

The wits appraisal in a Saudi population sample

Sahar F. Al-Barakati, BDS, MSc

اجريت الدرسة الحالية على ٦٠ شعاعية سيفالومترية لطلاب طب اسنان سعوديين (٣٠ طالب و ٣٠ طالبة) تتراوح اعمارهم من ٢٢-٢٣ سنة وذلك بغرض ايجاد معايير حسب طريقة ويتس، ولقارنة نتائج هذه الدرسة مع دراسات مماثلة تم اجراؤها على مجموعات عرقية أخرى. تم اختيار الحالات طبقا للمعايير التالية: علاقة صنف واحد للأرحاء والقواطع مع منظر جانبي لطيف ومقبول، وعدم وجود تشوهات قحفية ووجهية واضحة، ولم يتلقى أي من هؤلاء الطلبة معالجة تقويمية. أظهرت الدرسة أن معيار ويتس للنموذج السعودي كان 0.82 ± 2.2 ملم للذكور و 0.41 ± 2.3 ملم للإناث. تمت كذلك مقارنة هذه النتائج مع دراسات اخرى مشابهة.

This study was conducted on 60 cephalometric radiographs of Saudi dental students (30 males, 30 females), aged from 22 - 23 years, to establish wits appraisal and to compare the results of the present study with similar studies conducted on other racial groups. All subjects were selected according to the following criteria: class I molar and incisor relationship with pleasant profile, absence of obvious craniofacial deformities, and no evidence of previous orthodontic treatment. The wits appraisal of the Saudi sample was found to be $0.82 \text{ mm} \pm 2.2$, for males and $0.41 \text{ mm} \pm 2.3$ for females. Comparison with other reported studies were discussed.

Introduction and Review of Literature

Since the inception of cephalometric radiographs following introduction of the clinical use of craniostat by Broadbent,¹ many analyses have been produced to assist orthodontic clinicians and research workers. Such analyses include those of Bjork,² Wylie,³ Down,⁴ Ballard,⁵ Riedel,⁶ Steiner,^{7,8} Ricketts⁹ and Tweed.^{10,11} All of these analyses had been produced to assess skeletal and dental and soft tissue pattern. One of the most widely used and the simplest method to determine anteroposterior relationship of maxilla and mandible was ANB angle. It had been suggested by Riedel⁶ and used by Steiner.^{7,8} The interpretation of this angle was influenced by three factors: the anteroposterior position of point nasion, sella-nasion line, and the rotational effect of the jaws. To eliminate the influence of these factors, another diagnostic aid has been suggested by Jacobson¹² in 1975. It was called wits appraisal (due to the University of the Witwaterstand, South Africa).

The method entails drawing perpendiculars from points A and B on the maxilla and the mandible, respectively to the occlusal plane. The occlusal plane was defined as the line drawn through the overlap of the mesiobuccal cusps of the first molars and the buccal cusps of the first premolars (Fig. 1). Jacobson used a sample of twenty-one adult males selected on the basis of excellence of occlusion. It was found that point BO was approximately 1 mm. ahead of point AO. The calculated mean reading was 1.17 mm with standard deviation 1.9 (range, -2 to 4 mm.). In

twenty-five adult females selected on the same basis, points AO and BO generally coincided. The calculated mean reading was -0.10 mm with standard deviation 1.77 (range, -4.5 to 1.5 mm). He also found in skeletal class II jaw dysplasia, point BO would be located behind point AO (a positive reading) whereas in skeletal class III jaw disharmonies, the wits reading would be negative, namely, point BO being forward of point AO.

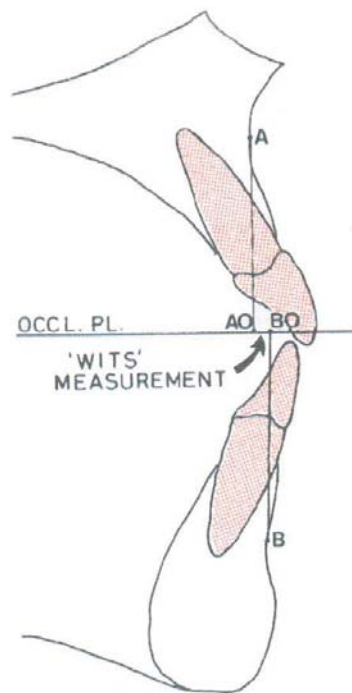


Fig. 1. Points AO and BO are the points of contact of perpendiculars dropped from points A and B, onto occlusal plane.

Received 16 April 2001; Revised 26 September 2001;
Accepted 27 October 2001
Lecturer, Division of Orthodontics, Department of Preventive
Dental Sciences
College of Dentistry, King Saud University, Riyadh, KSA

Address reprint requests to:
Dr. Sahar Al-Barakati
P.O. Box 5967
Riyadh 11432 Saudi Arabia
e-mail: salbarakati@hotmail.com

Since that time, numerous studies have been conducted to establish the wits value on different races. Robertson and Pearson¹³ in a cephalometric study of 50 children (25 males, 25 females) of South Wales population, found the wits value of $0.1 \text{ mm} \pm 1.9$ and $0.3 \text{ mm} \pm 1.7$ for males and females, respectively which were similar to those values reported by Jacobson.¹² Connor and Moshiri¹⁴ established the norms of 50 Black North American adults (25 males, 25 females) aged 18-50 years. They found the wits value was -0.31 mm for females and 0.59 mm for males. So *et al.*¹⁵ conducted a cephalometric study on 101 Southern Chinese (55 males, 46 females). They reported that the wits appraisal value was $-4.88 \text{ mm} \pm 3.61 \text{ mm}$ in males and $-4.47 \text{ mm} \pm 4.19$ in females.

The aim of this study was to establish the wits appraisal in a selected sample of Saudi males and females, and to compare the results with those reported by Jacobson and also with studies carried out in other different races.

Materials and Methods

The study was carried out on standardized cephalometric radiographs of a selected sample of 60 Saudi dental students (30 males, 30 females) at the College of Dentistry, King Saud University. The age range was from 22-23 years.

The sample was chosen on the basis of:

1. a class I molar and incisor relationship with pleasant profile from clinical examination
2. no obvious craniofacial deformities
3. presence of premolars in order to detect accurate functional occlusal plane
4. none of the subjects had received orthodontic treatment.

All of the lateral skull radiographs had been taken in a routine manner, with ear-rods placed in the external auditory meatus to stabilize the head. The head was adjusted so that the Frankfort plane was horizontal. Distance between the cone and mid-sagittal plane was set at 150 centimeters, giving magnification factor of 11 percent. The radiographs were traced by the author, using a sharp 3H pencil on acetate tracing paper. This was performed in a darkened room. The following landmarks: subspinale (A), supramentale (B) and occlusal plane (used by Jacobson¹²) were identified and recorded.

AO and BO lines, which were defined as perpendicular lines from A point and B point to

occlusal plane, were drawn. The linear distance between AO and BO was measured in millimetres and corrected for magnification and is presented as true values for comparison with other races. A total of 10 out of 60 radiographs were randomly selected and retraced with one-week interval to determine the error of the method. The Dahlberg's¹⁶ formula was used to calculate the method error.

Descriptive statistics (mean, standard deviation, range) were calculated from the observed values for each measurement. Finally, the values of both sexes were compared to each other and also compared with other studies. The t-test was used to determine the significance at the 0.05, 0.01, 0.001 and 0.0001 levels.

Results

The error method (using Dahlberg's¹⁶ formula) was recorded to be 0.74 mm and that was mainly created by the occlusal plane identification.

Table 1 displays the mean, standard deviation and the range of wits appraisal readings attained for the Saudi males and females, which were 0.82 mm and 0.41 mm respectively. The mean wits measurements were not statistically significant different between gender ($p > 0.05$).

Table 1. Descriptive statistics of wits values and statistical comparison of Saudi males and females.

Variable	No.	Sex	Mean Mm	S.D.	Range	P-value
Wits value	30	Males	0.82	2.2	-3.5 - 6.2	0.567 N.S.
	30	Females	0.41	2.3	-4.4 - 4.4	

N.S. - not significant, $p < 0.05$

Table 2. Comparison of wits values between Saudi males and other races.

Ethnic groups	No.	Age (Years)	Mean Mm	S.D.	P-value
Saudi students	30	22-23	0.8	2.2	-
Jacobson	21	Adult	-1.2	1.9	0.001***
Black Americans	25	18-50	0.5	3.84	0.573 N.S.
Chinese	55	10-15	-4.88	3.61	0.0001****
British Caucasians	9	19	-2.9	3.5	0.0001****

N.S. - not significant, $p < 0.001$ ***, $p < 0.0001$ ****

Table 3. Comparison of wits values between Saudi females and other races.

Ethnic groups	No.	Age (Years)	Mean Mm	S.D.	P-value
Saudi Students	30	22-23	0.4	2.3	-
Jacobson	25	Adult	-0.1	1.7	0.265 N.S.
Black Americans	25	18-50	-0.3	3.05	0.122 N.S.
Chinese	46	10-15	-4.4	4.1	0.0001****
British Caucasians	10	19	-2.5	3.2	0.0001****

N.S. - not significant, $p < 0.0001$ ****

Table 2 demonstrates a high significant difference between the wits mean values of the Saudi males and the other mean values established by Jacobson ($p < 0.001$); Chinese ($p < 0.0001$) and British Caucasian ($p < 0.0001$). No significant difference was observed between the Saudi males and the Black American males ($p > 0.05$).

Table 3 shows no significant difference when comparing the wits value of the Saudi females and other reported values; except in Chinese ($p < 0.0001$) and British Caucasian ($p < 0.0001$).

Discussion

The most commonly used measurement for jaw displasia is ANB angle. It is based on cranial reference plane involving other factors resulting in a satisfactory interpretation which sometimes was not obtained. These factors are the:

1. anteroposterior position of point nasion relative to the jaws;
2. rotational effect of the jaw relative to the cranial plane;
3. and therotational effect of the sella nasion line relative to the jaws^{12, 17-19}

Another measurement which provides the anteroposterior skeletal disharmony of the jaw is wits appraisal. The reference plane used is neither cranial nor extra cranial plane, but it is a common plane to both dentures, namely the occlusal plane.²⁰ In earlier published studies^{17,21} the occlusal plane was defined as the functional occlusal plane of the masticatory area. Jacobson²⁰ used the term occlusal plane with the same definition was as in earlier studies. This plane was noted to be concave in many subjects. That observation led Jacobson²⁰ to recommend that the most suitable and convenient method of

standardizing the plane of occlusion was to join the midpoint of overlap of the mesiobuccal cusps of the first molars and the buccal cusps of the first premolars.

The wits appraisal for the Saudi males and females in the present study were $0.82 \text{ mm} \pm 2.2$ and $0.4 \text{ mm} \pm 2.3$, respectively. However, there were no sex differences between both sexes although the males exhibited a greater value than the females. This finding does not support the existence of 1 mm discrepancy between the two sexes as reported by Jacobson.¹²

The mean value of wits appraisal in the Saudi males was significantly greater than that of Jacobson,¹² Chinese,¹⁵ and British Caucasian values.²² This may be due to the fact that the Saudi male has a protrusive maxilla^{23, 24} which is one of the factors which contributed towards midfacial prominence (class II malocclusion tendency) compared to the other races (e.g. Chinese) who have a tendency to class III malocclusion. Further, the comparison between the Saudi and the Black American¹⁴ showed no significant differences and this may be attributed to the fact that the Black American also has a protrusive maxilla.¹⁴ Furthermore, although the mean value of the wits appraisal in Saudi females was greater than other races, no significant differences were observed when compared to that reported by Jacobson¹² and Connor and Moshiri¹⁴ in Black Americans. However, significant difference was noticed when compared to the Chinese¹⁵ and British Caucasian²² ($p < 0.0001$). The wits appraisal is a linear measurement, which can be used as an adjunctive diagnostic aid in assessing the anteroposterior skeletal dysplasia, and not as a single diagnostic criterion. Its advantage is that, it overcomes the shortcoming of cranial references planes. Moreover, as pointed out by Jacobson,²⁵ no single parameter in cephalometric should be relied upon as the sole absolute value.

Conclusion

1. The wits appraisal for the Saudi sample was $0.82 \text{ mm} \pm 2.2$ and $0.41 \text{ mm} \pm 2.3$ for males and females, respectively.
2. No significant differences were observed between both sexes and also when compared to the data reported on Black Americans, whereas, significant difference was found with Chinese and British Caucasian data.
3. Significant difference was noted between

Jacobson's result and the Saudi males whereas no significant difference was revealed with the Saudi females.

References

1. Broadbent BH. A new x-ray technique and its application to orthodontics. *Angle Orthod* 1931; 1:45-86.
2. Bjork A. Cephalometric x-ray investigation in dentistry. *International Dent J* 1945;4:718-744.3.
3. Wylie WL. The assessment of anteroposterior dysplasia. *Angle Orthod* 1947;17:97-109.
4. Down WB. Variation in facial relationships, their significance in treatment and prognosis. *Am J Orthod* 1948; 34:812-40.
5. Ballard CF. Some basis for aetiology and diagnosis in Orthodontic. *Trans Br Soc for the study of Orthod* 1948; 27-38.
6. Riedel RA. The relation of maxillary structures to cranium in malocclusion and normal occlusion. *Angle Orthod* 1952;22:142-145.
7. Steiner CG. Cephalometrics for you and me. *Am J Orthod* 1953;39:729 - 755.
8. Steiner CG. Cephalometrics in clinical practice. *Angle Orthod* 1959;29:8-29.
9. Ricketts RM. The influence of Orthodontic treatment on facial growth and development. *Angle Orthod* 1960;30:103-133.
10. Tweed CH. The FMPA in Orthodontic diagnosis, classification, treatment planning and prognosis. *Am J Orthod and Oral Surg* 1946;32:175-230.
11. Tweed CH. Evolutionary trends in Orthodontics past, present and future. *Am J Orthod* 1953;39:81-108.
12. Jacobson A. The wits appraisal of jaw disharmony. *Am of Orthod* 1975;67:125-138.
13. Robertson NR, Pearson CJ. The wits appraisal of a sample of the South Wales population. *Br J Orthod* 1980;7:183-184.
14. Connor AM, Moshiri F. Orthognathic surgery norms for Black American patients. *Am J Orthod* 1985;87:119-133.
15. So LY, Davis J, King NM. Wits appraisal in Southern Chinese children. *The Angle Orthodontist* 1990;60:43-47.
16. Dhalberg A. Statistical method for medical and biological students. New York Interscience Publications, 1940.
17. Jenkins DH. Analysis of Orthodontic deformity employing lateral cephalostatic radiography. *Am J Orthod* 1955;41:442-452.
18. Nanda SK, Sassouni V. Planes of reference in roentgenographic cephalometry. *Angle Orthod* 1965;35:311-319.
19. Jarvinen S. Relation of the wits appraisal to ANB angle. a statistical appraisal. *Am J Orthod* 1988;94:432-435.
20. Jacobson A. Application of the wits appraisal. *A J Orthod* 1976;70:179-189.
21. Harvold EP, Hatton ME. The Burlington Orthodontic Research Center: A measure of its role in dental public health. *Canada Dent Asso J* 1962;28:617.
22. Bhatia SN, Leighton BC. A manual of facial growth. A computer analysis of longitudinal cephalometric growth data. Oxford University Press, 1993.
23. Nashashibi IA, Shaikh HS, Sarhan OA. Cephalometric norms of Saudi boys. *The Saudi Dental J* 1990;2:52-57.
24. Shalhoub SY, Sarahan OA, Shaikh HS. Adult cephalometric norms for Saudi Arabian with comparison of values for Saudi and North American Caucasian. *Br J Orthod* 1987;4:273-279.
25. Jacobson A. Update on the wits appraisal. *Angle Orthod* 1988;58:205-219.

Acknowledgement

This study (NF 1796) was registered with the College of Dentistry, Research Center (CDRC), King Saud University.