

Cephalometric Value of Batak Ethnic

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Abstract—Cephalometry is an essential diagnostic tool to obtain cranial radiograph that is necessary in complex assessment of cranium and orofacial. The cephalometric value is necessary in establishing a diagnosis and developing a comprehensive treatment plan. The standard cephalometric value could not be applied in various racial and ethnic groups, and thus, further research is required to obtain normal cephalometric value of various ethnic and race. The objective of the study is to obtain normal cephalometric value of skeletal, dental and soft tissue in Batak ethnic and to determine difference in between gender. This is an analytic observational study. The subjects of the study are 100 participants (18 males and 82 females) of Batak ethnic, whom lateral cephalometry and its analysis is performed on. The study shows that most male participants have more prognathic maxilla and mandible and more protruded upper and lower incisors compared to that of female participants. There is no significant difference on all variables of measurement of skeletal, dental and soft tissue in both male and female participants. The normal cephalometric value specifically differs in each ethnic and gender, and provides a useful tool in establishing a diagnosis and developing orthodontic treatment plan.

Keywords—Batak ethnic, diagnosis, lateral cephalometric

I. INTRODUCTION

Since its introduction in 1931 by Broadbent and Hofrath in America and Germany, cephalometric radiography has become an essential tool for clinical use and a useful tool for orthodontic research. A normal cephalometric value is helpful for orthodontists in diagnosing and developing a good orthodontic treatment plan. As the standard value of cephalometry is mostly based on Caucasian ethnicity originated from European, it is sometimes not suitable to be applied on various race and ethnic groups [1,2,3].

Cephalometry is helpful to determine its mean value, shape and variation in various populations, hence, a proper tool to analyze dentofacial variation in making a diagnosis and suitable treatment plan. [4]. The normal value of cephalometry could not be applied on every patient as racial and interracial characteristics may differ. Thus, cephalometric standard of various ethnic groups is highly needed [3].

Nysen proposed that the Indonesian population is comprised by 3 ethnic groups, i.e. Eastern (Southern Mongolian area) origin, Western (Australia) origin and Meridional (African) origin. Fisher divided the physical

traits of Indonesian population to 2 groups, i.e. Deutro-Malay and Proto-Malay. Deutro-Malays are native peoples of Aceh, Minangkabau, coastal Sumatera, Rejang Lebong, Lampung, Jawa Madura, Bali, Bugis, coastal Manado, the eastern Sunda and Malayu. Proto-Malays are native peoples of Batak, Gayo, Sasak and Toraja, while the peoples of Jakarta (Betawi), Borneo Malayu, Banjar and coastal Sulawesi are combination of Deutro and Proto-Malays [5].

The research of Munandar on the deutro-malays found that Indonesians have a more convex face and facial growth patterns are more vertical than Caucasian [7].

The objective of the study is to determine the normal cephalometric value of skeletal, dental and soft tissue in Batak ethnic based on gender.

II. MATERIALS AND METHODS

The subjects of the study are 100 participants of Batak ethnic (82 female and 18 male subjects), selected based on the criteria of inclusion, i.e. male and female of Batak ethnic, both parents and grandparents are of Batak ethnic (two generations of Batak ethnic), 18-25 years old, complete permanent dentition excluding third molar, no caries/proximal restoration or prostheses, no history of orthodontic treatment, crowded and mild diastema, Class I Angle first molar relationships, and normal overjet and overbite (2-4 mm).

Clinical examination was performed to determine occlusal status of subjects, and subjects with Class I Angle molar relationship were selected. Then, three researchers performed overjet, overbite, crowded and diastema relationship. The informed consent of the study is obtained from the Health Research ethical committee (Medical Faculty of Universitas Sumatera Utara/H. Adam Malik General Hospital).

Lateral cephalometry is performed on every subjects using cephalostat Cranex Excel ceph in Pramita Laboratory. All cephalometry images were obtained in natural head position, in centric occlusion, and relaxed lip position. All images are of the same standard and magnification.

Lateral cephalogram is manually hand traced by one of the researchers and the anatomic landmark is identified and re-checked by other two researchers, then re-measured twice by two other researchers. Intra-observer validity is then performed to ensure no different measurement results between first and second

researchers. The cephalometric landmarks and measurement variables in the study can be observed in Table I and Figure I.

TABLE I. CEPHALOMETRIC VARIABLES MEASURED

Variables	Definition
Skeletal	
SNA	Angle between Sella-Nasion and Nasion – A point
SNB	Angle between Sella-Nasion and Nasion – B point
ANB	Angle point A-N- point B
NaPog	Angle between N-point A-pogonion
MP-SN	Angle between mandibular plane to SN plane
NS-Gn	Angle between SN plane and SGn plane
Dental	
U1-SN	Angle formed between upper incisor axis and SN plane
L1-MP	Angle formed between lower incisor axis and MP plane
U1-NA	Distance from upper incisor edge to NA
U1-APog	Distance from upper incisor edge to APog
L1-NB	Distance from lower incisor edge to NB
Soft Tissue	
E line-Ls	Distance from Pn-Pog' to labrale superius
E line-Li	Distance from Pn-Pog' to labrale inferius
S line-Ls	Distance from soft tissue pogonion to the midpoint of the S-shaped curve between subnasale and nasal tip to labrale superius
S line-Li	Distance from soft tissue pogonion to the midpoint of the S-shaped curve between subnasale and nasal tip to labrale inferius
Merrifield's Z angle	Angle formed by the intersection of Frankfort horizontal (FH) and a line connecting the soft tissue chin (Pog') and the most protrusive lip point

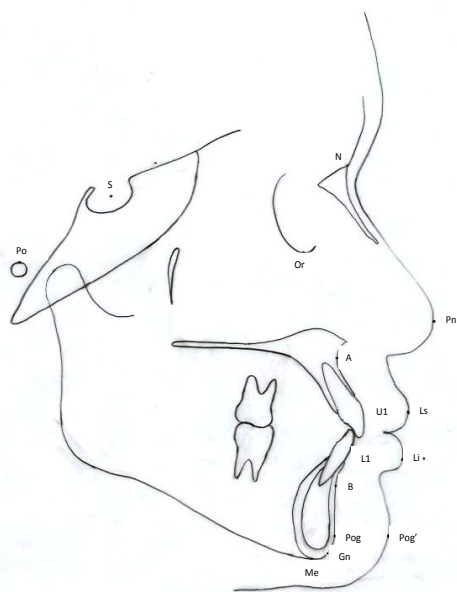


Figure 1. The cephalometric landmarks used in this study. S, Sella; N, nasion; Or, orbitale; Po, porion; A, point A; B, point B; Pog, pogonion; Me, menton; Gn, gnathion; U1, Upper incisor ; L1, Lower incisor; Pn, Pronasal; Ls, labrale superius; Li, labrale inferius; Pog', soft tissue pogonion.

Descriptive statistics were computed for each cephalometric variable using the SPSS. Descriptive statistic analysis for skeletal, dental and soft tissue measurements on male and female subjects of Batak

ethnic is performed after data normality test with Kolmogorov-Smirnov test. Independent t-test is then performed to determine the difference between genders.

III. RESULTS

The study includes 18 male and 82 female subjects of Batak ethnic, aged 18-25 years old. The comparison of descriptive statistic data and t-test result of skeletal cephalometry measurement can be observed in Table II. There is no significant difference in measurements of SNA, SNB, NaPog, and MP:SN and NSGn on both groups.

TABLE II. THE COMPARISON OF DESCRIPTIVE STATISTICS DATA DAN T-TEST RESULT OF SKELETAL CEPHALOMETRY MEASUREMENT

Variables	Male, n= 18			Female, n= 82			p-value
	Mean	SD	95% CI	Mean	SD	95 % CI	
SNA (°)	83.05	2.38	81.87-84.24	82.56	2.35	82.05-83.08	p>0.05
SNB (°)	80.86	2.15	79.98-81.93	80.35	2.71	79.75-80.95	p>0.05
ANB (°)	2.08	1.51	1.32-2.83	2.21	1.38	1.90-2.51	p>0.05
NaPog (°)	3.97	3.37	2.29-5.64	5.19	3.76	4.36-6.02	p>0.05
MP – SN(°)	30.44	5.18	27.86-33.02	30.89	5.97	29.57-32.20	p>0.05
NSGn (°)	68.33	3.06	66.80-69.85	68.13	3.15	67.44-68.82	p>0.05

Table III shows comparison of descriptive statistic and t-test result of dental cephalometry measurement of Batak ethnic. There is no significant difference in all dental measurements of male and female subjects (p<0.05).

Table IV shows comparison of descriptive statistic and t-test result of soft tissue cephalometry measurement of Batak ethnic. There is no significant difference in all dental measurements of male and female groups.

TABLE III. COMPARISON OF DESCRIPTIVE STATISTIC AND T-TEST RESULT OF DENTAL CEPHALOMETRY MEASUREMENT OF BATAK ETHNIC

Variables	Male, n= 18			Female, n= 82			p-value
	Mean	SD	95% CI	Mean	SD	95 % CI	
U1 : L1 (°)	119.55	9.66	114.74-124.36	122.48	9.61	120.37-124.59	p>0.05
U1 : SN (°)	110.38	8.04	106.38-114.38	108.03	5.80	106.76-109.31	p>0.05
L1 : MP (°)	100.75	6.39	97.56-103.93	100.07	7.86	98.35-101.80	p>0.05
U1-NA(mm)	7.27	3.07	5.74-8.80	6.91	2.47	6.37-7.45	p>0.05
U1-APog (mm)	9.16	3.13	7.60-10.72	8.39	2.38	7.86-8.91	p>0.05
L1 – NB (mm)	8.11	2.74	6.74-9.47	7.03	2.37	6.51-7.55	p>0.05

TABLE IV. COMPARISON OF DESCRIPTIVE STATISTIC AND T-TEST RESULT OF DENTAL CEPHALOMETRY MEASUREMENT OF BATAK ETHNIC

Variables	Male, n= 18			Female, n= 82			p-value
	Mean	SD	95% CI	Mean	SD	95 % CI	
E line-Ls (mm)	-0.16	3.02	-1.67-1.33	-0.65	2.56	-1.22--0.09	p>0.05
E line-Li (mm)	1.91	3.55	0.14-3.68	0.74	2.58	0.17-1.31	p>0.05
S line-Ls (mm)	4.50	3.13	2.94-6.05	2.81	2.03	2.36-3.25	p>0.05
S line-Li (mm)	4.63	2.92	3.18-6.09	3.12	2.08	2.66-3.58	p>0.05
Z Angle (°)	72.72	6.00	69.73-75.70	74.73	4.94	73.65-75.82	p>0.05

IV. DISCUSSION

The study aims to obtain a normal cephalometric value of skeletal, dental and soft tissue by evaluating subjects of Batak ethnic with no orthodontic history, normal occlusion and balanced lateral profile. The selection of suitable inclusion criteria is needed to create normal value that is essential in making diagnosis and orthodontic treatment plan for Batak ethnic.

To prevent bias in the study, the manually hand traced lateral cephalometry images were re-identified and re-check by two other researchers, and measurements were re-performed by two other researchers. The intra observer validity was then performed to ensure no different measurement results between the first and second researchers. The study results were shown by the interval confidence of 95% and mean of measurement variable and standard deviation. The difference between gender was tested with t-test and significance level of $p < 0.05$.

Fisher divided the Indonesian population to two groups based on physical traits, i.e. Deutro-Malay, and Proto-Malay. The Proto-Malay consists of Batak, Gayo, Sasak and Toraja [5]. The Batak ethnic is comprised of several tribes, i.e. Batak Toba, Batak Karo, Batak Pakpak, Batak Simalungun, Batak Angkola, and Batak Mandailing. The subjects of this study originated from several different cities in North Sumatera, but all subjects are of Batak descendants.

In skeletal measurements (Table III), the male subject shows more prognathic maxilla, as well as mandible, compared to female subjects, but no significant difference was found. This study is consistent with the study of Purmal et al on the normal cephalometric values of adult Malaysian Indian where no significant difference on SNA, SNB were found in both gender [6]. This study related to the research of Kim J et al where there is no significant difference in sexes on the measurement of SNA, SNB and ANB [2]. This is different to Gu Y, there is no significant difference in SNA, but SNB is significantly different in Chinese and Caucasian ethnic in female and male [8].

The result of this study is also similar to that of Gu Y et al on Caucasoid race where SNA and SNB value was found higher on males compared to that of females, but ANB value was found higher on females. Based on gender, no significant difference on SNA value was found, but significant difference of SNB and ANB can

be observed [8]. This study differs from Salama el et al that in the study there are significant differences in SNA, SNB in Sudan ethnic, but ANB did not differ significantly on gender [9].

There is no significant difference between genders on facial convexity measurements. The facial convexity of female subjects is higher compared to that of male subjects. This is not consistent to the study of Abu Tayem et al in Emirates adults, where male subjects had higher convexity of facial profile compared to female subjects. Similarly, rotation of mandible reveals no significant difference between genders, where female subjects show higher value compared to male subjects [1]. This is similar to the study of Bishara on Caucasoid race, where normal value was 33° in females and 28° in males [10]. This study is similar to the Kim J et al; there is no significant difference between genders on measurement MP:SN on Korean and Mongolian race [2].

In facial growth pattern, no significant difference was found on gender, where NSGn value is 68.33° in males, and 68.13° in females. This is similar to the study of Bishara, where value in males was 67° and in females was 68° [10].

Based on dental measurements, male subjects show more protrusive incisors compared to female subjects (U1-SN, L1-MP, U1-NA, U1-APog and L1-NB) but no significant difference was found. This is consistent to the study of Abu Tayem et al, where male subjects showed more protrusive incisor compared to female subjects [1]. This result consistent to the study of Gu Y et al, there is no significantly different on dental measurement on both sexes of Chinese and Caucasian [8].

For soft tissue measurements, no significant difference is found between genders. In the relationship of upper and lower lip to the esthetic line, lower lip line is more protrusive than upper lip line on both genders. In the relationship of lip position to S line, upper and lower lip is relatively more protrusive on both gender, but no significant difference is found. This is similar to the Munandar et al, that the central incisor position against the A Pog line of the deutro-malays is more advanced than the Caucasian [7].

This is also similar to the Kim J et al research where on the measurement of dental and soft tissue was not significantly different in male and female [2]. This result similar to Miyajima et al [11] and Basciftci et al [12] who did not found dental and soft tissue on gender in Japanese and Anatolian Turkish adult [11]. No significant differences in Esthetic line to labrale superior in Chinese and Caucasian male and female but in Esthetic line to labrale inferior Caucasian is significantly different [8].

In measurements on Z angle, male and female reveal no significant difference. This is similar to the study of Abu Tayem et al, where Z line of female is higher than that of male, but no significant difference was found [1].

In this study, normal values of Batak ethnic based on gender are most maxilla and mandible of male subjects are more prognatic than that of female subjects, upper and lower incisors of male subjects are more protrusive than that of female subjects, and upper and lower lip position of male subjects are more protrusive than that of female subject

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