Cephalometric norms for the Vietnamese population

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Abstract

Objectives: This study aims to define some oro-facial indexes and measurement of Vietnamese people aged 18-25 on cephalometric films using Steiner analysis to establish specific data resources in order to apply in treatment, esthetics, forensic recognition, anthropometrics and labour safety products. **Methods:** Comparative study. **Results:** To compare with Caucasian people regarding to skeletal-dental relationship, Vietnamese are likely to have more protrusive maxilla and mandibles. This indicates difference in oro-facial structure between Vietnamese and Caucasian people. **Conclusion:** Standards of one racial group could not be used without modification for other racial groups, and each different racial group would have to be treated according to its individual characteristics.

Key words: Cephalometric, normal occlusion, Vietnamese

INTRODUCTION

Roentgenographic cephalometrics was first introduced to study craniofacial growth and development. Later on, it was used to study facial form and its use gradually extended to the development of cephalometric norms to define the objectives of orthodontic treatment. The introduction of the cephalometer then provided avenues for creation of cephalometric analysis for clinical diagnosis and treatment planning and soon the cephalogram became an indispensable weapon in the armory of an orthodontist for correct diagnosis, treatment planning, prognostic evaluation, and comparative studies. The cephalometric norms for the Caucasians, for many decades, were being applied on the population groups worldwide. However, with time, many investigators concluded that there was variation of the craniofacial morphology between different ethnic groups.[1,2]

Thus, it became apparent that the widely studied Caucasian norms which were established using various cephalometric analyses were not sufficient to apply to different racial or ethnic groups' cephalometric studies on different ethnic groups including those of Chan's on Chinese, Garcia's on Mexican-Americans,[3] and Connor et al.'s on American black patients.[4] Studies by Cooke and Wei and Yeong and Huggare on Chinese,[5,6] Enlow et al. analysis of Black and Caucasian craniofacial patterns,[7] Bacon et al. on African Bantu and a Caucasoid population,[8] Hamdan and Rock on an Arabic population,[9] Alcalde et al. and Engel and Spolter and Miura et al. on Japanese,[10-12] Drummond et al. on Negroes[13] and Park et al.,[14] and Hwang et al.[15] on Korean adults had indicated that normal measurements of one group cannot be considered normal for other racial groups. Investigators such as Miura and Alcalde et al. in Japan[13] and Carlos J Garcia in the USA had established their norms on the basis of Steiner's analysis. The first cephalometric study on the Indian population was done by Kotak[16] on Gujarati girls and thereafter Nanda[17] and John et al.[18] had done cephalometric studies on various population groups of India.[19]

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However, till date, no study has been conducted on the population of Vietnamese. The Vietnamese are an East Asian ethnic group originating from present-day northern Vietnam and southern China. They are the majority ethnic group of Vietnam, comprising 86% of the population at the 1999 census. Although geographically and linguistically labeled as Southeast Asians, long periods of Chinese domination and influence have placed the Vietnamese culturally closer to East Asians, or more specifically their immediate northern neighbours, the Southern Chinese and other tribes within South China. The unique ethnicity of the Vietnamese mandates separate indicators and norms for applications in forensics, cosmetic surgery and research. It was therefore thought pertinent to undertake such a study for a young population of Vietnamese and observe various hard tissue cephalometric values by means of Steiner's analysis with a view to use these established norms in clinical practice.

Aim and objectives

The following objectives are accomplished by this study.
1. Establishment of skeletal and dental parameters for Vietnamese young adults using Steiner's analysis[2]
2. Evaluation of variability between male and female Vietnamese normal occlusion[20] cases
3. Comparison of cephalometric norms of Vietnamese population the Caucasians and other groups. Finally, all the measurements are computed statistically.

MATERIALS AND METHODS

The material for this study consisted of standardized lateral head roentgenograms of 30 Vietnamese young boys and 30 girls residing in the School of Odonto-Stomatology, Ha Noi Medicine University, Vietnam. They were selected as per the following criteria.
1. A normal acceptable and pleasing profile, 18–25 years of age, normal occlusion[20] with full complement of erupted teeth up to the second molar in proper intercuspation
2. No history of orthodontic treatment, gross carious lesion, and periodontal disease and no history of facial trauma.

A panel was formed to check the samples required for the study and they gave their consent regarding the fulfillment of the criteria of the samples. The study objective and methods were approved by the University ethical committee.

Landmarks used in the study

- Angular measurements: Angle SNA, SNB, ANB, SND, maxillary I to NA. Mandibular I to NB, maxillary I to mandibular I, occlusal plane to SN, and Go-Gn to SN
- Linear measurements (mm): Maxillary I to NA line, mandibular I to NB line, Pog to NB line, SL line, and SE line [Figure 1].

The patient's head was positioned in the PantOs 16 XP roentgenographic cephalostat maintaining a target-film distance of 5 feet or 152.4 cm. The X-ray film plate which is enclosed in a light-tight cassette was positioned parallel to the midsagittal plane of the patient such that the X-ray beam was directed perpendicular to it. The ear rods were used to stabilize the head in a vertical plane. The patient's head was positioned so that the Frankfort Horizontal plane would be parallel to the floor and was instructed to look straight and maintain a relaxed posture with teeth in centric occlusion during the exposure of the films.[21]

The lateral cephalogram was traced upon an A4 size acetate matte tracing sheet with a 3HB pencil over a well-illuminated viewing screen. Each cephalogram was traced twice and the average measurement is taken into account to minimize the error.[22]

The linear measurements were recorded with a measuring scale up to 0.05mm correction. The angular measurements were recorded with a protractor up to 0.05 mm correction. Statistical calculations performed included mean, standard deviation (SD), standard error, Student's *t*-test for each parameter. Statistical comparisons were done by the *t*-test and Pearson's test for reproducibility of values of these variables.

The mean values of this study had been compared with the Steiner's norms for Caucasian cases. By these data, a complete chart of the Steiner's analysis was established for young Vietnamese adult population [Figures 2 and 3].

RESULTS

The study sample size was found to be adequate for statistical analysis. The measurements were repeated by 2 seperate authors and the intra examiner variability was found to be statistically insignificant. The results are shown in Tables 1-3.
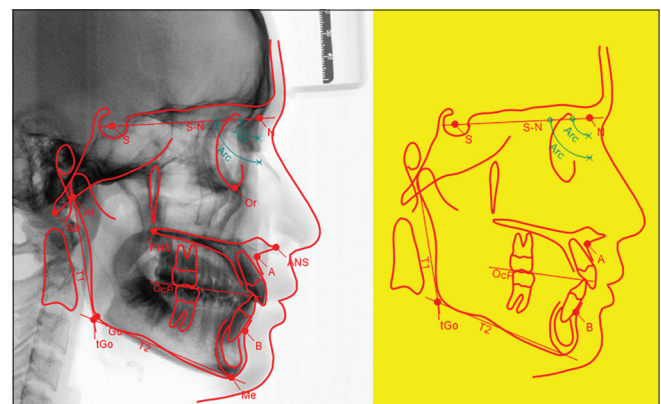

Figure 1: Hard and soft tissue analysis

Table 1: Comparative statistical evaluation of Steiner's norms and the present study

Parameters	Caucasian norms	Vietnamese sample (*n*=60) statistical evaluation				
		Mean	Standard deviation	Standard error	*t*	*P*
SNA°	82	84.4	3.065	0.48	6.76	<0.05
SNB°	80	81.3	3.1	0.53	4.67	<0.05
ANB°	2	2.9	1.32	0.21	5.94	<0.001
SND°	76	77.9	2.98	0.45	7.22	<0.001
SN-GoGn°	32	26.5	4.55	0.67	9.15	<0.001
Sn-Occ°	14	13.2	3.76	0.54	22.5	<0.001
I to NA°	22	24.8	5.24	0.91	4.83	<0.001
I to NB°	25	29.1	6.09	1.04	5.68	<0.001
I/i	131	122.6	8.35	1.32	8.05	<0.001
I to NA (mm)	4	4.2	1.74	0.32	0.5	NS
I to NB (mm)	4	4.7	2.07	0.38	2.63	<0.05
SE (mm)	22	20.8	2.51	0.41	2.34	<0.05
SL (mm)	51	53.0	3.79	0.46	2.71	<0.05
Pog-NB (mm)		2.4	1.33 (mentioned as 1.73 in table 2)	0.29		

NS – Not significant (*P*>0.05); *P*<0.05 – Significant at 5% level; *P*<0.01 – Significant at 1% level; *P*<0.001 – Significant at 0.1% level

Table 2: Comparisons of the mean angular and linear parameters between male and female Vietnamese cases

Parameters	Male			Female			Significance	
	Average	Standard deviation	Standard error	Average	Standard deviation	Standard error	*t*	*P*
SNA°	84.67	3.24	0.54	84.03	2.89	0.41	0.95	NS
SNB°	81.24	3.34	0.58	81.34	2.86	0.48	0.24	NS
ANB°	3.29	1.27	0.18	2.45	1.36	0.24	2.05	<0.05
SND°	78.46	3.05	0.43	77.41	2.91	0.47	0.04	NS
SN-GoGn°	26.13	3.68	0.47	26.82	5.42	0.87	0.61	NS
Sn-Occ°	12.64	3.51	0.42	13.73	4.01	0.65	1.67	<0.05
I to NA°	25.3	4.51	0.8	24.36	5.96	1.01	0.70	NS
I to NB°	29.74	6.04	1.03	28.42	6.13	1.04	0.91	NS
I/i	121.3	7.58	1.21	123.98	9.11	1.43	1.17	NS
I to NA (mm)	4.23	1.89	0.31	4.12	1.59	0.32	0.33	NS
I to NB (mm)	5.14	1.88	0.35	4.31	2.26	0.40	1.82	<0.05
SE (mm)	22.16	3.38	0.46	19.39	1.64	0.35	3.83	<0.001
SL (mm)	54.36	5.22	0.73	51.67	2.36	0.18	3.18	<0.01
Pog-NB (mm)	2.71	1.24	0.23	2.10	2.22	0.35	1.47	NS

NS – Not significant (*P*>0.05); *P*<0.05 – Significant at 5% level; *P*<0.01 – Significant at 1% level; *P*<0.001 – Significant at 0.1% level

Figure 2: Photograph showing cephalometric head plate

Figure 3: The subject was instructed to look straight and maintain a relaxed posture with teeth in centric occlusion during the exposure of the films

Table 3: Comparison of cephalometric values of present study (Vietnamese population), with Caucasians, Japanese, Koreans, Indians, and Mexican Americans using Steiner's reference norms

Cephalometric analysis	Caucasian Steiner	Present study (Vietnamese population)	Japanese	Korean	Mexican-American	India[23]
SNA°	82	84.4	81.3	81.15	83.6	84.14
SNB°	80	81.3	76.8	78.7	80.8	81.85
ANB°	2	2.9	4.5	2.5	2.8	2.27
SND°	76	77.9	73.4	75.8	77.3	79.36
SN-GoGn°	32	26.5	36.2	33.4	31.1	27.91
Sn-Occ°	14	13.2	20	16.9	15.8	11.79
I to NA°	22	24.8	24.1	23.4	20.5	27.44
I to NB°	25	29.1	31.2	27.4	26.7	30.75
I/i	131	122.6	120.3	126.55	130	119.69
I to NA (mm)	4	4.2	5.9	7	5.5	7.46
I to NB (mm)	4	4.7	7.8	7.2	5.7	7.5
SE (mm)	22	20.8	21		21.3	21.46
SL (mm)	51	53.0	41.1		53.9	59.66
Pog-NB (mm)		2.4	0.43	1.8	0.9	1.06

The mean for the various cephalometric values of Steiner's analysis. Present study – Mean values for 60 Vietnamese samples; Japanese – Mean values for 90 samples; Mexican Americans – Mean values for 59 samples; Indians – Mean values for 50 samples; Koreans – Mean values for 80 samples

DISCUSSION

The present study tries to establish a norm or standard for the skeletal and dental pattern of Vietnamese young adults according to the Steiner's analysis. The results were compared with the Steiner's norm for the Caucasians. Cephalometerically, nine angular and five linear measurements were used by Steiner. The Steiner's have been taken from Cecil C. Steiner's original article "Cephalometrics for you and me" published in the American Journal of Orthodontics, October (1953). The present study revealed that the mean values for the Vietnamese sample were significantly different in all measurable values from the means of Steiner's analysis of Caucasians.

Skeletal

Evaluating angle SNA and SNB, it is interesting to note that the maxillary and the mandibular apical base in the Vietnamese population were more prognathic ($P < 0.05$) when compared to Caucasians. However, there was no statistically significant difference between male and female Vietnamese population.

Angle ANB which is the most common indicator to determine the relative positions of the upper and lower jaws to each other showed an increased value than the Caucasians which meant a greater tendency toward bialveolar protrusion ($P < 0.001$). There was significant difference in the ANB value between male and female Vietnamese cases ($P < 0.05$).

The mean value of angle SND was more in Vietnamese cases indicating that the position of the center of the symphysis was placed more forward than the Caucasian sample. On comparison between male and female

Vietnamese cases, it was seen that there was no significant difference between them.

The mandibular plane to the cranial base plane of Vietnamese adults revealed that the angle was smaller than the Steiner's norm. From this study, it can be said that the Vietnamese group pattern exhibited a more horizontal growth pattern than that of Caucasians. The study recorded that there was no significant difference in the mean values between the boys and girls.

Vietnamese population showed a lesser inclination of occlusal plane than the Caucasians ($P < 0.001$) and this study also exhibited marked variation between male and female cases.

Dental

The dental measurements except for the linear value of maxillary I to NA, rest of the parameters were significantly different. Angle I to NA and mandibular I to NB (both angular and linear) recorded a greater value for the Vietnamese cases. These findings along with a more acute interincisal angle of the Vietnamese young adults demonstrated the fact that the upper and lower incisors of Vietnamese cases were more protruded when compared with that of Caucasian cases. Relating to angle comparison between male and female cases, there was only statistically significant difference in linear measurement of mandibular I to NB. No difference was found in other parameters, such as Angle I to NA (angular and linear), Angle I to NB, angle I to I, Angle I to NA (linear).

This study also suggested wide divergence in the SE distance in the Vietnamese population. Mean SE distance was less than that of Steiner's value as well as that of other researches. This study also depicted that the anteroposterior length of the mandible in relation to the cranial base was larger

in Vietnamese sample than Caucasians. Both SL and SE distance depicted a statistically significant difference between male and female cases with a value of $P < 0.001$, respectively.

In Vietnamese samples, the mean value of bony chin position in relation to the NB plane (Pog to NB) was 2.4 mm, with an SD of $\pm$ 1.33 mm. Steiner remarked that this value was less important because the pogonion was influenced greatly by growth. Hence, he did not establish any reference norm for this parameter. There was statistically no significant difference between the male (2.71 mm $\pm$ 1.24 mm) and female (2.10 mm $\pm$ 2.22 mm) Vietnamese cases.

SUMMARY AND CONCLUSION

From the current study, it is evident that in the Vietnamese population with so-called well-balanced faces, there are some fundamental variations in the craniofacial structure of Vietnamese when compared with Steiner's norms. These should be established to serve in the diagnosis and treatment of the Vietnamese patients. The results of the present study also support the view that a single standard of facial esthetics should not be supplied to all racial and ethnic groups. The following differences and similarities were demonstrated in the Vietnamese samples as compared to the Caucasians:

1. The anteroposterior position of the apical base of the maxilla and mandible in relation to the anterior cranial base was more anteriorly placed or prognathic as compared to the Caucasians. An increased ANB angle indicated a greater tendency toward bialveolar protrusion
2. The angular relationship of the mandibular plane in relation to the cranial base plane (SN-GoGn angle) was smaller which was suggestive of a strong horizontal growth pattern in the Vietnamese
3. The Vietnamese population, in terms of skeletal-dental correlation, has a tendency of protrusion when compared to Caucasian people
4. The study suggested wide divergence of the SE and SL distance in the Vietnamese population when compared to the Caucasians.

The study concluded that most of the cephalometric measurements of the Vietnamese cases were significantly different from the Steiner's norms and also from other ethnic groups because the various published methods represent population averages; it is important to consider each patient's treatment goals and needs during evaluation and treatment planning.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflicts of interest
There are no conflicts of interest.

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