บทวิทยาการ
Original Article

A Comparison of Cephalometric Profiles of Young Adults from Northern Thailand and the UK
การเปรียบเทียบค่ากะโหลกศีรษะด้านข้างของคนไทยภาคเหนือและคนคอเคเซี่ยนในสหราชอาณาจักร

มารศรี ชัยวรวิทย์กุล
ภาควิชาทันตกรรมจัดฟัน คณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่
Marasri Chaiworawitkul
Department of Orthodontics, Faculty of Dentistry, Chiang Mai University

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บทคัดย่อ

การศึกษามีวัตถุประสงค์เพื่อหาค่ากะโหลกศีรษะด้านข้างของคนไทยภาคเหนือที่มีใบหน้าด้านข้างปกติและมีการสบฟันดีโดยธรรมชาติ และทำการเปรียบเทียบค่าดังกล่าวกับค่าของคนคอเคเซี่ยน ข้อมูลของการศึกษานี้ได้จากการวัดภาพรังสีศีรษะด้านข้างของกลุ่มตัวอย่างที่มีการเจริญเติบโตสูงสุดสิ้นสุดแล้ว จำนวน 70 คน (ชาย 35 คน หญิง 35 คน) ผลการวัดถูกนำมาคำนวณค่าทางสถิติและแสดงผลเป็นค่าเฉลี่ยและนำมาเปรียบเทียบกับค่าดังกล่าวของคนคอเคเซี่ยนในสหราชอาณาจักร การตรวจสอบความแตกต่างระหว่างเชื้อชาติและเพศอาศัย ที เทสส์ ผลการศึกษาแสดงให้เห็นว่าเชื้อชาติมีผลต่อความแตกต่างดังกล่าวมากกว่าเพศ โดยทั่วไป พบว่าคนไทยภาคเหนือมีค่าความสัมพันธ์ของกระดูกฐานขากรรไกรบนและล่างไม่ต่างจากค่าของคนคอเคเซี่ยน แต่มีความยื่นของส่วนกระดูกดังกล่าวเทียบกับกระดูกฐานศีรษะ สัดส่วนใบหน้าด้านล่างและการยื่นของฟันตัดบนและฟันตัดล่าง มากกว่า

คำไขรหัส: ค่ากะโหลกศีรษะด้านข้าง คนไทยภาคเหนือ การสบฟันปกติ

Abstract

The purposes of this study were to develop a cephalometric profile of Northern Thai adults, and to compare the measurements to those of Caucasian adults. Cephalograms of 70 subjects, 35 males and 35 females, were used as a study group. All samples had natural optimal occlusion and passed the active growth period. Eleven cephalometric measurements were assessed for the skeletal and dental values, both in sagittal and vertical planes. Results of the measurements were assessed statistically and evaluated in terms of means and standard deviations. Comparisons of those values between races and sexes were performed with a two-sample t-test.

There were differences found between races and between genders. When the overall findings were evaluated, it could be concluded that in general, Northern Thais have a prognathic maxilla and mandible, but a similar relative prognathism when compared to Caucacian norms. An increased lower face height and

bimaxillary dental protrusion were also seen in this group.

Key words: cephalometric norms, Northern Thais, natural optimal occlusion

Introduction

Cephalometric evaluation is used to obtain information for orthodontic diagnosis and treatment planning and also for monitoring progress and outcome of treatment. Since then cephalometry has been developed by many numbers of the orthodontic profession, including Drs Broadbent, Brodie, Downs, Adams, Reidel and Graber. Cephalograms are not an absolute diagnostic tool, but are, for the most part, circumferential evidence which should be accepted and coordinated with other data to make it useful[1,2,3].

Shalhoub *et al*[4] stated that (with exception of monozygotic twins) no two faces are alike. Differences are more marked in different ethnic groups. Additionally, Miura[5], Kowalski *et al*[6], Burstone *et al*[7] and Richardson[8], have demonstrated marked cephalometric differences between different ethnic or racial groups, Moreover, the right and left halves of any given face do not match perfectly, but show subtle differences. Many techniques have been created for cephalometric analysis. Mean or norm values of many races are also available for different racial assessments.

In the last decade, computerized cephalometry has been a great help in the assessment of craniofacial features and orthognatic surgery procedures. Whilst it can do nothing that the orthodontist can not do, given the time and adequate skills, it has however made analysis of data much simpler and quicker. The orthodontist or his assistant has ability to measure, record, evaluate, compare, organize, sort, store data and retrieve information for analysis. With the use of computer technology, the measurement is made and recorded by machines. The digital analogue converter virtually eliminates human error recording. In addition, the ability to transfer data to other media is great advantage. The opportunities of computer use are unquestioned when any phenomenon can be reduced to mathematical formation[9]

Cephalometric studies of various races had been reported; however, there was no a comparison of Thais and British values. The aim of this study were therefore not only to reveal cephalometric norms of Northern Thais, but also to find that profile.

Materials and Methods

Materials

The materials consisted of 70 lateral cephalograms, 35 males and 35 females, of Northern Thai subjects who were considered to have natural optimal occlusion and normal racial profile. All samples were of Northern Thai origin and determined as young adults, at age from 16 years old in males and 15 years old in females. The average age was 20.1 years old with a range of 16.3 to 25.7 years in males and 15.8 to 28.8 years in females. The lateral radiographs were collected by the staff of the Department of Orthodontics, Faculty of Dentistry, Chiang Mai University, Thailand with the examination of 6,817 subjects. British Published Data presented by Bhatia and Leighton[10] were used for the comparison. A final

selection of 35 females and 35 males with an average age of 20 years was made. The 70 subjects chosen were considered to have excellent occlusion and normal soft tissue function. Normal soft tissue function was considered to be more important than profile.

Methods

Particular landmarks known for their accuracy were selected for 11 measurements. The selection was based on simplicity and reproducibility of the identification of landmarks which are accepted by orthodontists in general. The referent points were identical with those used in the study of British samples by Bhatia and Leighton[10]. SN line was used to represent the anterior cranial base. A line connecting ANS and PNS represented the maxillary plane, whilst a line connecting Menton and Gonion represented the mandibular plane. In addition, the lower anterior face height proportion (LFH) was evaluated by the percentage of the anterior lower face height and the anterior total face height as the following formula.

$$\text{LFH (\%)} = \frac{\text{the length from Me perpendicular to the maxillary plane}}{\text{the total length from N and Me perpendicular to the maxillary plane}} \times 100$$

All cephalograms were traced and then digitised twice in order to reduce random errors. Only one operator was involved in this study. Digitisation was achieved with the Quick Ceph Image Pro™ version 2.0.

After traced images were stored on the computer, the reference points were digitised. Then measurements were then automatically calculated. The average of the replicated measurements was used for analysis and interpretation. In cases when the differences of the two values exceeded 0.5 mm, the measurements were repeated. The pair with the closest registrations was then used.

A two-sample t-test was undertaken to detect errors due to different methods used in this study and in the study by Bhatia and Leighton[10]. Errors of measurements were assessed using methods suggested by Houston[11] and Stirrups[12].

Results

The accuracy of all measurements was proved and results of the measurements are presented. Table 1 shows the results of the cephalometric analysis of the British published group and of the British sampled group with a comparison of the two groups by two-sample *t*-test. Angular measurements are expressed in degrees, linear measurements in millimetres and face height as a percentage.

Table 1 *Results of the cephalometric analysis of the British published group and of the British sampled group*

Variable	British published		British sampled		*t*-value	p-value
	Mean	SD	Mean	SD		
SNA	81.65	4.58	80.87	4.11	0.570	N/S*
SNB	79.80	4.54	78.81	3.90	0.741	N/S
ANB	1.80	2.15	1.89	1.47	-0.152	N/S
SN-Mx	8.25	2.62	8.46	3.63	-0.218	N/S
SN-Md	31.50	6.57	32.06	4.26	-0.315	N/S
MMPA	23.20	6.60	23.59	4.55	-0.215	N/S
LFH	53.90	1.91	54.14	2.32	-0.367	N/S
1-1 angle	128.75	10.94	130.29	8.74	-0.490	N/S
1-Mx	113.65	7.12	112.27	4.24	0.729	N/S
1-Md	94.20	7.99	93.72	9.89	0.174	N/S
1-APo	2.20	2.65	1.95	2.22	0.324	N/S
*N/S = p>0.05						

Results of cephalometric measurements of Northern Thais are shown in table 2. Angular, linear and face height measurements are revealed in the same pattern as in table 1.

Table 2 Results of cephalometric measurements of Northern Thais

Variable	Thai	
	Mean	SD
SNA	83.64	3.35
SNB	81.42	3.06
ANB	2.22	1.70
SN-Mx	9.30	2.98
SN-Md	31.40	4.46
MMPA	22.11	4.35
LFH	55.36	1.59
1-1 angle	122.21	6.77
1-Mx	118.14	5.44
1-Md	97.62	6.49
1-APo	4.83	2.09

A comparison of the cephalometric measurements of Northern Thai males and females was made by the use of a two-sample *t*-test. The results for differences between means of those two groups are presented in Table 3.

Table 3 Results of comparisons of the cephalometric measurements of Northern Thai males and females.

Variable	Thai Male		Thai Female		*t*-value	p-value
	Mean	SD	Mean	SD		
SNA	83.76	3.26	83.51	3.48	0.310	N/S*
SNB	81.75	3.17	81.08	2.96	0.914	N/S
ANB	2.01	1.66	2.43	1.74	-1.033	N/S
SN-Mx	8.66	2.43	9.94	3.37	-1.823	N/S
SN-Md	29.97	4.20	32.83	4.31	-2.812	< 0.01
MMPA	21.31	4.14	22.90	4.46	-1.546	N/S
LFH	55.54	1.55	55.17	1.63	0.973	N/S
1-1 angle	122.60	6.46	121.82	7.14	0.479	N/S
1 - Mx	117.32	5.66	118.96	5.17	-1.266	N/S
1-Md	98.78	4.03	96.45	8.15	1.516	N/S
1-APo	4.86	2.23	4.79	1.97	0.139	N/S
* N/S = p > 0.05						

Discussion

The study group in this observation comprised of Northern Thai males and females who were examined for excellent occlusion and normal soft tissue function. Seventy cephalogram were used for cephalometric measurement purposes. The skeleto-dental morphology of this ethnic group was presented in terms of means and standard deviation. No statistically significant differences of means of variables of the British published data and British sampled groups were found. Therefore, any conclusion that results from this study can be reasonably compared to those from the study by Bhatia and Leighton[10].

Variations in each variable were observed, especially in the angle of upper and lower incisors, the angle of upper incisor relative to the maxillary plane and the angle of lower incisor relative to the mandibular plane. Moreover, the variations in the angle of mandibular plane relative to the cranial base and the maxillary plane were greater than those in other skeletal measurements.

As with the British subjects, it is noticeable that standard deviations of values which related to mandibular plane (SN-Md and MMPA) or inclination of upper and/or lower incisor (1-1angle, 1-Mx, 1-Md) were high, indicating wide levels of variability. These could be observed in both males and females and the combined group. However, the variability expressed in Northern Thais was of narrower ranges. Errors in precision of identifying Gonion and the lower incisor apex, as well as the natural compensation mechanism, possibly generated these variations[13,14].

Value representing normal skeletodental features of Northern Thais found in this study are extremely closed to those presented in the studies of Chatkupt *et al*[15] and Jotikasthira[16]. For example, SNA, SNB, ANB and 1-1 angle were approximately 83.2, 81.4, 1.8 and 123 degrees respectively. However, noticeable differences between each value existed when compared to the norms presented by Suchato and Chaiwat[17], who

studied Thai subjects drawn from the central part of Thailand. In their study 84.2, 81.3, 2.9 and 124.7 degrees were presented for SNA, SNB, ANB and 1-1 angle respectively. These studies suggested that although, Central and Northern Thai faces looked similar to each other, a more prognathic maxilla was found in the first group, resulting greater ANB angle. The angle of maxilla relative to the cranial base was however greater in the second group, indicating a more posterior inclination of the maxilla. The differences within Thais have supported other intra-racial observation, such as those of Solow and Sarnas[18] and Trenouth *et al*[19].

Very little differences between genders were found in the Northern Thai sample in this study. However, the angle of the mandible relative to the cranial case (SN-Md) was greater in females than in males ($p < 0.01$). This agrees with the studies by Suchato and Chaiwat[17], Chatkupt *et al*[15] and Jotikasthira[16]. The smaller angle may indicate a more anterior inclination of the mandible in the males. Nevertheless, the *t*-tests failed to show a significant difference in other skeletal parts, for example, the less angle of the maxilla relative to the cranial base (SN-Mx) and the less angle of the mandibular relative to the maxilla (MMPA) in the male group. Patanaporn[20] compared Northern Thai males and females by Ricketts analysis and reported that skeletofacial morphology was clearly different between the genders. The means of anterior cranial length, Porion location, posterior face height and upper molar position to PTV were significantly higher in males. Since the measurements utilized in this study were different from those in this earlier study, any comparison could not be carried out. This controversial point therefore unresolved. Investigation into the skeletofacial morphology in all aspects should be useful.

Studies of skeletofacial morphology of different racial subjects with normal occlusions, normal orofacial functions and acceptable profiles have been undertaken. Differences between and within each ethic group in the skeletofacial morphology have been revealed. It is reasonable to believe that genetic control and environment factors influence skeletofacial growth. Genetic control clearly affects variations and between races. The environmental aspect is also an importance factor affecting variations in and between races. These result in variation of skeletofacial morphology. Dentition has been claimed as a buffer zone of different growth of the skeleton. A natural compensatory mechanism of the dental components exists to maintain a balanced relation of various skeletal parts. For instance, there are wide variations for incisor angulations are even greater between races.

Since the purpose of this and other research is to provide meaningful data for diagnosis and treatment, the results of any such study should be used carefully. In terms of cephalometric studies, one should consider the background of each study (such as aims, materials and methods) before applying the results into practice. Differences in race, age and sex should also be considered.

Conclusions

The present investigation has drawn the following conclusions.

1. Statistically significant differences between the young adult British and the young adult Northern Thai samples in both skeletal and dental measurements were found. Although there was no significant difference in the relative prognathism (ANB angle), the Northern Thai sample presented with a more prognathic maxilla (SNA) and mandible (SNB). No difference in vertical skeletal relationship was revealed. More proclined upper and lower incisors were discovered in the Northern Thais.

2. Hardly any differences between the young adult British males and the young adult Northern Thais males in skeletal features were found; only a greater angle of maxilla relative to the cranial base in the latter group. A smaller interincisal angle with the more proclined lower incisor was also found in the Northern Thai males.

3. Differences were found in the young adult British females and the young adult Northern Thai females. Greater prognathism of the maxilla and mandible were reported in the latter group. A smaller interincisal angle with more proclined upper incisor was also discovered in the Northern Thai females. Moreover, the position of lower incisor edge relative to APo line was more protruded in this sample, though no statistical difference in the inclination of the lower incisor was seen.

4. A difference between males and females was found in the young adult Northern Thai sample. The angle of the mandible relative to the cranial base was greater significantly in the females.

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ขอสำเนาบทความที่:

ผศ.ทพญ.มารศรี ชัยวรวิทย์กุล ภาควิชาทันตกรรมจัดฟัน คณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ อ.เมือง จ.เชียงใหม่ 50202

Reprint request:

Assist. Prof. Marasri Chaiworawitkul, Department of Orthodontics, Faculty of Dentistry, Chiang Mai University, Muang, Chiang Mai 50202.