanner

Fig. 3 Normodivergent lateral cephalogram tracing



CS Scanned with CamScanner

Fig.4 Hyperdivergent lateral cephalogram tracing

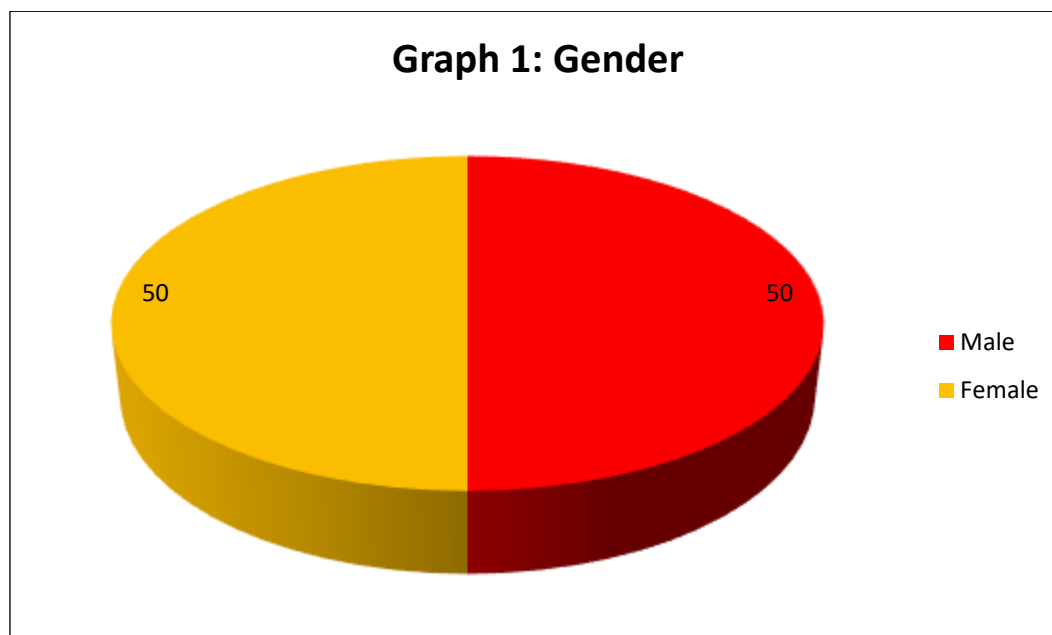
RESULT

For the present study, Patient visiting the Department of Orthodontics And Dentofacial Orthopaedics for seeking orthodontic treatment was screened as per the exclusion and inclusion criteria and 150 subjects were involved. The information regarding demographic data can be obtained in **Table 1**.

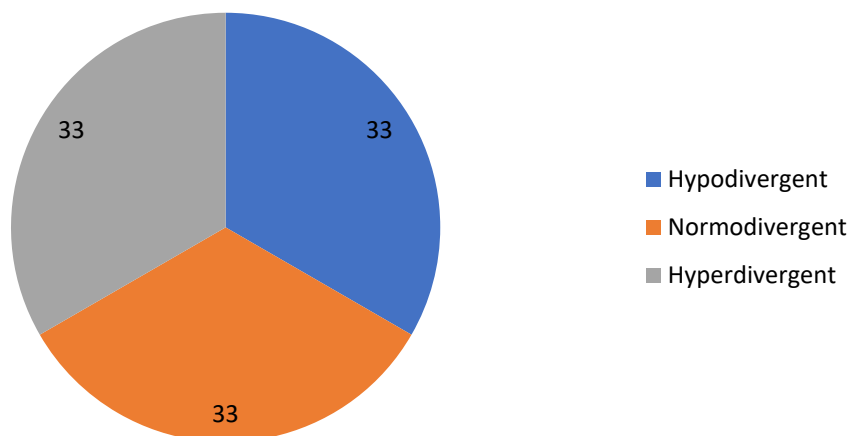
Table 1: Descriptive demographic		
Age		
<i>Range in years</i>	<i>Mean±SD</i>	<i>TotalN(%)</i>
16-25	20.05±3.1	150 (100)
Gender		
	<i>N (%)</i>	<i>Total N(%)</i>
Male	75 (50)	150 (100)
Female	75 (50)	

The subjects belonged to the age ranging from 16 to 25 years (20.05 ± 3.1). these 150 subjects had 1:1 male-female ratio (75 each) (**Graph 1**). Furthermore, 50 each were distributed for hypodivergent, normodivergent and hyperdivergent (**Graph 2**).

Table 2: Distribution of subject as per mandibular pattern		
	<i>N (%)</i>	<i>Total N(%)</i>
Hypodivergent	50 (33)	150 (100)
Normodivergent	50 (33)	
Hyperdivergent	50 (33)	



Graph 2: Mandibular Pattern



Graph 3: Lip thickness

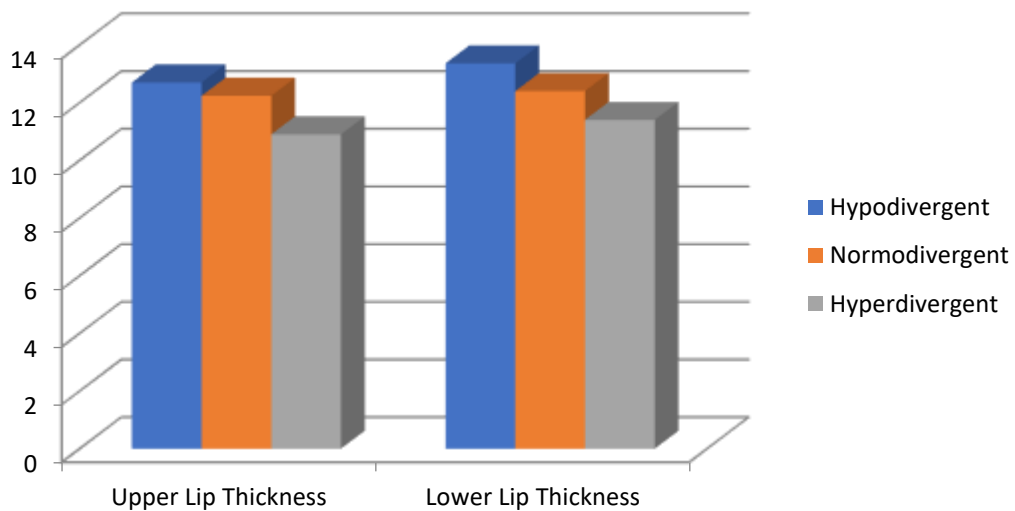


Table 3: Comparison of upper and lower lip among study groups				
	Mean±SD	SE	F-value	p-value
UPPER LIP THICKNESS				
Hypodivergent	12.74±2.3	0.32	13.1	<0.001*
Normodivergent	11.49±2.2	0.29		
Hyperdivergent	10.92±1.08	0.15		
LOWER LIP THICKNESS				
Hypodivergent	13.36±1.8	0.3	20.01`	<0.001*
Normodivergent	12.4±1.5	0.24		
Hyperdivergent	11.4±1.4	0.21		

Test applied: One-way ANOVA, *p < 0.05 – significant,

p < 0.001 – extremely significant

The intergroup contrast of all three groups were statistically significant for upper lip width (p=0.001) and lower lip width (p= 0.001) as noted in **Table 3, Graph 3**. One- way Anova test was run to evaluate this statistical significance. The hyperdivergent readings were found to be least in all groups whereas the measurements for hypodivergent were maximum comparatively.

Table 4: Comparison of nose thickness among study groups				
	Mean±SD	SE	F-value	p-value
NOSE THICKNESS				
Hypodivergent	11.08±1.3	0.17	`1.2	0.31
Normodivergent	10.74±1.04	0.15		
Hyperdivergent	11.08±1.3	0.18		

Test applied: One-way ANOVA, *p < 0.05 – significant,

p < 0.001 – extremely significant

When the nose thickness of all three groups were compared, statistical nonsignificant result was obtained ($p=0.31$). The intergroup comparison mean of 11.08 ± 1.3 for hypodivergent mandible, 10.74 ± 1.04 for normodivert and 10.74 ± 1.04 for hyperdivergent was obtained (Table 4, Graph 4).

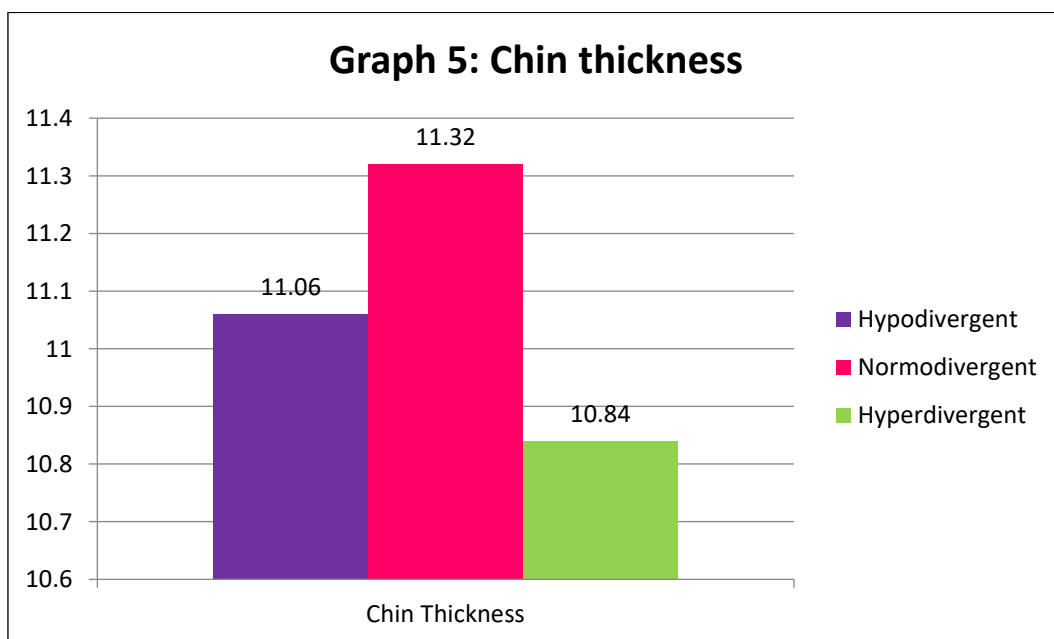
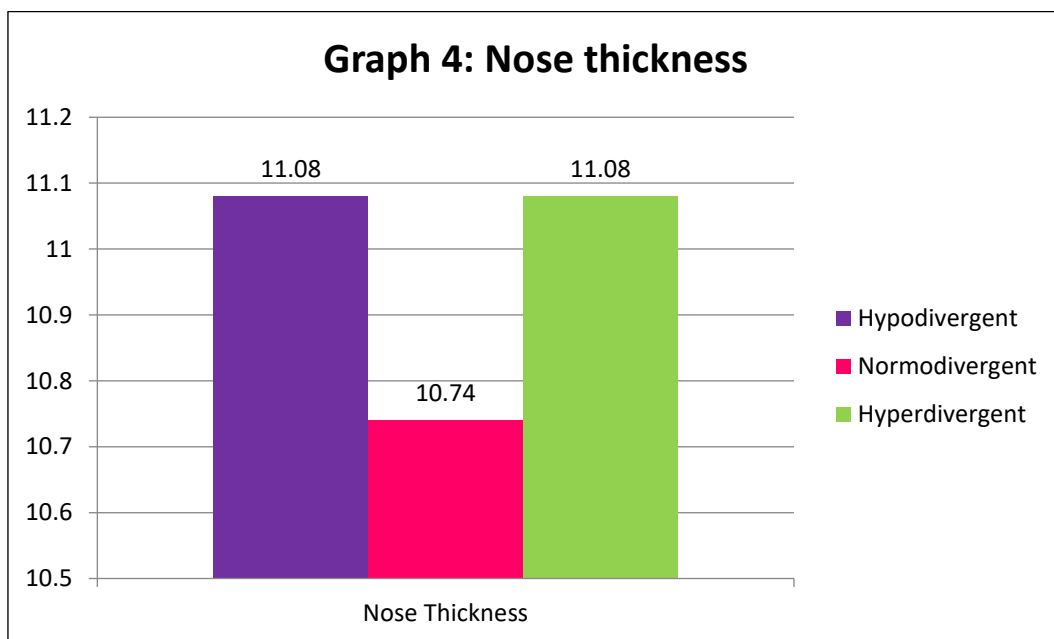


Table 5: Comparison of chin thickness among study groups				
	Mean±SD	SE	F-value	p-value
CHIN THICKNESS				
Hypodivergent	11.07±1.5	0.25	1.05	0.05*
Normodivergent	10.12±1.8	0.19		
Hyperdivergent	09.84±2.2	0.23		

Test applied: One-way ANOVA, *p < 0.05 – significant,

p < 0.001 – extremely significant

When the chin thickness of all three groups were compared, statistical significant result was obtained (p=0.05). The intergroup comparison mean of 11.07±1.5 for hypodivergent mandible, 10.12±1.8 for normodivert and 09.84±2.2 for hyperdivergent was obtained. (**Table 5, Graph 5**).

Table 6: Comparison of chin throat angle among study groups				
	Mean±SD	SE	F-value	p-value
CHIN THROAT ANGLE				
Hypodivergent	88.02±3.01	0.43	61.5	<0.001*
Normodivergent	86.44±3.4	0.47		
Hyperdivergent	78.74±6.31	1.01		

Test applied: One-way ANOVA, *p < 0.05 – significant,

p < 0.001 – extremely significant

The intergroup contrast of all three groups were statistically significant for chin throat angle (p=0.001) as noted in **Table 6, Graph 6**. One- way Anova test was run to evaluate this statistical significance. The hyperdivergent readings were found to

be least in all groups whereas the measurements for hypodivergent were maximum comparatively.

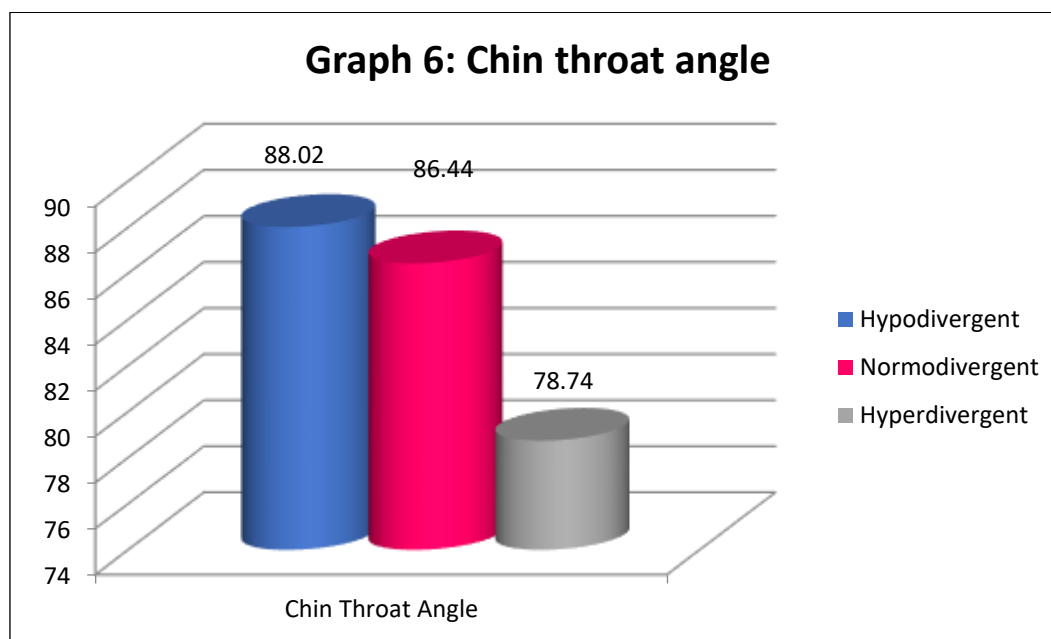


Table 7: Intergroup Multiple comparisons – Upper Lip Thickness

	Mean Difference	SE	p-value
Hypodivergent-Normodivergent	1.82	0.41	<0.001*
Hypodivergent – Hyperdivergent	0.51		0.36
Normodivergent–Hypodivergent	-1.82		0.001*
Normodivergent - Hyperdivergent	-1.32		<0.001*
Hyperdivergent – Hypodivergent	-0.5		0.36
Hyperdivergent - Normodivergent	1.32		0.001*

Test applied: Post-hoc Tukey Test, *p < 0.001 – extremely significant,

p < 0.05 – significant

On running intergroup contrast between two groups of groups, statistical significance was obtained in terms of upper lip thickness at various levels **Table 7**, **Graph 7**. Both hypo and hyper divergent groups were statistically significant ($p = 0.001$) when compared with normodivergent group running post-hoc tukey test.

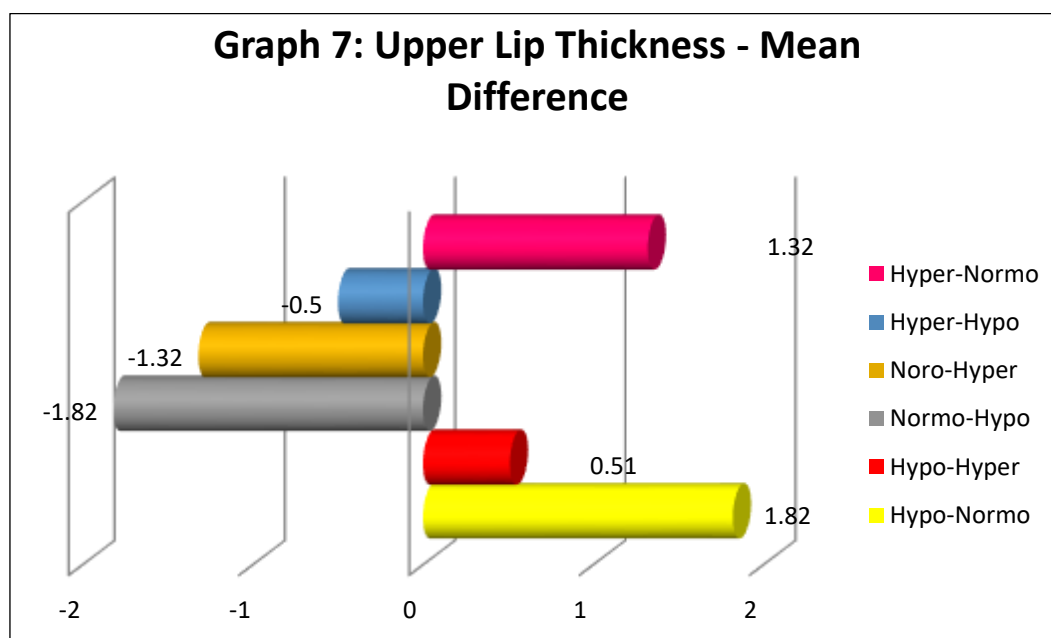


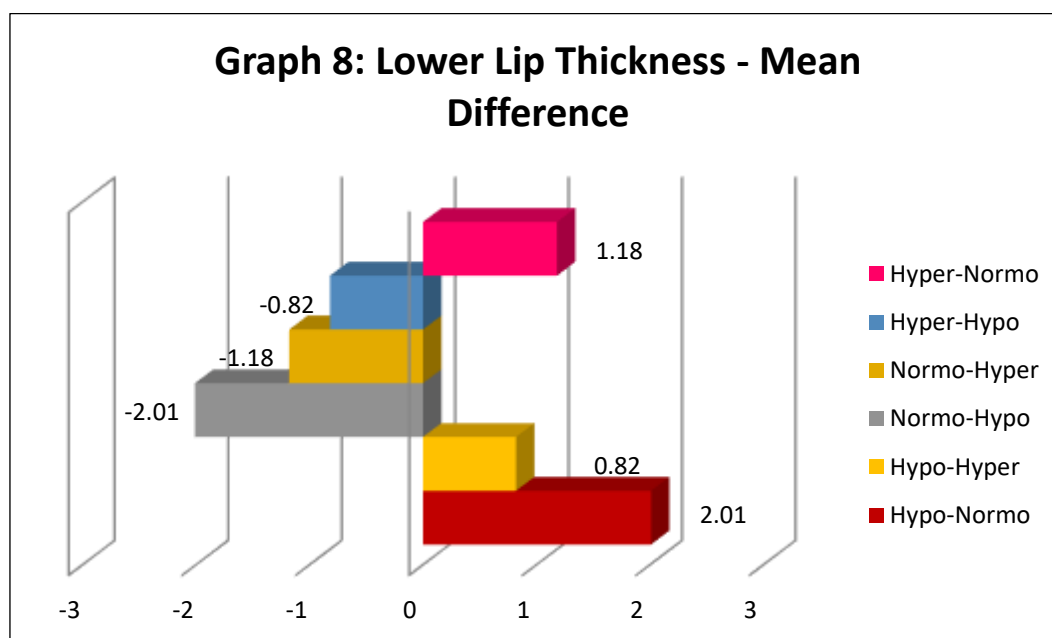
Table 8: Intergroup Multiple comparisons – Lower Lip Thickness

	Mean Difference	SE	p-value
Hypodivergent-Normodivergent	2.01	0.32	<0.001*
Hypodivergent – Hyperdivergent	0.82		0.03
Normodivergent -Hypodivergent	-2.01		<0.001*
Normodivergent - Hyperdivergent	-1.18		0.001*
Hyperdivergent – Hypodivergent	-0.82		0.03
Hyperdivergent - Normodivergent	1.18		0.001*

Test applied: Post-hoc Tukey Test, * $p < 0.001$ – extremely significant,

$p < 0.05$ – significant

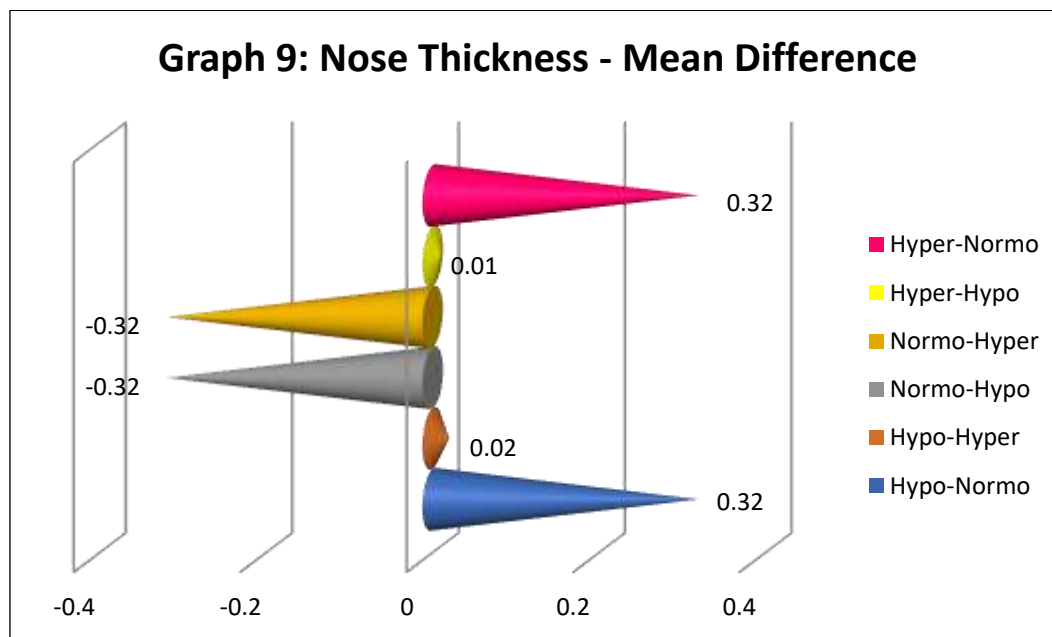
On running intergroup contrast between two groups of groups, statistical significance was obtained in terms of lower lip thickness at various levels **Table 8**, **Graph 8**. Both hypo and hyper divergent groups were statistically significant ($p=0.001$) when compared with normodivergent group running post-hoc tukey test.



	Mean Difference	SE	p-value
Hypodivergent-Normodivergent	0.32	0.24	0.37
Hypodivergent – Hyperdivergent	0.02		1.01
Normodivergent -Hypodivergent	-0.32		0.37
Normodivergent - Hyperdivergent	-0.32		0.37
Hyperdivergent – Hypodivergent	0.01		1.01
Hyperdivergent - Normodivergent	0.32		0.38

Test applied: Post-hoc Tukey Test, * $p < 0.05$ – significant,
 $p < 0.001$ – extremely significant

On running intergroup contrast between two groups of groups, no statistical significance was obtained in terms of nose thickness **Table 5, Graph 7.**



	Mean Difference	SE	p-value
Hypodivergent-Normodivergent	-0.26	0.33	0.05*
Hypodivergent – Hyperdivergent	-0.22		0.001*
Normodivergent -Hypodivergent	0.26		0.05*
Normodivergent - Hyperdivergent	0.5		0.32
Hyperdivergent – Hypodivergent	-0.22		0.001*
Hyperdivergent - Normodivergent	-0.5		0.32

Test applied: Post-hoc Tukey Test, *p < 0.05 – significant,

p < 0.001 – extremely significant

On running intergroup contrast between two groups of groups, statistical significance was obtained in terms of chin thickness at various levels **Table 10 Graph 10**. In contrast to other result obtained, other than the hyper-normo divergent comparison, other groups were statistically significant ($p=0.001$) by running post-hoc tukey test.

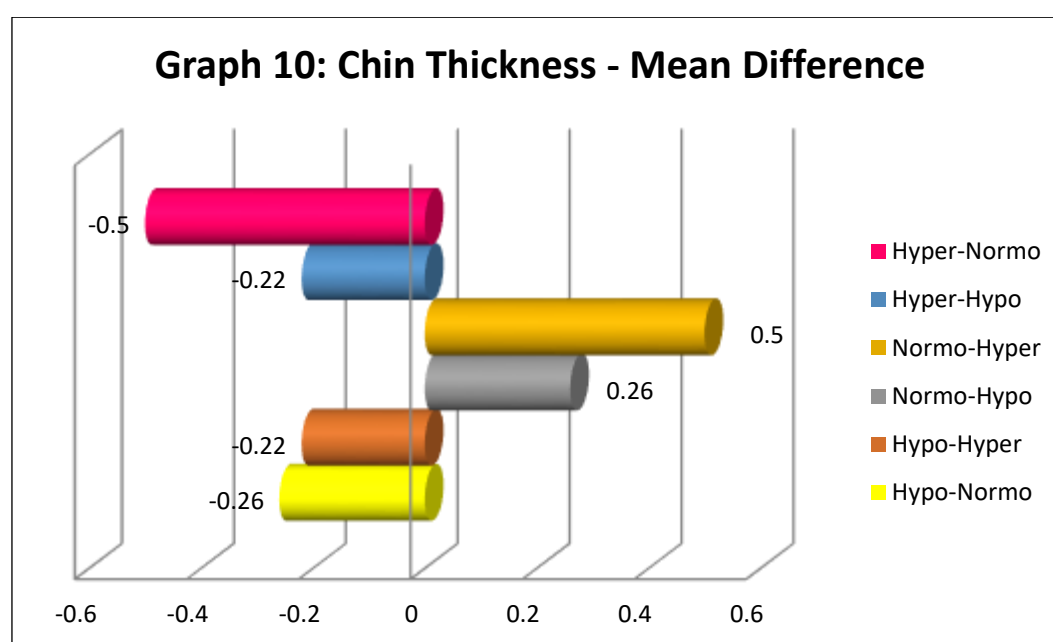


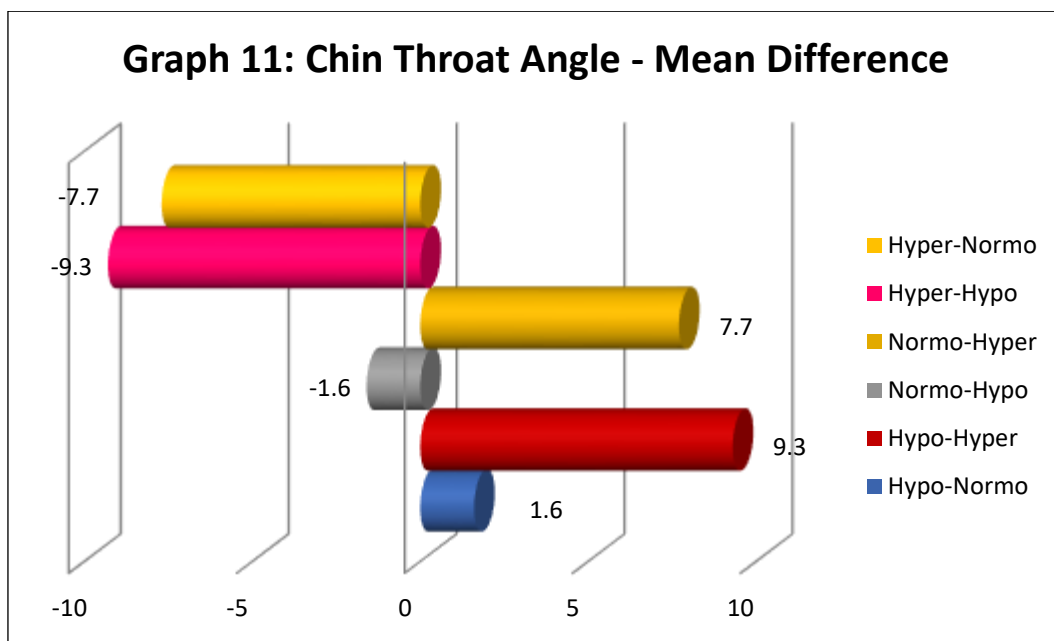
Table 11: Multiple comparisons – Chin Throat angle

	Mean Difference	SE	p-value
Hypodivergent-Normodivergent	1.6	0.8	0.18
Hypodivergent – Hyperdivergent	9.3		<0.001*
Normodivergent -Hypodivergent	-1.6		0.18
Normodivergent - Hyperdivergent	7.7		<0.001*
Hyperdivergent – Hypodivergent	-9.3		<0.001*
Hyperdivergent - Normodivergent	-7.7		<0.001*

Test applied: Post-hoc Tukey Test, * $p < 0.001$ – extremely significant,

$p < 0.05$ – significant

On running intergroup contrast between two groups of groups, statistical significance was obtained in terms of lower lip thickness at various levels **Table 11 Graph 11**. In contrast to other result obtained, other than the hypo-normo divergent comparison, other groups were statistically significant ($p=0.001$) by running post-hoc tukey test



DISCUSSION

The orthodontist places a high value on the soft tissue lining of the face. Most of us are so used to x-rays, models, and pictures that we forget to overlook the patient's forehead, nose, chin, and lips, which make up the soft tissue frameworks with which orthodontists are most concerned. The previous belief that once the occlusion is addressed, the soft tissue screen will take care of itself has moved our study and inquiry into this crucial aspect of our job.⁵⁸ The thickness of the soft tissues that surround bones and teeth varies greatly, and variances are much higher in patients with diverse development patterns.

More than real hard tissues, the thickness of the overlaying soft tissues determines the profile's convexity. Racial, ethnic, and temporal characteristics can all influence the evaluation of a facial profile. The convexity of skeletal and soft tissue profiles was shown to have an inverse relationship. Because of the protrusion of the

chin, there is a tendency for the convexity of the skeletal profile to be reduced. The soft tissue profile does not react in the same way, showing that the mechanics of soft tissue thickness increase are different.⁵⁹

The examination of soft tissues is crucial for identification, cure planning, & achieving face harmony. Holdaway⁶⁰ discovered that cure aims were much enhanced when soft tissue properties were taken into account. In orthodontics, Lateral Cephalometric Radiographs (LCR) has been used for investigated the soft tissue shape, with the idea that the shape of the soft tissue contour greatly impacts the face's aesthetics.

In orthodontic testing & treatment planning, evaluating soft tissue characteristics in patients receiving orthodontic therapy or corrective jaw surgery is critical. In order to achieve harmonious face aesthetics and an acceptable functional occlusion, both soft & hard tissue standards must be addressed. The goal of this analysis was to measure and analyse the soft tissue width of the nose and chin in adult patients with several mandibular divergence designs, and to analyse these values across males and females using a lateral cephalogram to determine the soft tissue response.

The individuals in this study were 16–25 years old to guarantee that the upper lip size & thickness, & also the soft tissue chin thickness, had attained adult size. Following the eruption of the maxillary central incisors, Subtelny⁶¹ discovered that the upper lip maintains a stable vertical connection between incisal edge & the prosthion of the central incisor. They went on to say that the length of the lower and upper lips steadily increased till he was 15 years old.

Lip thickness

In the present study, upper lip thickness was highest in hypo-divergent mandible, 12.74 ± 2.3 . Likewise, lower lip thickness was 13.36 ± 1.8 . The upper lip thickness was minimum in hyperdivergent group. This was true for lower lip readings recorded too 11.4 ± 1.4 . The findings obtained in study done by Ashraf K et al⁴⁹ are in accordance with our study where hypodivergent group showed maximum thickness in upper lip. Whereas Perokic T⁵⁰ observed women to have thicker soft tissue in lower lip in their study.

In our research, we discovered that the hypodivergent group had the thickest upper lip. This is consistent with Blanchette et al.⁶² findings, however the lower lip thickness in their research was lower among short-face people.

Feres et al²⁷ concur with Blanchette⁶² and Nanda's⁶³ findings. However, there was no big variation in upper lip measurement across the 3 face varieties in our study. The hypodivergent group's mean values were somewhat higher than the hyperdivergent groups, the variation was statistically significant.

Nose thickness

In present study, both hypo and hyper divergent reading was 10.08 ± 1.3 whereas normodivergent reading was 11.74 ± 1.04 . Sachan A et al³⁴ observed male predilection over females in terms of nose thickness. Similar findings were observed in a study done by Surani S⁵¹. This was found in accordance to our study. Whereas, the findings of Yumuşak FV⁴⁴ study were in contrast to our study where both genders showed similar findings this may be because of ethnicity.

Chin thickness

The chin thickness was maximum in hypodivergent i.e. 11.07 ± 1.5 . Followed by normodivergent group 10.12 ± 1.8 and hyperdivergent group 09.84 ± 2.2 . The findings obtained in studies conducted by Ashraf K⁴⁹ et al are in accordance with our study where hypodivergent group showed maximum thickness. Similarly, Sattar A⁴⁸ et al, Surani S⁵¹ and Macari et al²⁸ observed similar findings. Where, in their study, males showed greatest thickness among all groups than females.

Females' soft tissue chin thickness was larger than boys', according to Genecov⁶⁴ and Perovic T⁵⁰. In their research of white North European individuals, Nanda et al⁶³ found that the long vertical patterns had considerably greater thickness in all chin measures. Sodawala J et al⁵⁶ no difference in findings among both the genders.

Genecov⁶⁴ observed up to the age of 18 where females had a 1.6mm rise in soft tissue drape across the chin, but males had a 2.4mm rise. As a result, by the age of 17, both sexes had identical soft tissue thickness. Beyond the age of 16, Foley et al⁶⁵ found no variation in soft tissue thickness. This could possibly be the reason why the few studies shows equal observation among male and female.

Chin-throat angle

In the study, the chin-throat angle ranged from 78 to 88 degrees in hypodivergent, hyperdivergent, and normodivergent participants. Hypodivergent had the highest chin-throat angle ($88.02^\circ \pm 3.01^\circ$), followed by normodivergent ($86.44^\circ \pm 3.4^\circ$), and hyperdivergent ($78.74^\circ \pm 6.3^\circ$) in conditions of small facial angle, whereas a protrusive face had the lowest ($78.74^\circ \pm 6.3^\circ$). Our findings are consistent

with Stoner,⁶⁶ with a bigger angle in the hypodivergent group indicating a protrusive face and a lower angle in the hyperdivergent group suggesting a retrusive face. Perovic T⁵⁰ observed women with thicker soft tissue in their study.

The hyperdivergent group had the smallest mean distance (10.84 ± 2.1 millimetre), followed by the hypodivergent group (11.06 ± 1.8), and the normodivergent group had the largest (11.32 ± 1.8). Our findings were in contrast to those of Celikoglu et al²⁹ who found that the values of soft tissue thickness for both women & men were lowest in high angle group. The values were statistically and substantially lower in the high angle group for women. Furthermore, the values of soft tissue thickness of low & normal angle groups were identical.

When the area of therapeutic action is limited to the lower face, the chin-throat connection, together with the location of the chin relative to the nose & lips, allows practitioners to establish the chin extension in the facial profile, which is a significant step.

SUMMARY

This cross sectional study was conducted in the Department Of Orthodontics And Dentofacial Orthopedics. Ethical committee approval was obtained from the Institutional Ethics Committee. Using convenience sampling technique, 150 untreated subjects with different facial divergence pattern with age ranging from 16 – 25 years were selected from outpatient Department of Orthodontics and Dentofacial Orthopedics. The subjects requiring orthodontic treatment and who satisfied the inclusion criteria for the study were included. Subjects were divided into sub-groups based on Tweed's analysis and FMA angles.

The parameters of interest were compared across 150 subjects with different mandibular divergences stated as under:

Group 1: Normodivergent Subject (N = 50)(25 Males & 25 Females)

Group 2: Hypodivergent Subject (N = 50)(25 Males & 25 Females)

Group 3: Hyperdivergent Subject (N = 50) (25 Males & 25 Females)

Pre-treatment lateral cephalograms of patients aged 16-25 years were obtained for the study. The subjects belonged to the age ranging from 16 to 25 years (20.05 ± 3.1). these 150 subjects had 1:1 male-female ratio (75 each). Furthermore, 50 each were distributed for hypodivergent, normodivergent and hyperdivergent. The data obtained was tabulated in excel sheet and was subjected for statistical analysis.

Following results was concluded from the current study:

1. The intergroup comparison of all three groups were statistically significant for upper lip thickness ($p=0.001$). On running intergroup comparison between two groups of groups, statistical significance was obtained in terms of upper lip thickness at various levels Both hypo and hyper divergent groups were statistically significant ($p=0.001$) when compared with normodivergent group.
2. The intergroup comparison of all three groups were statistically significant for lower lip thickness ($p=0.001$). On running intergroup comparison between two groups of groups, statistical significance was obtained in terms of lower lip thickness at various levels. Both hypo and hyper divergent groups were statistically significant ($p=0.001$) when compared with normodivergent group.
3. The result obtained for nose thickness of all three groups was statistical nonsignificant ($p=0.31$). On running intergroup comparison between two groups of groups, no statistical significance was obtained in terms of nose thickness.

4. The result obtained for chin thickness of all three groups was statistical significant ($p=0.05$). On running intergroup comparison between two groups of groups, statistical significance was obtained in terms of chin thickness.
5. The intergroup comparison of all three groups were statistically significant for chin throat angle ($p=0.001$). On running intergroup comparison between two groups of groups, statistical significance was obtained in terms of lower lip thickness at various levels. In contrast to other result obtained, other than the hypo-normo divergent comparison, other groups were statistically significant ($p=0.001$).

CONCLUSION

1. Upper and lower lip thickness were maximum in hypodivergent and minimum in hyperdivergent subjects.
2. Nose thickness was insignificant among the three divergences.
3. Chin thickness was maximum in hypodivergent and least in hyperdivergent subjects.
4. Chin-throat angle was maximum in hypodivergent and minimum in hyperdivergent subjects.

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ANNEXURE

CASE RECORD FORM

NAME:

Date:

AGE/ SEX:

ADDRESS:

CONTACT NUMBER:

OPD NUMBER:

Chief Complaint:

Past medical history:

Past dental history:

History of abnormal habit:

CLINICAL EXAMINATION:

- **EXTRAORAL EXAMINATION:**

Facial profile:

Facial symmetry:

TMJ examination:

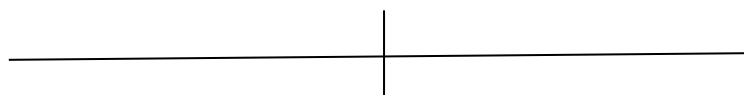
Lip competency:

Nasolabial angle:

Mentolabial sulcus:

• INTRAORAL EXAMINATION:

Teeth present:



Teeth in occlusion:

Molar relation:

Canine relation:

Other findings:

Overjet:

Overbite:

Probable diagnosis:

Investigations:

Staff signature

(गोपनीय)
माहिती पूर्ण संमती फॉर्म

**EVALUATION AND COMPARISON OF LIPS, NOSE, CHIN AND CHIN-
THROAT ANGLE IN PATIENTS WITH DIFFERENT MANDIBULAR
DIVERGENCES- A CEPHALOMETRIC STUDY**

नाव: श्री/चि./श्रीमती/कु. . _____

निवासी: _____

वय _____ वर्ष.

माझ्या इच्छेच्या / निवडीचा कोणत्याही स्वरूपाचा कोणताही दबाव / प्रोत्साहन न लावता, याद्वारे डॉ. _____ ने प्रकल्पाचे आयोजन करण्याची माझी मंजूरी देतो/देते.

मी "रुग्णाच्या माहिती पत्रकाची" पावती स्वीकारत आहे आणि डॉक्टरांनी मला या संशोधन प्रकल्पाबद्दल योग्य आणि सूचनेबद्दल माहिती दिली आहे. मी Lateral cephalogram करण्याची अधिकृती देतो .मी माझ्या एक्स-रे, छायाचित्रे, आवश्यकते नुसार इतर तपासण्या करण्यास सहमत आहे.

मी या प्रकल्पात भाग घेण्यास सहमती देतो आणि या चाचणीच्या काळात कोणतीही इतर योजना एकत्रित करणा नाही. मी डेन्टल हॉस्पिटल मध्ये किंवा इतर ठिकाणी दिलेल्या नियोजित तारखा आणि वेळांचे पालन करीन.

मी प्रमाणित करतो की मी या फॉर्मची माहिती वाचलेली आहे किंवा कोणाकडून वाचवून घेतली आहे.

_____ दिनांक _____

रुग्ण / कायदेशीरपणे अधिकृत प्रतिनिधी

स्वाक्षरी

(Confidential)

Informed Consent Form

EVALUATION AND COMPARISON OF LIPS, NOSE, CHIN AND CHIN-THROAT ANGLE IN PATIENTS WITH DIFFERENT MANDIBULAR DIVERGENCES- A CEPHALOMETRIC STUDY

NAME: Mr./Master/Mrs./Miss. _____

Resident of: _____

_____ aged _____ years, exercising my free will/choice, without any pressure/lure of incentive in any form, hereby give my consent for the project to be conducted by **Dr.** _____.

I acknowledge the receipt of “patient’s information sheet”, and also the doctor has informed me about this research project suitably and sufficiently to my satisfaction.

I agree to undergo this procedure and allow to take lateral cephalogram as part of the study.

I agree to let my X-rays, photographs, other investigations to be taken as required.

I agree to take part in this project and will not mix any other projects during the period of this trial. I shall report to the dental hospital or other place where called on given appointment dates and time.

I certify that I have read or had read to me the contents of this form.

Date _____

Patient /legally authorized representative signature

INFORMED CONSENT FORM

वैयक्तीक माहिती

खरणाचे नाव :
वय/लिंग :
पत्ता :

दिनांक :

मोबाईल नंबर :

मी कबूल करतो की डॉक्टरांनी मला या संशोधन प्रकल्पाबद्दल समाधानकारक माहिती दिली आहे. मी माझ्या एक्स-रे, छायाचित्रे, इंप्रेशन आणि आवश्यकतेनुसार अन्य तपासण्या करण्यास सहमत आहे. मी या प्रकल्पात भाग घेण्यास सहमती देतो आणि या चाचणीच्या कालावधीत कोणतेही अन्य प्रकल्प एकत्रित करणार नाही. मला डेन्टल हॉस्पिटल किंवा इतर ठिकाणी दिलेल्या भेटीची तारीख आणि वेळ सांगितली आहे. मी डॉक्टर आणि पॅरामेडिकल कर्मचा-यांना सर्व बाबतीत सहकार्य करेल. या अभ्यासात मी माझ्या सहभागाचे निकाल प्रकाशित करण्यास परवानगी देतो. मला कोणतीही नुकसान भरपाई दिली जाणार नाही. असे करण्यासाठी कोणतेही कारण न देता मला कोणत्याही वेळी या संशोधन प्रकल्पातून बाहेर पडण्याचा अधिकार मिळालेला आहे. मी या अन्वये केलेल्या चाचणीत सहभागासाठी माझी संमती नोंदवित आहे.

१) खरणाचे नाव	स्वाक्षरी	तारीख	वेळ
२) साक्षीदाराचे नाव	स्वाक्षरी	तारीख	वेळ
३) डॉक्टरचे नाव	स्वाक्षरी	तारीख	वेळ