

Comparison of Reproducibility of Nasolabial Angle Constructed by Anatomic point method and Tangent line method

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ABSTRACT

Introduction: Investigators have drawn nasolabial angle using different soft tissue landmarks. This has created confusion among the orthodontic students and clinicians regarding its construction.

Objective: To evaluate two commonly used methods of constructing the nasolabial angle in order to establish a single reproducible method.

Materials & Method: Lateral cephalograms of 120 patients undergoing orthodontic treatment were obtained from the records of the patients. Soft tissue profile on the lateral cephalograms were traced manually by the principal investigator. All the tracings were photocopied and 6 copies of each tracing were made. Nasolabial angles were constructed and measured on photocopied copies of the tracings first using the anatomic point method and then using the tangent line method by the principal investigator and another investigator independently.

Result: The average nasolabial angle values for anatomic point method and tangent line method were found to be $94.32^\circ \pm 14.05^\circ$ and $92.4^\circ \pm 14.59^\circ$ respectively. The intra-class correlation coefficient demonstrated excellent intra-observer and inter-observer agreement among the two methods of nasolabial angle construction.

Conclusion: Both anatomic point method and tangent line method of nasolabial angle construction have excellent reproducibility in terms of intra-observer and inter-observer agreement.

Key-words: anatomic point method, lateral cephalogram, nasolabial angle, tangent line method

INTRODUCTION

Traditionally, orthodontic diagnosis and treatment planning was based on hard tissue relationship of jaws and dentition. However, there has been a paradigm shift towards soft tissue-based orthodontic diagnosis and treatment planning. The primary goal of orthodontic treatment is to achieve the ideal soft tissue profile. This emerging soft tissue paradigm places greater emphasis on clinical examination of soft tissue function and esthetics than has previously been the case.¹ Even though there are various soft tissue diagnostic parameters, nasolabial angle is considered a dependable representative of the soft tissue profile and a clinical and cephalometric parameter to establish the treatment goals.^{2,3}

Nasolabial angle, the angle formed between the lower border of the nose and the upper lip, is an important parameter in orthodontic diagnosis and treatment planning.⁴ The angle is an indicator of relative position of maxilla, maxillary dentition and nose. Decision of

extraction or non-extraction during orthodontic treatment is also influenced by nasolabial angle.⁵

Lack of universal definition of nasolabial angle has led to variability in construction of nasolabial angle. Over the years, various investigators⁶⁻⁹ have drawn the nasolabial angle using different soft tissue landmarks. This has created confusion among the orthodontic students and clinicians alike regarding the construction of nasolabial angle. An improperly constructed nasolabial angle can adversely affect orthodontic diagnosis and treatment planning.¹⁰ Till date, there are no studies in orthodontic literature comparing the reproducibility of different methods of construction of nasolabial angle. Hence, the primary objective of this study was to evaluate two commonly used methods of construction of the nasolabial angle, namely anatomic point method and tangent line method, in order to establish a single reproducible method. The secondary objective was to assess whether the two methods of construction would lead to significant difference in the values of the angle.

MATERIALS AND METHOD

Pre-treatment lateral cephalograms of one hundred and twenty patients (55 males and 65 females) who were undergoing orthodontic treatment in the Department of Orthodontics, BP Koirala Institute of Health Sciences (BPKIHS), Dharan were obtained from the records of the patients. Lateral cephalograms of the patients with lip and nose deformities were excluded from the study. Ethical clearance was obtained from the Institutional Review Committee of BPKIHS before conducting the study.

Soft tissue profile on the lateral cephalogram was traced manually on 0.003 inch matte acetate paper using sharp 3H drawing pencil by the principal investigator (JG) and verified by another investigator (PRP) for all lateral cephalograms. All the tracings were photocopied and six copies of each tracing were made: two each for anatomic point method and tangent line method of nasolabial angle construction for the principal investigator and one each for anatomic point method and tangent line method of nasolabial angle construction for another investigator (RG).

Nasolabial angles were constructed on photocopied tracing first using the anatomic point method and then using the tangent line method separately by the principal investigator. Another investigator (RG) also constructed these angles using both methods independently (Figure 1). Landmarks given by Park and Burstone⁷ were used for the construction of nasolabial angle in anatomic point method (Figure 2). Similarly, Scheideman and coworkers' method⁶ was used to construct nasolabial angle using tangent lines (Figure 3). Then the angles were measured and the values were recorded by both the investigators independently. Additionally, the nasolabial angles were reconstructed and measured by the principal investigator after 2 weeks of initial measurement.

SPSS software version 11 was used for data analysis. Intra-class correlation coefficient (ICC) was calculated to assess the intra-observer and inter-observer reproducibility. Independent samples T-test was used to compare the mean values of nasolabial angle obtained by two construction methods.

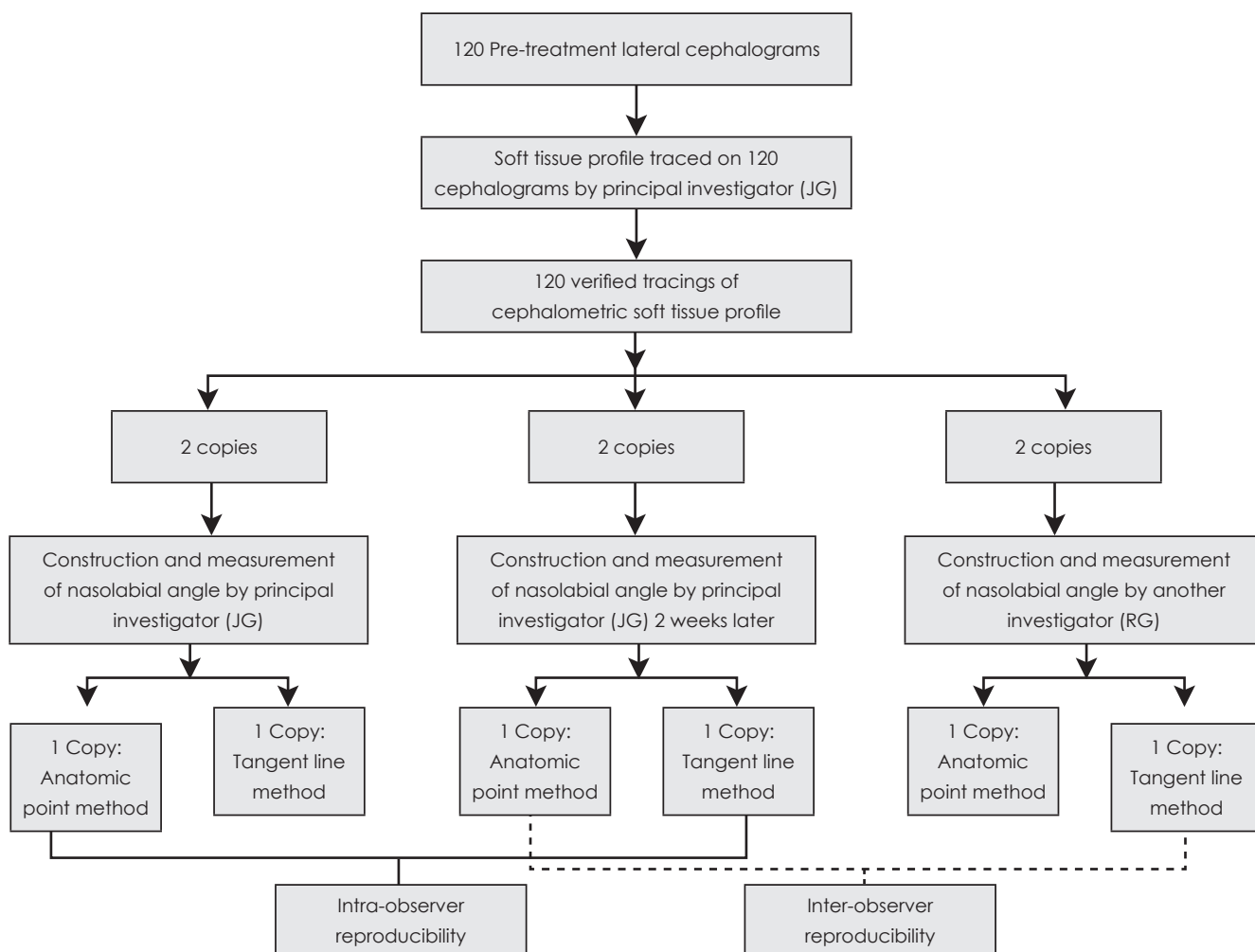


Figure 1: Flow diagram depicting the methodology used

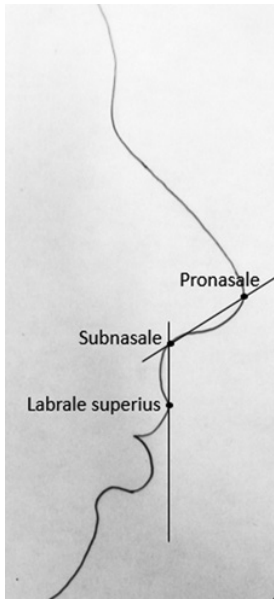


Figure 2: Anatomic point method of construction of nasolabial angle

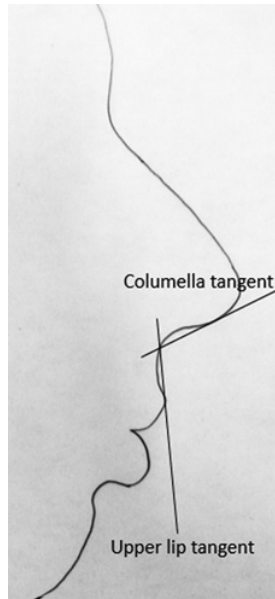


Figure 3: Tangent line method of construction of nasolabial angle

RESULT

The mean age of the samples was 21.11 ± 3.57 years. Likewise, the average nasolabial angle values for anatomic point method and tangent line method were found to be $94.32^\circ \pm 14.05^\circ$ and $92.4^\circ \pm 14.59^\circ$ respectively. This difference was not statistically significant. The intra-class correlation coefficient (ICC) demonstrated excellent intra-observer and inter-observer agreement among the two methods of nasolabial angle construction (Table 1,2).

DISCUSSION

Achievement of esthetically pleasing and balanced face is the primary goal of soft tissue driven orthodontic treatment.¹¹ However, accurate quantification of soft tissue profile on lateral cephalogram is a cumbersome task because soft tissue profile is made up of numerous curved lines which have to be converted into straight lines for measuring angles. This process of transforming curves into straight lines could vary with person and time making it less reproducible.¹² The nasolabial angle is no exception. This angle is formed by two straight lines in the nasolabial region of soft tissue profile, one from the columella of the nose and the other from the upper lip.¹³ These two lines can be constructed using anatomic landmarks or by drawing tangents to the soft tissue contours of nose and upper lip.

Cephalometric analysis which is used for orthodontic diagnosis and treatment planning is not foolproof. Human errors can creep which may jeopardise the accuracy, reproducibility and even validity of the cephalometric measurements.¹⁴ So in an attempt to minimize errors, 6 copies of original tracing were made using photocopy machine instead of tracing each of

Table 1: Intra-observer agreement for anatomic point and tangent line methods of nasolabial angle construction

Method used	ICC value	Strength of agreement
Anatomic point method	0.986	Excellent
Tangent line method	0.992	Excellent

Table 2: Inter-observer agreement for anatomic point and tangent line methods of nasolabial angle construction

Method used	ICC value	Strength of agreement
Anatomic point method	0.998	Excellent
Tangent line method	0.882	Excellent

them. Also, hand tracing was preferred over digital tracing even though studies have shown no clinically significant difference between the two methods because hand tracing is all-time gold standard.^{15,16}

In reviewing the literature, no study was found which compared the reproducibility of nasolabial angle construction by anatomic point method and tangent line method alone. However, two studies were found which assessed the reproducibility of angular measurements of soft tissue profile with nasolabial angle as one of the components using the two methods.^{12,17}

This study found excellent inter-observer reproducibilities of the anatomic point method and tangent line method of nasolabial angle construction. However, these findings are in contrary to the findings of Garg¹⁷ and Hwang *et al*¹² who have reported greater interobserver reproducibility with anatomic point method of nasolabial angle construction. This discrepancy in results could be attributed to differences in methods of drawing tangent lines for nasolabial angle construction. This study used the method described by Scheideman *et al*⁶ whereas Garg¹⁷ and Hwang *et al*¹² had followed the method given by McNamara *et al*.¹⁸ It is possible to hypothesise that the method of Scheideman *et al*⁶ has greater reproducibility than McNamara *et al*.¹⁸ However, a further study with more focus on tangent line method of nasolabial angle construction is needed to validate this hypothesis.

This study also demonstrated excellent intra-observer reproducibilities of the anatomic point method and tangent line method of nasolabial angle construction when assessed within 2 weeks of initial construction and measurement in 120 lateral cephalograms. These findings are in agreement with Garg's findings¹⁷ which showed no advantage of anatomic point method over tangent line method as far as intra-observer reproducibility was concerned. It is somewhat surprising given that the Garg's study¹⁷ had shown poor inter-observer reproducibility of tangent line method. The reason

for this is not clear but it may have something to do with small sample size of just 40 samples. In contrary, Hwang *et al*¹² reported greater intra-observer reproducibility with anatomic point method of nasolabial angle construction over tangent line method.

The mean difference between the nasolabial angle values constructed using anatomic point method and tangent line method was 1.92°. This was found to be statistically insignificant. Furthermore, any cephalometric measurement difference less than 2° is considered clinically insignificant.¹⁹ It can thus be suggested that either of the two methods could be used for cephalometric analysis. However, it would be prudent to

specify the method of nasolabial angle construction along with its value in orthodontic practice.

CONCLUSION

Both anatomic point method and tangent line method of nasolabial angle construction have excellent reproducibility in terms of intra-observer and inter-observer agreement. Also, there is no significant difference between the average values of the nasolabial angle constructed by the two methods. Hence, either of the two methods can be used for nasolabial angle construction during cephalometric soft tissue analysis.



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