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A Retrospective Cephalometric Study Examining the Angular Relationship between the Sella - Nasion Plane and the Frankfort Horizontal Plane in the Maratha Population

Mrunali Tone[1], Sandeep Jethe[2], Varsha Merani[3], Shailesh Dongre[4], Arun Mhaske[5], Suyog Shendage[6].

[1]Post Graduate Student, Department of Orthodontics and Dentofacial Orthopedics at D Y Patil Dental School Lohegaon Pune, India
Corresponding author Email id: *mrunalitoneortho[at]gmail.com*
Tel no – 7021086767
[2]MDS (Orthodontics and Dentofacial Orthopedics), Head of the Dept. and Guide at D Y Patil Dental School Lohegaon Pune, India
Tel no – 9822269241
[3]MDS (Orthodontics and Dentofacial Orthopedics), Associate Professor at D Y Patil Dental School Lohegaon Pune, India
Tel no – 9822650461
[4]MDS (Orthodontics and Dentofacial Orthopedics), Associate Professor at D Y Patil Dental School Lohegaon Pune, India
Tel no – 8412821263
[5]MDS (Orthodontics and Dentofacial Orthopedics), Assistant Professor at D Y Patil Dental School Lohegaon Pune, India
Tel no – 8975074379
[6]MDS (Orthodontics and Dentofacial Orthopedics), Assistant Professor at D Y Patil Dental School Lohegaon Pune, India
Tel no – 9359578558

Abstract: ***This study examines the FH-SN Frankfort Horizontal-Sella Nasion angle, a crucial parameter in orthodontic diagnosis and treatment planning, focusing on a population from Pune. Utilizing lateral cephalograms, the research aims to establish the average FH-SN angle in this demographic, while also exploring potential gender-based differences. The study, conducted at D Y Patil Dental School, analyzed cephalograms from 120 participants, evenly distributed across genders, with no craniofacial abnormalities. Findings revealed an average FH-SN angle of 7.67 3.29, closely aligning with the traditionally accepted 7. Interestingly, while females exhibited a slightly higher FH-SN angle than males, this difference was not statistically significant. The studys implications for cephalometric analysis and orthodontic diagnosis, especially concerning individual variations in the FH-SN angle, are discussed, highlighting the need for further longitudinal research and the importance of multiple reference planes in cephalometric evaluations.***

Keywords: Cephalometry, FH-SN Angle, Orthodontic Diagnosis, Gender Differences, Pune Population

1. Introduction

Orthodontic care today aims to improve social well - being and quality of life through harmonious facial esthetics. A lateral cephalogram is a fundamental orthodontic tool used for diagnosis, treatment planning, evaluating care outcomes, predicting growth, and conducting research[1]. (Figure 1)

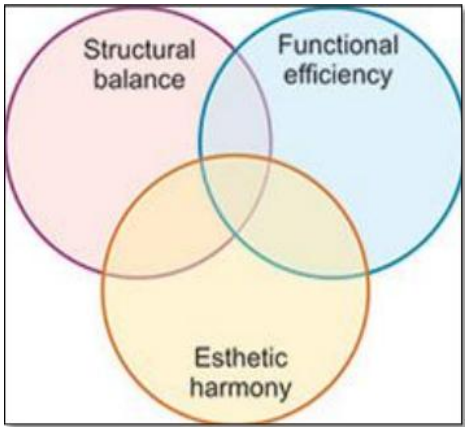

Figure 1: Jacobson's Triad

Various investigators have drawn different reference planes for cephalometric analysis, which has been a mainstay of orthodontic diagnosis. The SN plane is the most commonly used and important reference plane, followed by the FH plane.

Frankfort Horizontal plane is formed by joining the inferiormost point of the bony orbit called Orbitale (Or) to the superiormost point of the external auditory meatus called Porion (Po)

The Sella Nasion plane is formed by joining the midpoint of Sella Tursica (S) with Nasion (N)

These are the two planes that are commonly used in cephalometric analyses. While there are changes in all cephalometric planes, the SN plane and the FH plane have been determined to be reasonably stable[22].

Daugaard - Jensen showed the link between the FH and SN planes in 1957, finding a virtually consistent mean angle of 7° during growth.

A line traced in a clockwise orientation around 7° from SN yields the true horizontal axis, or constructed FH, and the literature indicates that the angle between these lines is relatively consistent at 7°.

But as of yet, there isn't enough solid proof of this consistency. The cephalometric diagnosis may be impacted by modifications to the FH - SN angulation[3].

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Nevertheless, a number of investigations have demonstrated that the FH - SN angulation is not always 7°, hence determining the FH - SN angle is essential before making any cephalometric inferences[2].

Finding the average FH - SN angle for a group of Pune - based patients is the main goal of this investigation. Determining whether or not sexual dimorphism is present in the FH - SN angle is the secondary goal.

2. Material & Methods

The D Y Patil Dental School's institutional ethics committee gave its approval before the study could be carried out in Lohegaon, Pune. The tools used were a 3H pencil, 0.003 - inch acetate tracing paper, an X - ray viewer, a geometry box with an eraser, divider, and protractor, and a ruler and set squares.

A total of 120 lateral cephalograms of patients from Pune between the ages of 12 and 25 were chosen from the orthodontics and dentofacial orthopedics department record room at D Y Patil Dental School Lohegaon, Pune. There were 60 male patients and 60 female patients.

There were no craniofacial abnormalities present in any of these patients. The study excluded radiographs that had magnified images and unclear landmarks.

Each participant's lateral cephalometric radiographs showed centric occlusion and a horizontally oriented Frankfort Plane in accordance with the Natural Head Position (NHP). Lateral cephalograms were manually drawn in a dark room using an X - ray viewer and a sharp 3H pencil on acetate tracing paper. Prior to the construction of the reference planes (FH and SN), another investigator confirmed the cephalometric landmarks. Next, the angle between the SN plane and the FH plane was measured to the nearest 0.5 degree and recorded. (Figure2)

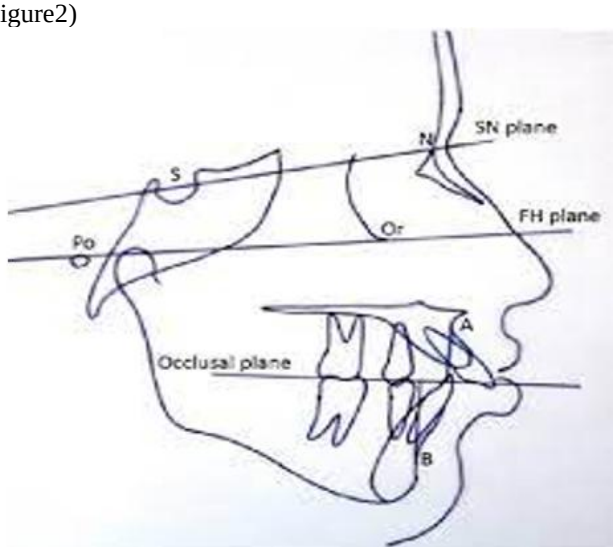


Figure 2: Diagram illustrating FH - SN Plane

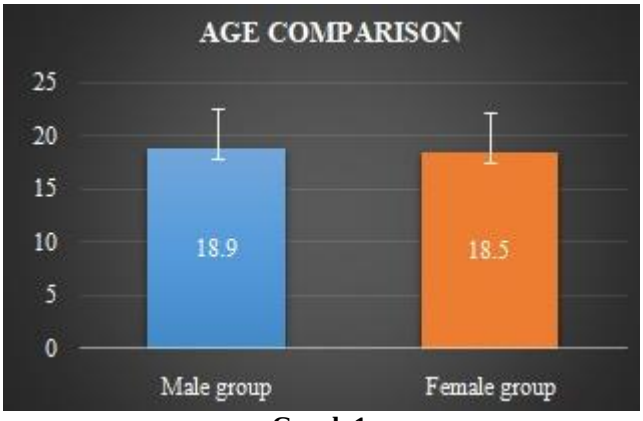
To guarantee intra - observer variability, 25 lateral cephalograms were randomly chosen and remeasured two weeks after the first measurement. The obtained data was assessed for normal distribution using the Shapiro - Wilk and Kolmogorov - Smirnov tests. Using an independent t - test, the gender dimorphism of the FH - SN angle for the samples was assessed. The FH - SN angle mean and standard deviation for each of the 120 samples were then determined. (Table1, Table2, Graph1, Table3, Table4, Graph2).

Table 1: Descriptive statistics of age parameter in both gender

	Mean	SD	SE	Minimum	Maximum
Male group	18.9	3.64	0.47	13.0	26.0
Female group	18.5	3.68	0.47	12.0	25.0
Overall	18.7	3.65	0.47	12.0	26.0

Table 2: Comparative statistics of age parameter between both gender

Age	Mean	SD	Unpaired t test	P value, Significance
Male group	18.9	3.64	t = 0.598	p =0.551 (no statistical significant difference)
Female group	18.5	3.68		



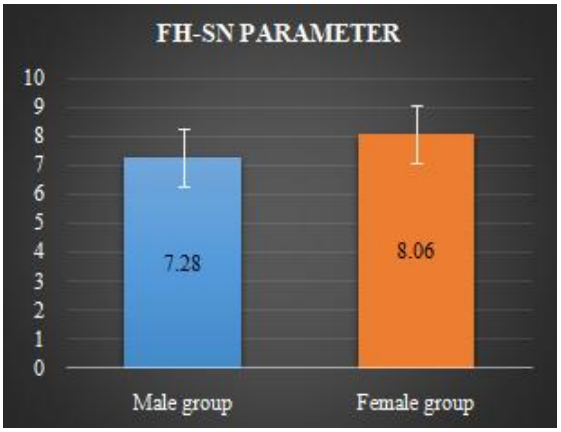
Graph 1

Table 3: Descriptive statistics of FH - SN Angle parameter in both gender

FH - SN	Mean	SD	SE	Minimum	Maximum
Male group	7.28	3.10	0.4	1.0	16.0
Female group	8.06	3.46	0.44	2.0	15.0
Overall	7.67	3.29	0.42	1.0	16.0

Table 4: Comparative statistics of FH - SN parameter between both gender

FH - SN	Mean	SD	Unpaired t test	P value, Significance
Male group	7.28	3.10	t = - 1.305	p = 0.195 (no statistical significant difference)
Female group	8.06	3.46		



Graph 2

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3. Results

The sample's average age was 18.7 ± 3.65 years. The results of the Shapiro - Wilk and Kolmogorov - Smirnov tests were found to be greater than 0.05, indicating that the data may have had a normal distribution. The FH - SN angle averaged 7.67 ± 3.29. Although the FH - SN angle was higher in the female samples than the male samples, there was no statistically significant difference between the two groups.

4. Discussion

The goal of the current retrospective cephalometric study was to calculate the average FH - SN angle for a cohort of patients from Pune. In this study, the average FH - SN angle was 7.67° ± 3.29°.

This value is relatively close to the standard 7° angle of separation between the SN and FH planes. However, some research has also reported an FH - SN angle greater than 7°[4 - 7].

The racial variation that may exist between the study samples could be the cause of this discrepancy in the FH - SN angle. Furthermore, a difference in cephalometry of less than 2° is not regarded as clinically significant[8].

The FH - SN angle clearly demonstrates inter - individual variability. Although the FH - SN angle's intra - individual variability is still up for debate, it is generally agreed that the angle stays roughly constant (7°) over the course of a person's lifetime.

Age - related increases in the FH - SN angle have been documented in certain studies[4 - 7].

Because of its cross - sectional design, this study is unable to provide an answer to the question of whether the FH - SN angle changes with age. Therefore, additional longitudinal research with a sufficient sample size is required to evaluate how the FH - SN angle varies with an individual's age.

The diagnosis of an orthodontic case is impacted by variations in the FH - SN angle. Moore[9] states that SNA and SNB values decrease as the FH - SN angle increases.

Variations in the inclination of the SN line, the FH line, or both may be the cause of variations in the FH - SN angle.

Therefore, before establishing any cephalometric diagnosis, it is crucial to assess the FH - SN angle[10].

Cephalometric parameters that rely solely on the FH line should be used to make a cephalometric diagnosis if the variation in the FH - SN angle is caused by the SN line. However, cephalometric planes are often highly variable and poorly related.

As a result, multiple reference planes should always be used when performing cephalometric analysis.

5. Conclusion

Although the FH - SN angle was higher in the female samples than the male samples, there was no statistically significant difference between the two groups.

Declaration of Conflicting Interests
Regarding the research, writing, and/or publication of this article, the authors have declared that they have no potential conflicts of interest.

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Ethical Approval
This article does not require approval from an ethical committee or patient consent because it is not a clinical study.

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