Original Article

Indian Journal of Dental Education
Volume 17 Number 3 July - August 2024
DOI: https://dx.doi.org/10.21088/ijde.0974.6099.17324.2

Determination of Yen Angle in Children with Mouth Breathing Habit

Anusree Nair[1], Rena Ephraim[2], Sharath Chandrashekhar[3], Dhanya K. B.[4], Ramnesh P.[5], Rakesh R[6]

How to cite this article:

Anusree Nair, Rena Ephraim, Sharath Chandrashekhar *et al*. Determination of Yen Angle in Children with Mouth Breathing Habit. Ind J Dent Educ. 2024;17(3):121-126.

Abstract

Background: There is a lengthy and contentious history of the connection between respiratory function and the development of occlusal and craniofacial morphology. Mouth-breathing influences skeletal growth and thereby affect the cephalometric parameters. The present study aimed to determine the YEN angle in children with mouth breathing habit having Class I occlusion.

Aim: Determination of YEN angle in children with mouth breathing habit.

Settings and Design: Department of Pediatric and Preventive Dentistry, Mahe institute of dental sciences, Mahe. Prospective study.

Methods: 48 children of age group 9-12 years with mouth-breathing habit having Class I malocclusion were selected. Water holding and butterfly test was used to confirm the diagnosis of the habit. Their lateral cephalograms were taken and the ANB angle, Wit's assessment YEN angle was measured by manual methods. The Pearson's correlation coefficient and the coefficient of variation statistical analysis were carried out with an alpha level of 5%.

Results: The mean YEN angle in mouth breathers with Class I occlusion was 119.7±2.783°. The YEN angle showed a moderately negative correlation with the ANB angle, which was statistically significant (r=-0.31, p=0.03).

Conclusion: From our study we found that the YEN angle is a homogenously distributed angular parameter that is highly predictable when utilized to evaluate sagittal discrepancy in patients with Class I occlusion having mouth-breathing habit.

Keywords: YEN angle; ANB angle; Wit's analysis; Class I occlusion; Mouth breathing.

Author's Affiliation: [1]Postgraduate, [2]Professor & HOD, [3,4]Associate Professor, [5]Assistant Professor, [6]Private Practitioner, Department of Pediatric and Preventive Dentistry, Mahe Institute of Dental Sciences and Hospital, Mahe 673310, Kerala, India.

Corresponding Author: Rena Ephraim, Professor & HOD, Department of Pediatric and Preventive Dentistry, Mahe Institute of Dental Sciences and Hospital, Mahe 673310, Kerala, India.

E-mail: renajosephdr4@gmail.com

Received on: 10.08.2024

Accepted on: 11.09.2024

INTRODUCTION

When breathing occurs continuously through the mouth, there are several obstructions to breathing that will eventually lead to many anomalies if not treated.[1] A change in breathing pattern that favours mouth breathing can lead to a number of functional changes that affect the position of tongue, mandible the balance of oral and perioral muscles. The most common obstruction of the nasal airway in children is adenoid/palatine tonsillar hypertrophy. When this obstruction is present, there are many anomalies that can occur in children. Mouth-breathing children have frequently been observed to have "adenoid facies". This represents as increased anterior facial height, narrow or "V"-shaped maxillary arch, clockwise rotation of mandible, a retro positioned hyoid bone, posterior cross-bite and retro positioned mandibular incisors in comparison to healthy controls.[2] The balanced development of craniofacial structures requires appropriate nasal respiratory function, according to Moss' functional matrix theory.[3] The quantity and direction of craniofacial growth are influenced by nasal breathing in addition to other craniofacial complex tasks, including mastication and swallowing.[4] Mouth breathing (MB) can cause a variety of functional alterations, such as shifts in the posture of the tongue and the imbalance of the oral and perioral muscles which can lead to Class II or Class III skeletal patterns. Additionally, studies on MB have documented adjustments to head and neck posture, which seems to improve oral breathing by opening up the upper airway to more air.[4,5]

There are numerous angular and linear measurements to assess the sagittal discrepancy between maxilla and mandible, which is of prime importance in diagnosis and treatment-planning especially in children with mouth breathing habit. Neela *et al.* in 2009 introduced an angle called Yen angle, to evaluate the sagittal relationship between maxilla and mandible.[6] It's main advantage is that it eliminates the difficulty in locating points A and B or the functional occlusal plane. As it is not influenced by growth changes it can be used in deciduous and mixed dentition as well. It uses the following three reference points: S (midpoint of the Sellaturcica), M (midpoint of the premaxilla) and G (centre of the largest circle that is tangent to the internal inferior, anterior posterior surfaces of the mandibular symphysis). Though morphological landmarks seem to be more reliable, constructed points may in some instances better represent the true nature of the underlying skeletal pattern. When S, M G are connected, they form the YEN angle, which is measured at M.YEN angle between 117 to 123 degrees have a skeletal Class I pattern; an angle less than 117 degrees can be considered a Class II an angle greater than 123 degrees indicates a Class III relationship.[6,7,8] Early detection of the type of malocclusion that can develop in children with mouth breathing habit can help to predict the type of treatment that has to be advocated in them to get the best results. Hence, the purpose of the study was to determine if there was any variation in YEN angle in children with mouth breathing habit.

AIM OF THE STUDY

Determination of YEN angle in children with mouth breathing habit.

MATERIALS AND METHODOLOGY

After obtaining the ethical clearance from the Institutional ethics committee, 48 lateral cephalograms of children of age group 9-12 years were selected from the department of Pediatric and Preventive Dentistry from our college, based on the inclusion and exclusion criteria. The inclusion criteria included children who were brought to the department with established mouth breathing habit having class I skeletal base. The exclusion criteria included children with class II &class III skeletal base, other deleterious habits or having physical, mental or any systemic ailments. After getting the parental consent the children were examined for mouth breathing habit. Water holding test and butterfly tests were used to confirm the mouth breathing habit in these children. The lateral cephalograms of the selected children were taken with standardized procedure. It was taken from a distance of 1.5m with the head at right angle to the X-ray beam at a distance of 30cm, (although this has been found to vary slightly). The cephalostat machine incorporates two posts placed in the external auditory meatus. The patient's sagittal plane was parallel to the X-ray film, the teeth in centric occlusion and the Frankfort plane was aligned horizontally. The ANB angle was determined and Wit's analysis was done to confirm the class I skeletal base pattern. The points S, M G were traced. The Yen angle formed by these three points was measured for each subject. This angle was recorded and compared with the normal Yen angle given for class I skeletal base.

STATISTICAL ANALYSIS

The collected data was tabulated in a spreadsheet using Microsoft Excel 2021 and statistical analysis was carried out using IBM SPSS for Windows, Version 27.0. (Armonk, NY: IBM Corp). A Shapiro-Wilk's test and a Visual inspection of the histograms, normal Q-Q plots box plots showed that the collected data were skewed for both the outcome variables. Descriptive statistics was used to report quantitative variables and were reported in terms of the mean (central tendency) and standard deviations (SD, measures of dispersion). The Pearson's correlation coefficient and the coefficient of variation were determined. The p value of ≤0.05 was considered as the level of significance.

RESULTS

The mean age of the study participants was 10.15±0.94 years where the total study sample was 48 (21 girls and 27 boys). The overall YEN angle was found to be 119.7±2.783° ranging from 118.9°-120.5° (Fig. 1). In girls, the mean YEN angle was found to be 118.8±1.921° in boys 120.4±3.142 respectively.

Table 1 and Fig. 2 shows the distribution of the skeletal patterns assessed by YEN angle when cross-tabulated with the Class I skeletal pattern assessed by ANB angle + Wits Appraisal. It was found that the YEN angle in 45 study subjects (20 girls and25 boys) out of total 48 were within the normal ranges of a class I skeletal base. The YEN angle incorrectly assessed only three subjects (1 girl and 2 boys) to possess a Class III skeletal pattern.

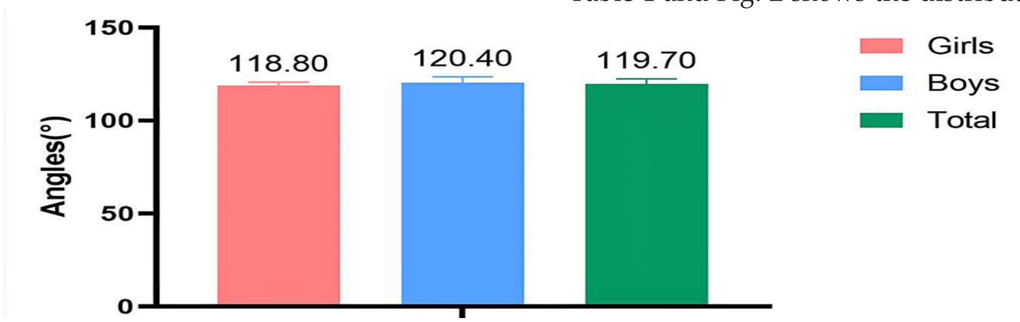

Fig. 1: Bar Graph showing mean YEN Angle (in°) according to the type of malocclusion assessed by ANB angle and Wit's Appraisal in Females, Males and All Patients

Mean YEN Angle (°)

Table 1: Distribution of study subjects according to Skeletal pattern assessed by YEN angle cross-tabulated with Class I skeletal pattern assessed by ANB angle+Wits Appraisal

		Skeletal pattern according to YEN angle	
		Class I	**Class III**
Skeletal pattern according to ANB angle+Wits Appraisal	**Girls**	20(95.2%)	1(4.8%)
	Boys	25(92.6%)	2(7.4%)
	Total	45(93.8%)	3(6.3%)

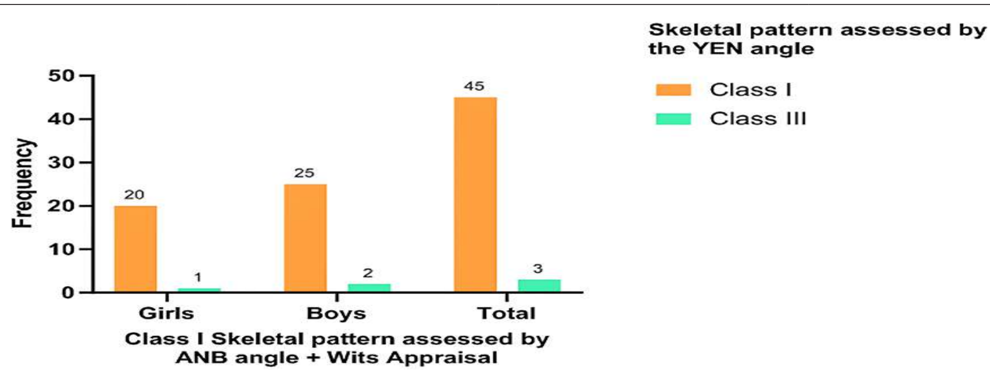

Fig. 2: Bar Graph showing the distribution of study subjects according to Skeletal pattern assessed by YEN angle cross-tabulated with Skeletal pattern assessed by ANB angle + Wits Appraisal

Our findings shows that the YEN angle had the lowest coefficient of variation, indicating a more uniformly distributed and predictable angular component. When compared to the ANB angle, the YEN angle has the lowest coefficient of variation (Girls: 1.62; Boys: 2.61, Total: 2.32), suggesting that it is a more predictable and homogenously distributed angular parameter that can be used to detect sagittal discrepancy in class I skeletal base patients in the current population (Table 2) as elicited.

Table 2: Descriptive statistics of the ANB angle and YEN angle (in°) according to Gender

	Angles	Mean±SD	CV	95%CI	Min-Max
Girls (n=21)	ANB angle	2.048±0.4155	20.29	1.858-2.237	1.5-3
	YEN angle	118.8±1.921	1.62	117.9-119.6	117-125
Boys (n=27)	**ANB angle**	**2.019±0.5798**	**28.72**	**1.789-2.248**	**1-3**
	YEN angle	**120.4±3.142**	**2.61**	**119.2-121.7**	**117-130**
Total (N=48)	**ANB angle**	**2.031±0.5095**	**25.09**	**1.883-2.179**	**1-3**
	YEN angle	**119.7±2.783**	**2.32**	**118.9-120.5**	**117-130**

CV:Coefficient of variability; CI: Confidence intervals

n=sample size per Gender, N=total sample size

Pearson's correlation coefficient (Table 3 and Fig. 3) was used to analyse the degree of association between the ANB angle and the YEN angle. A statistically significant, moderately negative correlation was seen when all the study subjects were taken into consideration [*r*= -0.31, *p*=0.03]. However, a moderately negative correlation was seen between the two variables in girls [*r*= -0.32, *p*=0.14] and boys [*r*= -0.31, *p*=0.11] which was not statistically significant.

Table 3: Correlation between the ANB angle and YEN angle stratified by Types of Malocclusions

Variables		**Correlation between ANB angle and YEN angle**	**Interpretation**
Girls (n=21)	r	-0.32	Moderately Negative
	p-value	0.14NS	
Boys (n=27)	r	-0.31	Moderately Negative
	p-value	0.11NS	
Total (N=48)	r	-0.31	Moderately Negative
	p-value	0.03*	

r: Pearson's correlation coefficient*: statistically significant (p ≤0.05)

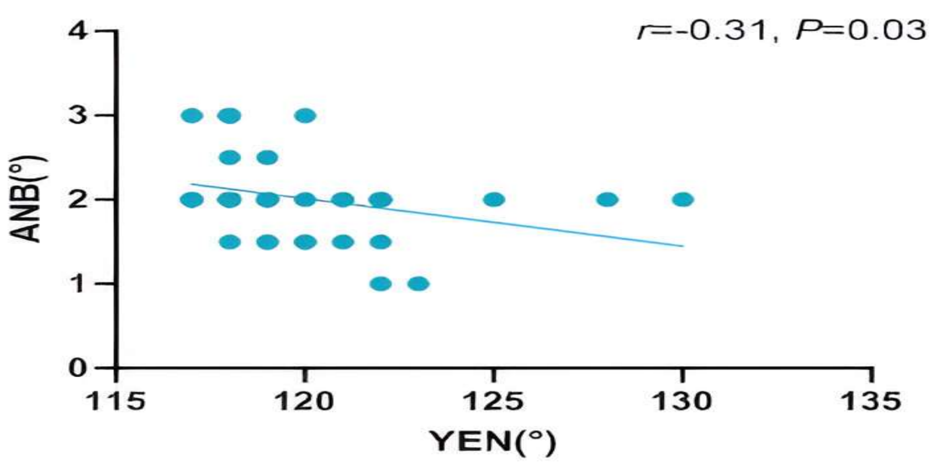

Fig. 3: Scatter Plot showing the correlation between the ANB angle and YEN angle in all patients

DISCUSSION

In the current study, lateral cephalometric radiographs of forty-eight children in the age group of 9-12 years, who reported with mouth-breathing habit and who had not received any orthodontic treatment were taken. The mean age of the study participants was 10.15±0.94 years. Children with Class I skeletal base were selected using cephalograms based on the ANB angle and the Wits assessment. Children with mouth breathing habit having a Class I skeletal base were selected because we found that most of the lateral cephalograms showed an ANB angle of 1-2 degrees and wits appraisal of 0-1mm which indicated a Class I skeletal base. Increase in sample size of the same skeletal base could increase the relevance of our study.

The sagittal disparity between the maxilla and mandible can be measured in a variety of angular and linear ways it is crucial for diagnosis and treatment planning especially in growing children with mouth breathing habit. However, there are inherent shortcomings in all of these metrics. Two of the broadly used measurements are ANB angle and Wits appraisal, which have been documented as the principal methods to assess the skeletal pattern of an individual.[6] Here in this study we used these measurements related to anteroposterior jaw relationships. It has been questioned whether the ANB angle is a reliable indicator of the sagittal jaw relationship.[9] The validity of these parameters has been investigated by many authors.[10,11]According to the literature, the anterosuperior movement of the nose throughout the growth is the primary cause of the alterations in the sella-nasion plane that impact the reliability of the ANB angle.[10,11] Jacobson had showed that the ANB angle does not provide an adequate assessment of jaw relationships because rotational growth of the jaws and the anteroposterior position of nasion influence the ANB angle.[10] Hussels and Nanda noted two additional factors affecting the ANB angle, the vertical length from nasion to point B and from point A to point B which means that the ANB angle will rise or decrease depending on how much point N is vertically displaced in either a downward or upward direction.[11]Hence there was a necessity of determining an angle which has the least amount of variations. Roth and Chang showed that the Wits appraisal is affected by the vertical dimensions of the jaws and the occlusal plane inclination. Alsoit can be misled by erupting tooth buds.[9,12] Thus each analysis has its own limitations and drawbacks. But the use of these two parameters together describes a more favourable jaw relationships.[10,11] We used both the methods to determine the skeletal base in our study to increase the accuracy.

The YEN angle is a recently suggested analytical technique that relies on constructed points instead of anatomical landmarks as it may in a few instances better depict the true nature of the underlying skeletal pattern.[6] Out of 48 total samples (21 girls and 27 boys), the YEN angle was found to be 119.7±2.783°, ranging from118.9°-120.5° in children with class I skeletal base. The mean YEN angle was found to be 118.8±1.921° in girls 120.4±3.142° in boys. The skeletal patterns assessed by YEN angle when cross-tabulated with the Class I skeletal pattern assessed by ANB angle + Wits Appraisal, it was found that the YEN angle correctly assessed 45 study samples including 20 girls and 25 boys. The YEN angle assessed only three subjects (one girl, two boys) to possess a Class III skeletal pattern which may be a sign of developing Class III due to the mouth breathing habit.

Although there are numerous studies in the literature reporting the assessment of the anteroposterior jaw relationship using the YEN angle on normal individuals, studies are sparse in children with mouth breathing habit where morphological differences in maxilloskeletal relationships can occur due to the habit.[6,7,14,15] The impact of mouth breathing on the growth of the maxillofacial boneis still up for debate.

To the best of the author’s knowledge, no study in the past has reported the influence of mouth-breathing habits on skeletal patterns taking the YEN angle as a reference parameter, which formed the premise of the present study. A knowledge of the skeletal pattern of a child with mouth breathing habit can better outline the treatment plan for that particular individual inorder to obtain a predictable and favourable result. In a growing child, a proper assessment of the skeletal base is of utmost importance as mouth breathing habit can bring about certain temporary or permanent changes in the skeletal pattern.

It was thought that the most often used metric for analysing sagittal skeletal discrepancies was the ANB angle.[16] When compared to the YEN angle, the ANB value in our study showed a lesser efficacy in predicting sagittal dysplasia in Class I patients with a coefficient of variability (CV) of 25.09,compared to a CV of 2.32 in the former. This is consistent with the research conducted by Chang HP *et al*., Brown*et al.* and Rotberg *et al.*[13,17,18] In our study, the Yen angle remained in the normal range of the known Class I skeletal base even in the children with mouth breathing habit. The results of the present study coincided with the study done by Mittal *et al.*and that of Neela *et al.* although the studies were carried out in children with normal breathing patterns.[6,7] We also found a correlation between the observations of the YEN angle with the ANB angle and found that in Class I skeletal base, the two parameters had a moderate negative correlation which was statistically significant (r= -0.31, p = 0.03*). This result aligned with the studies done on normal individuals by Mittal *et al.*, Doshi *et al.*, Katti *et al.* Mehta *et al.*[7,9,14,15]

However, it should be noted that any one measurement should not be regarded as an absolute method of detecting a skeletal relationship. The other sagittal characteristics can also be employed as they seem to be correlated. A diagnosis may be inaccurate if it is based solely on a single parameter that hasn't been updated in years treatment decisions made using that diagnosis may be insufficient or even detrimental.[15]

CONCLUSION

Our study found that the YEN angle is a homogenously distributed angular parameter that is highly predictable when utilized to evaluate sagittal discrepancy. Even in children with mouth-breathing habit the skeletal pattern could be correlated to the YEN angle more reliably than the ANB angle and Wits appraisal. However, studies with more sample size and other skeletal bases should be carried out to determine the complete reliability of the YEN angle.

REFERENCES

1. Chung LM, P. BeltriOrta. Comparison of cephalometric patterns in mouth breathing and nose breathing children. Int J Pediatr Otorhinolaryngol. 2014.
2. McNamara JA. Influence of respiratory pattern on craniofacial growth. Angle Orthod. 1981;51(4):269–300.
3. Moss ML, Salentijn L. The primary role of functional matrices in facial growth. Am J Orthod. 1969;55(6):566-77.
4. Zheng W, Zhang X, Dong J, He J. Facial morphological characteristics of mouth breathers vs. nasal breathers: A systematic review and meta-analysis of lateral cephalometric data. ExpTher Med. 2020;19(6):3738-50.
5. Bakor SF, Enlow DH, Pontes P, De Biase NG. Craniofacial growth variations in nasal-breathing, oral-breathing tracheotomized children. Am J Orthod Dentofacial Orthop. 2011;140(4):486-92.
6. Neela PK, Mascarenhas R, Husain A. A new sagittal dysplasia indicator: The Yen angle. World J Orthod. 2009;10:147–51.
7. Mittal A, Bohra S, Murli S *et al.* An evaluation of Yen and W angle in assessment of anteroposterior jaw relationship. J Indian Orthod Soc. 2016;50:26–30.
8. Jain S, Raghunath N, Murlidhar N. A comparision of W angle, Pi angle and Yen angle as an indicator for assessing anteroposterior skeletal dysplasia in various malocclusions among regional population: A cephalometric study. Int J Dent Res Develop. 2018;8:29–40.
9. Katti CG, Mohan A, A A. Predictability of ANB, Beta and YEN angles as anteroposterior dysplasia indicators in Gulbarga population. J Indian Orthod Soc. 2020;54(4):321-24.
10. Jacobson A. Application of the "Wits" appraisal. Am J Orthod. 1976;70:179-89.
11. Hussels W, Nanda RS. Analysis of factors affecting angle ANB. Am J Orthod. 1984;85:411-23.
12. Roth R. The Wits appraisal: its skeletal and dento-alveolar background. Eur J Orthod. 1982;4.
13. Chang HP. Assessment of anteroposterior jaw relationship. Am J Orthod Dentofacial Orthop. 1987;92:117-22.
14. Doshi JR, Jain P, Jain M, *et al.* Mount Vernon Index vs Yen angle for assessment of anteroposterior apical jaw base relationship. Int J ClinPediatr Dent. 2021;14(1):32-5.
15. Mehta PH, Bansal N, Singh G*et al.*Evaluation of Beta, Yen W angle in assessment of anteroposterior jaw relationship in North Indian population: A Cephalometric Study. J Mahatma Gandhi Univ Med Sci Tech. 2021;6(2):60-3.
16. Baik CY, Ververidou M. A new approach of assessing sagittal discrepancies: The Beta angle. Am J Orthod. 2004;126(1):100-5.
17. Brown M. Eight methods of analyzing a cephalogram to establish anteroposterior skeletal discrepancy. Br J Orthod. 1981;8(3):139-46.
18. Rotberg S, Fried N, Kane J, Shapiro E. Predicting the "Wits" appraisal from the ANB angle. Am J Orthod. 1980;77(6):636-42.