Original Article

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Soft Tissue Nose and Chin Thickness in Adult Orthodontic Patients with Various Mandibular Growth Patterns

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ABSTRACT

Introduction: Individuals with various mandibular growth patterns may require Orthognathic surgery to improve nose and chin thickness to compensate for increased mandibular divergence. Determining soft tissue nose and chin thickness is crucial in these situations. This study was conducted to evaluate soft tissue nose and chin thickness of patients with mandibular divergences and their association between and within different genders of orthodontic patients visiting People's Dental College and Hospital.

Materials and Methods: A descriptive cross-sectional study was conducted from 12th Oct 2023 to 12th Sept 2024 at People's Dental College and Hospital. A convenience sampling method was used to collect 291 samples (pre-treatment lateral cephalograms of 158 females, 133 male patients) age ranging between 18 to 30 years. Nose and chin parameters were analyzed, measured with SPSS 16 version software, using an independent student's t-test to find out any statistical difference ($p<0.05$) between various mandibular divergences.

Results: Among 291 subjects, 63 (males 29, females 34) had hypodivergent, 99 (29 males, 70 females) normodivergent, 129 (73 males, 56 females) hyperdivergent growth patterns. Soft tissue nose thickness was greater in females than in males among various mandibular divergence patterns ($p<0.05$), while soft tissue chin thickness in males was greater at the level of Pog, Gn, in hypodivergent, at the level of Me in hyperdivergent than in female samples. Within the same genders, no significant difference in soft tissue nose among various mandibular divergences, soft tissue chin thickness at the level of Pog in hypodivergent males was greater compared to normodivergent males. At the level of Gn, Me, normodivergent females had greater chin thickness than hyperdivergent females.

Conclusion: The soft tissue nose and chin thickness were variable in different levels of chin between and within genders among various mandibular divergences.

Keywords: Chin thickness, Growth patterns, Lateral Cephalogram, Soft tissue nose

INTRODUCTION

Orthodontic diagnosis has shifted from hard tissue to soft tissue evaluation as soft tissue profiles can develop in and out of proportion of the underlying skeletal structure. The limit of orthodontic treatment is largely determined by soft tissue evaluation in terms of functionality, stability, and aesthetics. Consequently, the Orthodontists must plan treatment within the patient's limits of soft tissue adaptation and contours. The relationship between the chin and nose is crucial for achieving optimal aesthetic outcomes.[1] The Steiner, Ricketts, and Holdaway analyses describe the facial

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profile using soft tissue nose and chin thickness as a reference.[2-4] For harmonious facial esthetics and occlusal function, soft and hard tissue norms should be considered.[2]

The soft tissue thickness between chin and nose will give the potential implications for rhinoplasty and genioplasty in patients with different vertical growth patterns of the mandible who might require greater nose thickness and chin advancement to compensate for the increased mandibular divergence and the study showed male patients have greater nose and chin thickness compare to female patients.[5]

Most of the literature state that hyperdivergent mandible have decreased chin thickness and nose thickness compared to hypodivergent and normodivergent patients and review of orthodontic literature considers changes in the soft tissue proportion only after the completion of orthodontic treatment.[5-7] There should be ethnic variation of soft tissue profile in different countries so in Nepal also these variations might be there. Hence, this study was conducted to determine the soft tissue nose and chin thickness among different mandibular divergence between genders and to find the association among the mandibular divergence patterns and the soft tissue nose and chin thickness within the genders of Nepalese Orthodontic Patients visiting People's Dental College and Hospital.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted from 12th Oct 2023 to 12th Sept 2024 at the People's Dental College and Hospital. Ethical clearance was obtained from the Institutional Review Committee of People's Dental College and Hospital (Ref. 1, CH No.3, 2080/2081). A written and signed consent form was taken from the patients about the radiation hazards. A convenience sampling method was used to collect a total of 291 samples of pre-treatment Lateral cephalograms of 158 female and 133 male patients from the Department of Orthodontics at People's Dental College and Hospital, with ages ranging between 18 to 30 years. All the clinical records of the patients were verified and reviewed by the principal investigator.

Sample Size

The sample will be calculated by using the formula

$$n= \frac{Z^2 \times \sigma^2}{e^2}$$

Where, n= minimum required sample size, Z = 1.96 at 95% Confidence Interval (CI), σ = standard deviation (3.08) taken from previous study, Surani S.S et.al[5] , e = margin of error, 0.5

The sample size estimated with above mention formula was 145. The total sample size was 291 since 2 similar groups were studied. All pretreatment lateral cephalograms record of patients age between 18-30 years, good quality radiographs and no history of previous orthodontic treatment were included in the study. The patients having a history of trauma, craniofacial abnormalities, systemic disorder were excluded from the study as there may higher chance of changes in the soft tissue nose and chin position.

The records were further divided into three groups according to their vertical skeletal mandibular growth patterns, depending upon the angle formed by mandibular plane i.e (Go-Gn) to Sella-Nasion plane (SN) on lateral cephalogram. For hypodivergent vertical skeletal pattern (males 29, females 34) mean value of mandibular plane angle is <23.2 degrees, for normodivergent (males 29, females 70) mean value of mandibular plane angle > 23.2° - < 32°, for hyperdivergent (males 73, females 56) vertical skeletal pattern mean value of mandibular plane angle is >= 32°[10] were selected. The lateral cephalometric radiographs were obtained with teeth in centric occlusion using a cephalostat. Images were obtained using Sirona Orthophos SL. For lateral cephalogram, the patients were exposed at 73kV-15mA to 84kV-13mA, with standard procedures and natural head position which was achieved by instructing the subject on standing position in the cephalostat to look at a distance point exactly at the eye level in the mirror. After selection of lateral cephalograms from the department of Orthodontics, People's Dental College and Hospital, all the selected radiographs were traced on acetate tracing paper with a 3H sharp pencil on a view box using transilluminated light in a dark room. Standardization of cephalometric radiographs was done to minimize the magnification error of linear measurements. The mathematical protractor and standard metallic scale were used to measure the soft tissue nose and chin thickness. The description of cephalometric parameters was given in Table 1, Fig 1.

Table 1: Various Cephalometric Parameters used in the study

Cephalometric Parameters	Description
SNA	Angle between Sella (S) - Nasion (N) plane to Nasion (N) – point A plane
SNB	Angle between Sella (S) - Nasion (N) plane to Nasion (N) – point B plane
ANB	Angle between SNA and SNB
Go-Gn to SN	Angle between Sella (S) - Nasion (N) line and Gonion (Go) - Gnathion (Gn)
Soft tissue nose thickness	Line from (TVL) passing through subnasale , perpendicular distance from tip of nose to TVL
Soft tissue chin thickness	
Pog-Pog’	Distance between bony Pogonion (Pog) and the soft tissue Pogonion (Pog’)
Gn-Gn’	Distance between bony gnathion (Gn) and soft tissue Gn’
Me-Me’	Distance between bony menton (Me) and the soft tissue Me’

Soft tissue nose was measured from True Vertical line (TVL), which can be traced perpendicular to true horizontal line passing through subnasale. Chin thickness was measured at Pogonion (Po), Menton (Me), Gnathion (Gn). In lateral cephalogram, gonial angle was measured from angle formed by the line joining Gonion(Go) to Gnathion (Gn) and Sella (S) to Nasion (N) according to Steiner’s analysis.[2,10] All the information gathered were recorded in proforma. The obtained data were analyzed using standard data analyzing software SPSS version 16.

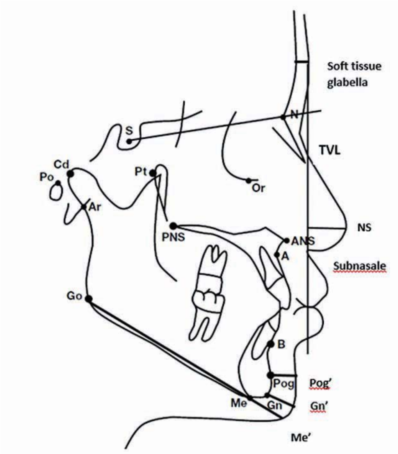

Figure 1. Lateral cephalogram showing soft tissue nose and chin parameters.

The soft tissue chin thickness was measured at three different chin levels showing the above figure 1. Pog-Pog’ = distance between bony pogonion (Pog) and the soft tissue pogonion (Pog’). Gn-Gn’ = distance between bony gnathion (Gn) and the soft tissue gnathion (Gn’). Me-Me’ = distance between the bony menton (Me) and the soft tissue menton (Me’). The soft tissue nose thickness (N’) was measured by drawing a true vertical line (TVL) passing through the subnasale, and a perpendicular distance was measured from the tip of the nose to TVL. According to Arnett etal,[12] TVL is the most reliable landmark to measure the soft tissue thickness; hence it was used in the study. The fifty lateral cephalograms radiographs were selected randomly on a lottery basis and were re-measured by the same examiner after 3 to 4 weeks of interval time for the intra-observer variation test using an intraclass correlation coefficient. The observed value was 0.95, indicating more reliability between the measurements. Normality of data was checked using the Kolmogorov – Smirnov test to validate the data for statistical significance with a significance level set at $P<0.05$. The descriptive statistics were then calculated. The soft tissue nose and chin differences between and within genders among mandibular divergences were checked. Among different mandibular divergences and soft tissue nose and thickness were analyzed and compared using an independent student’s t-test.

RESULTS

The findings of the current study revealed a statistically significant difference in soft tissue nose thickness ($P<0.05$) between genders, indicating that females exhibited greater nose thickness compared to males among various vertical skeletal mandibular growth patterns (Table 2). Furthermore, the study demonstrated a statistically significant difference ($P<0.05$) in soft tissue chin thickness (N’) measurements between genders, specifically within the hypodivergent and hyperdivergent groups. In both hypodivergent groups at Pog, Gn and hyperdivergent groups at the level of Me, male showed greater chin thickness than female’s subjects; however, no significant difference was observed between genders in the normodivergent subjects.

Table 2: Descriptive statistics of differences in soft tissue nose and chin thickness between genders using independent student's t-test.

Mandibular divergence	Parameters	Male		Female		Difference	P value
	mm	Mean	SD	Mean	SD	M-F	
Hypodivergent	Nose (N')	11.75	1.87	12.09	2.61	1.29	0.02*
	Pog- Pog'	13.03	1.85	10.53	2.01	1.82	0.00*
	Gn- Gn'	13.05	2.33	10.40	2.47	1.34	0.03*
	Me- Me'	10.89	3.01	11.93	2.62	1.09	0.14
Normodivergent	Nose (N')	10.97	2.80	11.53	2.48	1.51	0.00*
	Pog -Pog'	12.49	2.62	10.78	2.06	0.10	0.79
	Gn- Gn'	13.96	3.17	10.86	2.84	0.10	0.83
	Me- Me'	11.20	3.73	12.42	3.52	0.07	0.90
Hyperdivergent	Nose (N')	11.00	2.39	11.69	2.53	2.27	0.00*
	Pog -Pog'	12.83	3.18	10.33	3.01	0.86	0.22
	Gn -Gn'	11.75	3.42	9.62	3.37	1.37	0.07
	Me- Me'	13.03	3.33	10.71	3.58	2.11	0.00*

*(*P<0.05) statistically significant, SD: standard deviation.*

Table 3 showed the association between mandibular divergence and the thickness of soft tissue in the nose and chin, within gender, revealed the following results through an independent student's t-test. The analysis of soft tissue nose thickness (N') revealed no significant differences between the divergence groups. However, in hypodivergent males, the thickness of the chin at the Pog level was greater compared to that of normodivergent males. Furthermore, in female subjects, significant differences were observed at the Gn and Me levels between normodivergent and hyperdivergent vertical mandibular skeletal patterns ($P<0.05$). This indicates that normodivergent females exhibit greater chin thickness than hyperdivergent groups at the Gn and Me levels, suggesting that as the mandibular divergence increases, chin thickness tends to decrease at various chin levels.

Table 3: Descriptive statistics of differences in soft tissue nose and chin thickness between genders using student's T-test.

Mandibular divergence	Parameters	Male		P value	Female		P value
	mm	Mean±std	Mean±std		Mean±std	Mean±std	
Hypodivergent-normodivegent	Nose(N')	11.75±1.87	10.97± 2.80	0.48	12.09±2.61	11.53±2.48	0.31
	Pog- Pog'	13.03±1.85	12.49± 2.62	0.00*	10.53±2.01	10.78±2.06	0.55
	Gn- Gn'	13.05±2.33	13.96± 3.17	0.18	10.40±2.47	10.86±2.84	0.40
	Me- Me'	10.89±3.01	11.20± 3.73	0.45	11.93±2.62	12.42±3.52	0.44
Hypodivergent-hyperdivergent	Nose (N')	11.75±1.87	11.00± 2.39	0.31	12.09±2.61	11.69±2.53	0.49
	Pog -Pog'	13.03±1.85	12.83± 3.18	0.09	10.53±2.01	10.33± 3.01	0.72
	Gn- Gn'	13.05±2.33	11.75± 3.42	0.33	10.40±2.47	9.62±3.37	0.21
	Me- Me'	10.89±3.01	13.03± 3.33	0.80	11.93±2.62	10.71±3.58	0.07

Normodivergent-hyperdivergent	Nose(N’)	10.97± 2.80	11.00± 2.39	0.10	11.53±2.48	11.69±2.53	0.72
	Pog -Pog’	12.49± 2.62	12.83± 3.18	0.64	10.78±2.06	10.33±3.01	0.34
	Gn -Gn’	13.96± 3.17	11.75± 3.42	0.97	10.86±2.84	9.62± 3.37	0.02*
	Me- Me’	11.20± 3.73	13.03± 3.33	0.65	12.42±3.52	10.71±3.58	0.00*

*(*P<0.05) statistically significant, SD: standard deviation.*

DISCUSSION

Soft tissue evaluation is crucial for accurate diagnosis and treatment planning in patients undergoing orthodontic treatment and orthognathic surgery. It is essential to consider both hard and soft tissue norms to establish optimal occlusal function and aesthetic harmony. The thickness of soft tissue between the chin and nose can provide significant insights for rhinoplasty and genioplasty, particularly in patients exhibiting different vertical growth patterns of the mandible. These patients may require increased nasal thickness and chin advancement to address the effects of greater mandibular divergence. Consequently, the present study aims to determine and compare the soft tissue thickness of the nose and chin between and within genders, as well as to evaluate these measurements in relation to various mandibular growth patterns, utilizing lateral cephalometric radiographs at People’s Dental College and Hospital.

The findings of the study indicate that there were statistically significant differences in soft tissue nose and chin thickness measurements between and within the genders (Table 2, 3). The findings of the current study revealed females (12.09±2.61 mm) had greater nose thickness compared to males (11.75±1.87 mm) individuals among various vertical skeletal mandibular growth patterns (Table 2), which contradicts the findings of Surani et al.[5], who reported that male noses (13.61±1.6 mm) were proportionately larger and thicker than those of females (12.82±1.3 mm). Additionally, in our study hypodivergent female subjects demonstrated greater nose thickness compared to hyperdivergent and normodivergent male subjects (P<0.05, table 2), suggesting that as the mandibular plane increases, the soft tissue nose thickness decreases in both genders. Furthermore, the study demonstrated a statistically significant difference (*P<0.05) in soft tissue chin thickness (N’) measurements between genders in hypodivergent and hyperdivergent groups. The male individuals showed greater chin thickness in both hypodivergent groups at Pog, Gn (13.035±1.85 mm, 13.05±2.33 mm) and hyperdivergent groups at the level of Me (13.035±3.33 mm) compared to female individuals. The hypodivergent groups of females at level of Pog, Gn were (10.53±2.01 mm, 10.40±2.47 mm) and hyperdivergent groups at the level of Me (10.71± 3.58 mm) however, no significant difference was observed between genders in the normodivergent subjects. Our study agrees with other research that concluded males had thicker soft tissue chin compared to females.[5-7] Furthermore, our findings agree with study of Macari and Hanna and Kumar et al.[6,14], who indicated that hyperdivergent vertical skeletal mandibular growth patterns were associated with reduced soft tissue chin thickness compared with hypodivergent and normodivergent groups. Again, Shinde et al.[8] evaluate and compare the soft tissue chin thickness in class I, II, III adults with three mandibular divergences. Their finding concluded, the soft tissue chin thickness measurements were highest in class II hypodivergent group compared to hyperdivergent and normodivergent groups between genders which agrees with our findings. Again, the association between mandibular divergence and the thickness of soft tissue in the nose and chin within gender revealed the soft tissue nose thickness (N’), showed no significant differences between the divergence groups. However, the soft tissue chin in hypodivergent males, at the Pog level was greater compared to normodivergent males. Furthermore, in female subjects, significant differences were observed at the Gn and Me levels between normodivergent and hyperdivergent vertical mandibular skeletal patterns (P<0.05). This indicates that normodivergent females exhibit greater chin thickness than hyperdivergent groups at the Gn and Me levels, suggesting that as the mandibular divergence increases, chin thickness tends to decrease at various chin levels. Similar findings were reported by Patil et al. and Shinde et al.[7,8] Again, Park et al.[9] conducted an analysis of the horizontal movement of both soft and hard tissues following setback genioplasty. Their findings indicate that the thickness and ratio of soft tissue must be taken into account to enhance the predictive accuracy of the soft tissue profile of the chin. So, our study also emphasizes the significance of soft tissue thickness in achieving improved treatment outcomes in orthodontics. During the developmental period the angular shapes and positional relationships of nose, chin, and lip were found to be constant for both sexes, and independent of underlying hard tissue so treatment planning should be according to timing of soft tissue development[12]. Again, Norman et al.[13] results concluded that the soft tissue chin is significantly associated with vertical facial divergence which agrees with this study. Again,our finding contradicts with Celikoglu et al.[16], who reported that soft tissue chin thickness was lowest in the high mandibular skeletal pattern group compared to normal patterns, with women exhibiting statistically significantly thinner measurements at the labrale superius, labrale inferius, and pogonion in the high-angle group relative to the normal angle group. Additionally, our analysis revealed no significant differences in the association between mandibular divergence and soft tissue nose and chin thickness within the same gender. Females exhibited greater nose thickness compared to males, which contradicts the findings of Enlow and Hans[17], and Nahid[18], who reported that male noses were proportionately larger and thicker than those of females. However, when examining chin parameters in male individuals, a significant difference ($p<0.05$) was noted at the level of Pog, indicating that hypodivergent males had greater chin thickness compared to normodivergent males. In females, significant differences were observed at the Gn and Me levels, where normodivergent females exhibited greater chin thickness than hyperdivergent subjects. Moreover, in males, a decrease in mandibular divergence corresponds to an increase in chin thickness at the Pog level, indicating that soft tissue chin thickness is not uniform across all measurement levels which was in agreement with the study done by Pujari et al.[15] Additionally, the research conducted by Mahto et al.[19] on comparison of facial soft tissue thickness of adult male and female subjects among three sagittal skeletal malocclusions at different cephalometric landmarks points revealed greater mean value of soft tissue thickness in male compared to female subjects which was in agreement with our study. The difference in their finding suggests that there might be racial or ethnic variation in soft tissues. Also, Shrivastava et al.[20] compared various nasal parameters in different anteroposterior jaw relationships and growth patterns. Their finding indicated that there were no significant differences in nasal depth between different sagittal skeletal relationships and growth patterns and no gender dimorphism was observed which contrasts with the result of our study.

The current study results can be used as a reference during diagnosis and treatment planning of a patient undergoing fixed orthodontic treatment therapy. When planning orthognathic surgery, mandibular divergence should be considered to prevent undesirable alteration in soft tissue change. The limitation of the present study is related to the unequal distribution of sample size within the genders may restrict to generalizability of our findings to broader populations which could introduce bias or limit the applicability of our results. Also, the unequal sample distribution among the various mandibular growth patterns might have affected the outcome in our study, so the result should not be generalized for the whole Nepalese population. Furthermore, the study conducted with an equal and large number of study samples should be recommended.

CONCLUSION

The soft tissue nose and chin were significantly associated with various mandibular growth patterns between the genders. As the mandibular divergence increases, soft tissue nose and chin thickness at different chin level decreases between and within the genders. The soft tissue nose and chin thickness were variable in different levels of chin among mandibular divergences.

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Conflicts of Interest: None.

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REFERENCES

1. Ackerman JL, Profit WR, Sarver DM. The emerging soft tissue paradigm in orthodontic diagnosis and treatment planning. Clin Orthod Res. 1999;2(2):49-52.
2. CC Steiner. The use of cephalometrics as an aid to planning and assessing orthodontic treatment. Am J Orthod. 1960; 46:721-35.
3. RM Ricketts. Esthetics, environment, and the law of lip relation. Am J Orthod. 1968;54(4):272-89.
4. RA Holdaway. Soft-tissue cephalometric analysis and its use in orthodontic treatment planning. Am J Orthod. 1983; 84:1–28.
5. Surani S.S, Bhat SR. A Cephalometric study to compare the soft tissue nose and chin thickness in adult patients with various mandibular divergence patterns. Int J Scie Res. 2019;8(1):15-17.
6. Macari AT, Hanna AE. Comparisons of soft tissue chin thickness in adult patients with various mandibular divergence patterns. Angle Orthod. 2014; 84(4):708-14.
7. Patil HS, Golwalkar S, Chougule K, Kulkarni NR. Comparative Evaluation of Soft Tissue Chin Thickness in Adult Patients with Skeletal Class II Malocclusion with Various Vertical Growth Patterns: a Cephalometric Study. Folia Med. 2021; 63(1):74-80.
8. Shinde N, Jethe S, Agarkar S, Deshmukh S, Kharche A, Rahalkar J. Comparative Evaluation of Soft Tissue Chin Thickness in Skeletal Class I and Class II Adults with Three Mandibular Divergence- A Cephalometric Study. J Adv Med Dent Scie Res. 2019;7(2):33-40.
9. Park JY, Kim MJ, Hwang SJ. Soft tissue profile changes after setback genioplasty in orthognathic surgery patients. J Craniomaxillofac Surg. 2013;41(7):657-64.
10. Bhattarai P. Steiner's Cephalometric Analysis of Nepalese Adults Aged 18 to 30 Years. J Nep Dent Asso.2005;7(1):1-9.
11. Genecov JS, Sinclair PM, Dechow PC. Development of the nose and soft tissue profile. Angle Orthod.1990 Autumn; 60(3):191–8.
12. Arnett G W, & Bergman RT. Facial keys to orthodontic diagnosis and treatment planning. Part I. Am J Orthod Dentofacial Orthop.1993;103(4):299-312.
13. Noman M, Hashmi G, Manzoor Ali M, Yousaf U, Hussain M, Mujeeb R. Comparison of Soft Tissue Chin Thickness in Adult Patients With Various Mandibular Divergence Patterns.2024; 16(4):e59150.
14. Kumar AA, Parthiban P, Kumar SS, Divakar G, Sekar SS, Silambu MR. Assessment and evaluation of soft tissue measurements between various mandibular divergences in the south Indian population: A cephalometric study. J Pharm Bioallied Sci . 2022;14:152-5.
15. Pujari K, Jatania A, Tiwari A. Evaluation of soft tissue chin thickness and lip thickness in different mandibular divergence patterns in Maratwada population-A cephalometric study. J Contemp Orthod. 2023;7(2):90–3.
16. Celikoglu M, Buyuk SK, Ekizer A, Sekerci AE, Sisman Y. Assessment of the soft tissue thickness at the lower anterior face in adult patients with different skeletal vertical patterns using cone-beam computed tomography. Angle Orthod. 2015;85(2):211-7.
17. Enlow and Hans. Essentials of facial growth. Philadelphia. W. B. Saunders 1996.
18. Nahidh M. Nose and skeletal patterns, is there a relationship? J Baghdad College Dentistry 2009;21(4):111-17.
19. Mahto RK, Kafle D, Singh PK, Khanal S, Khanal S. Variation of Facial Soft Tissue Thickness in Nepalese Adult Orthodontic Subjects. Orthod J Nepal 2018;8(2):22-8.
20. Shrivastava R, Shrestha BK, Sah MP, Chhetri A, Gahatraj S, Shrestha S. Comparision of various nasal parameters in different anteroposterior jaw relationships and growth patterns. Orthod J Nepal. 2023;13(2):15-20.