KAPADOKYA BÖLGESİNDEKİ TÜRK BİREYLERDE "WİTS" DEĞERLENDİRMESİ
"Wits" Appraisal in Cappadocian Turkish Population

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Özet: *Bu çalışmanın amacı genç erişkin Kapadokyalı Türk kadın ve erkekleri için Wits değerlendirmesi normlarını belirlemek ve cinsiyetler arası muhtemel farklılıkları değerlendirmektir. Erciyes Üniversitesi, Diş Hekimliği Fakültesi, Ortodonti Anabilim Dalı arşivinden 29 erkek ve 41 kadın toplam 70 hastanın (yaş aralığı 20-35) sefalometrik röntgeleri seçildi. Tüm hastalar normal oklüzyona, Angle Sınıf 1 okluzal ilişkiye ve dengeli yüze sahipti. Maksilla ve mandibulanın birbirleriyle ve kranial kaideyle açışal ilişkileri Sella- Nasion-A noktası açısı (SNA), Sella-Nasion-B noktası açısı (SNB) ve A noktası-Nasion-B noktası açısı (ANB) ile, maksilla ve mandibulanın doğrusal ilişkisi Wits değerlenirmesi ile yapılmıştır. Tüm parametreler için aritmetik ortalama, standart deviasyon, minimum ve maksimum değerler hesaplanmıştır. Cinsiyetlerin karşılaştırılmasında bağımsız örneklem t testi kullanılmıştır. Tanımlayıcı istatistiksel analize göre SNA, SNB, ANB ve Wits değerleri sırasıyla bayanlar için 80.24±3.85, 77.94±3.19 ve 2.31±1.82 derece ve -0.01±3.14 mm, erkeler için 80.75±3.67, 78.54±3.38 ve 2.21±2.38 derece ve -1.02±3.53 mm olarak bulunmuştur. Belirlenen değerler için cinsiyetler arasında istatistiksel olarak anlamlı bir fark bulunmamıştır. Çalışmanın sonucunda Kapadokyalı Türk erkek ve kadınlar için teşhis ve tedavi planlamasında kullanılabilecek Wits normları belirlenmiştir.*

Anahtar kelimeler: *Normlar, wits değerlendirmesi, sefalometrik analiz*

Summary: *The aim of the present study was to identify specific normative data for Wits appraisal and evaluate possible sex differences between Cappadocian Turkish young adult males and females. The material comprised the lateral cephalometric radiographs of 70 patients (age range: 20-35 years), 29 males and 41 females, selected from the archive at Erciyes University, Faculty of Dentistry, Department of Orthodontics. All patients have normal occlusions, Angle Class I occlusal relationships and well balanced faces. The anteroposterior angular relationship of the maxilla to the mandible and the cranial base was measured by Sella- Nasion-point A angle (SNA), Sella-Nasion-point B angle (SNB) and point A-Nasion-point B angle (ANB), and linear relationship of maxilla to the mandible by Wits appraisal. For all variables arithmetic means, standard deviation, minimum and maximum values were calculated. Independent samples-t test was performed for the sex comparisons. Descriptive statistical values indicated that SNA, SNB, ANB and Wits values were found as 80.24±3.85, 77.94±3.19 and 2.31±1.82 degrees and -0.01± 3.14 mm for female and 80.75±3.67, 78.54± 3.38 and 2.21±2.38 degrees and -1.02±3.53 mm for male subjects respectively. There were no statistically significant differences between males and females for all defined measurements. According to the results of study, Wits norms which can be used for diagnosis and treatment planning of Cappadocian Turkish males and females were developed.*

Key words: *Norms, wits appraisal, cephalometric analysis*

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The introduction of cephalometric radiography as an orthodontic diagnostic tool permitted an accurate evaluation of the skeletal relationship of patients with various types of malocclusions (1). The importance of correctly identifying the maxillary and mandibular dental bases relationship cannot be overemphasized in orthodontic diagnosis. The clinician uses this relationship to establish detailed treatment goals and proper treatment mechanics (2-4).

Many methods have been developed to determine the skeletal anteroposterior jaw relationship (4) such as Sella-Nasion-A point (SNA), Sella-Nasion-B point (SNB) and A point-Nasion-B point (ANB) angles (5); Frankfort Horizontal (FH) plane to AB plane angle (FABA) (3), distance between points A and B projected onto FH plane (AF-BF distance) (6), point A and pogonion distances to nasion perpendicular (to FH plane) (7) etc. To help the clinician both linear and angular measurements has been incorporated into various cephalometric analyses (2) None of the methods used to measure anteroposterior relationship of the maxillary and mandibular dental bases is entirely satisfactory (8).

In appraising the sagittal disharmony of the jaws, the ANB angle, the difference between the SNA and SNB angles, is the most commonly used measurement (8,9). In other words ANB angle is formed between Nasion-A and Nasion-B plane. The relative forward and backward positioning of Nasion by virtue of an excessively long or short anterior cranial base (represented by line SN) or a relative posterior or anterior positioning of both jaws within the skeletal craniofacial complex will directly influence the ANB reading (1,8,9). Rotation of the jaws relative to the anterior cranial base also alters the position of A and B points and, hence the value of ANB (8).

The Wits appraisal is a linear measurement and not an analysis per se. This appraisal entails drawing perpendiculars on a lateral cephalometric radiographs tracing from points A and B on the maxilla and mandible, respectively, onto the occlusal plane which is drawn through the region of maximum cuspal interdigitation. The relation between these points determines anteroposterior relationship of maxilla and mandibula (10). For more accurate diagnosis of the anteroposterior apical base relationship, both the ANB angle and Wits appraisal should be used (1,10).

A data based on different sexes, races and age groups will provide clinicians more complete information regarding skeletal sagittal jaw relationship (4). Consequently, the purpose of the study was to identify (1) specific normative data for Wits appraisal (2) possible sex differences between Cappadocian Turkish young male and female subjects with normal occlusion and well-balanced faces.

MATERIAL AND METHODS

The material comprised the lateral cephalometric radiographs of 70 patients, 29 males and 41 females aged between 20-35 years who were admitted from Cappadocia Region of Turkey, selected from the archive at Erciyes University, Faculty of Dentistry, Department of Orthodontics, in Kayseri, Turkey. The following criteria were used to select the sample: (1) Angle Class I occlusal relationships with normal overbite and overjet, (2) well-aligned maxillary and mandibular dental arches, (3) normal growth and development, (4) good facial symmetry and (5) no history of previous orthodontic or prosthodontic treatment (11,12). The lateral cephalometric radiograph of each subject was taken with a Planmeca cephalometer (Proline XC, Helsinki, Finland). All subjects were positioned in the cephalostat with the sagittal plane at a right angle to the path of the x-rays, the Frankfort plane parallel to the horizontal, the teeth in centric occlusion, and the lips slightly closed (13).

In the present study: the anteroposterior angular relationship of the maxilla to the mandible and the cranial base was measured by ANB, SNA and SNB angles and, linear relationship of maxilla to the mandible by Wits appraisal.

In Wits appraisal perpendicular lines were con-

structed from points A and B onto functional occlusal plane which is drawn through the region of maximum cuspal interdigitation of posterior teeth. The points at which the perpendicular lines meet the occlusal plane are AO and BO for points A and B respectively. The distance between AO and BO was measured. If AO is located posterior to BO, the Wits appraisal values is negative; if AO is located anterior to BO, it is positive (1,9). The landmarks and analyses are shown in Figure 1 and 2.

All statistical analyses were performed with a statistical software package (Statistical Package for Social Sciences for Windows 98, version 13.0; SPSS, Chicago, Ill). For both variable arithmetic mean, standard deviation were calculated. Independent samples-*t* test was performed for the sex comparisons. To determine the errors associated with radiographic measurements, 25 radiographs were selected randomly. Their tracings and measurements were repeated 8 weeks after the first measurement. A paired-*t* test was applied to the first and second measurements.

RESULTS

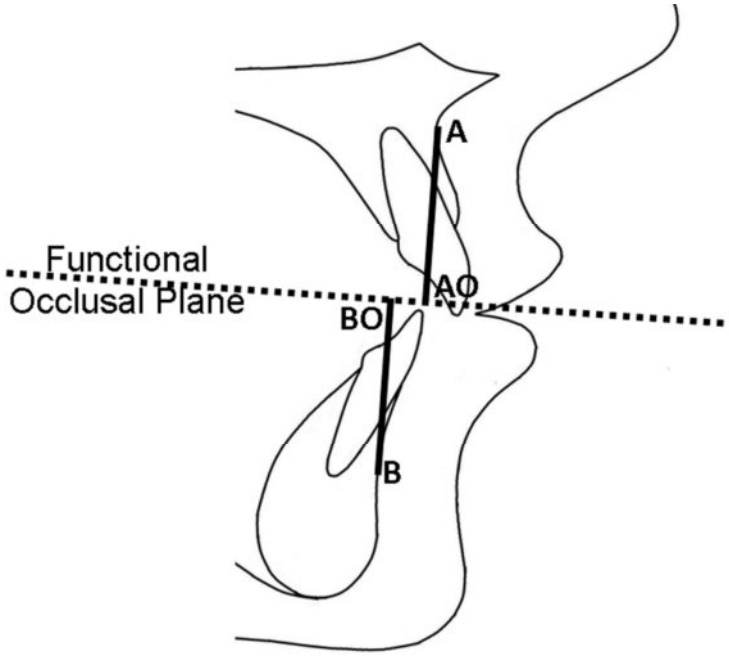

Figure 1. Functional occlusal plane A, B, AO and BO points are shown. AO and BO for points are constructed where the perpendiculars drawn by points A and B intersects functional occlusal plane which is drawn through the region of maximum cuspal interdigitation. The distance between AO and BO was measured. If AO is located posterior to BO, the Wits appraisal values is negative; if AO is located anterior to BO, it is positive AO

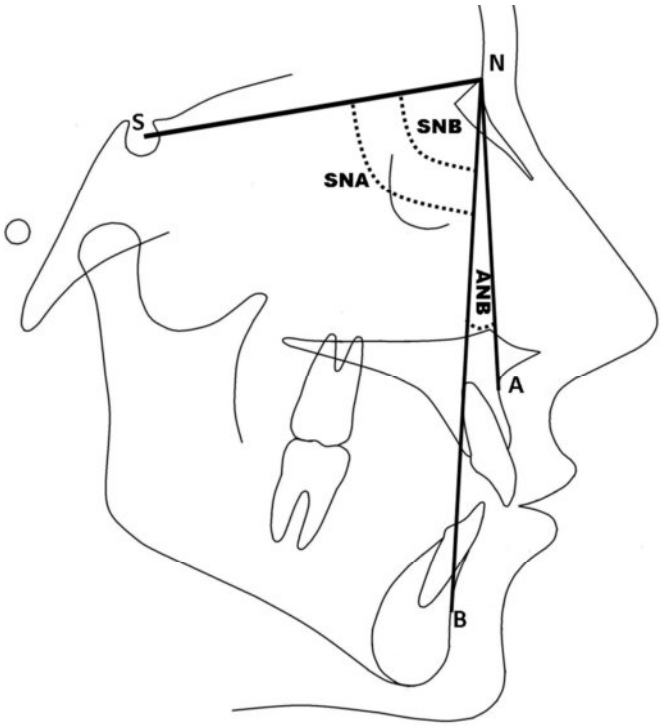

Figure 2. Angular relationship of maxilla and mandible was measured by ANB angle which is constructed between point A-Nasion(N) -point B and relationship of maxilla and mandible to cranial base was measured by Sella(S)-N-point A (SNA) and S-N- point B (SNB) angles.

The difference between the first and second measurements of the 25 radiographs was insignificant. Correlation analysis applied to the same measurements showed the highest *r* value (0.988) for SNB and the lowest *r* value (0.801) for Wits appraisal.

SNA, SNB, ANB and Wits values were found as 80.24±3.85, 77.94±3.19 and 2.31±1.82 degrees and -0.01± 3.14 mm for female and 80.75±3.67, 78.54±3.38 and 2.21±2.38 degrees and -1.02±3.53 mm for male subjects, respectively. There were no statistically significant differences between males and females for all measurements (Table 1).

Table I. Descriptive statistics of for SNA, SNB, ANB and Wits appraisal and comparison of both sexes

	Male (n=29) (Mean±SD)	Female (n=41) (Mean±SD)	P-value	p
SNA	80.75±3.67	80.24±3.85	0.33	>0.05
SNB	78.54±3.38	77.94±3.19	0.62	>0.05
ANB	2.21±2.38	2.31±1.82	0.34	>0.05
Wits appraisal	-1.02±3.53	-0.01±3.14	0.74	>0.05

SNA: Sella-Nasion-A point
SNB: Sella-Nasion-B point
ANB: A point-Nasion-B point

DISCUSSION

Orthodontic treatment plans and objectives are deeply driven by cephalometric information. When diagnoses are not correct, treatment plans can be inadequate or wrong which might cause an extended treatment time, at the least. The other consequences, such as patient and parental disappointment, are common (14). Evaluation of cephalometric radiographs might be done by various methods. Because of differences in the dentofacial relationships of various ethnic and racial groups, the applicability of the norms described in these analyses to Cappadocian Turkish people is controversial. Therefore, it is important to develop standards for various populations (12). According to literature we determined that Gazilerli evaluated Steiner, Downs and Tweed cephalometric values for Turkish children (14,15). Holdaway and soft tissue measurements were evaluated in previous studies (14,17-21) for Turkish population. Uysal and Sari (22) described posteranterior cephalometric norms and Uysal and Malkoc (23) derived submentovertex norms for Turkish adults. Basciftci et al. (11) reported cephalometric norms for Turkish adults but Wits value was not measured yet. Oktay (24) compared ANB, Wits, AF-BF, and APDIA and found high correlations among these measurements however, inclusion criteria was comprise varying degrees, either skeletal or dentoalveolar malocclusions or both and norms for Wits were not determined. As it was mentioned that for more accurate diagnosis of the maxillary-mandibular apical base relationship, instead of using only ANB angle, the Wits appraisal should be included in the routine cephalometric analysis (1,8), and no published data was exist in the literature about Wits norms for Turkish population. Thus, we aimed to determine these values in the present research.

An ideal cephalometric analysis should not only be sex- and race-specific, it should also be age-related (4). As in previous studies it was found that Wits value does not affected in time (1,25). Thus, the groups were not divided into age groups in this study. Ideally, subjects used for establishing cephalometric norms would have excellent occlusion and an optimal profile. However, it is not ethical to obtain new cephalometric radiographs only for research purposes (4). Under such limitations, we could not increase sample size and equalize the groups.

Subjects, having Angle Class I occlusal relationships, normal occlusion and well balanced faces were selected for this study and SNA (80.45±3.76°) SNB (78.19±3.26°) and ANB (2.26±2.05°) were determined for all subjects, was similar to Gazilerli that reported SNA (81°), SNB (78°) and ANB (3°) and quite different than a study (11) reported SNA (82.57°) SNB (79.92°) and ANB (2.65°). These differences in SNA and SNB may be due to construction of SN plane however ANB value is almost similar to previous study.

Correct location or representation of the occlusal plane plays an important role in Wits appraisal, which can present a problem in some aspects. Transversely the left and right sides of posterior teeth may not always coincide or superimpose correctly (10). In present study this problem was eliminated as all patients have a good occlusion and balanced profile. Another controversy is about occlusal plane construction sagittally. Traditionally, the occlusal plane extended from the cuspal image overlap of the first molars to the middle of the incisor overlap. However, because of the possible supra- or infra-eruption in malocclusions, a more appropriate plane would be a representative functional occlusal plane drawn through the cuspal overlap of the maxillary first molars and the first bicuspids (10). However over-bite and over-jet relations are optimal in our sample, we decided to use functional occlusal plane.

Another factor which should be considered in comparing the 'Wits' appraisal and ANB is the accuracy with which the cephalometric points used in the measurements can be located. Points "A" and "B" are common to both methods and difficulties in location will affect both methods equally (8).

First Jacobson (9) proposed the norm for Wits appraisal to be -1.0 mm for males and 0.0 for females in a for a sample (21 female and 21 male adults) selected on the basis of excellence of occlusion which is in accordance with present study -0.01±3.14 for females and -1.02±3.53 for males. Richardson (8) reported -0.32±2.87 for 25 young adults without sex preference. In an another study, it was reported 2.45±2.33 degrees ANB and -0.09±3.49 mm Wits for males and 2.40±2.96 ANB and -0.38±2.06 Wits values for females were found patients having normal occlusion at an age of 15 years (25). Huang et al. (4) evaluated differences between Caucasians and African Americans' cephalometric norms for different age groups and sexes. Whereas SNA was 80.89±3.09 and 80.60±2.85 for Caucasians, it was 83.14±3.92 and 86.18±4.36 for African Americans 12-18 aged, males and females respectively. Similarly, Wits value was found to be -1.60±2.52 in Caucasians which is smaller African Americans' Wits values, -3.08±2.21 for females for the 12-18 age group. This was quite smaller value than we determined for females. For Caucasians males, it was reported -1.27±2.21 which is similar to the present findings. In addition, the norms determined for Korean children (2.05±1.87 for males and -2.15±1.91 for females) (3) and Chinese children (-4.9 for males and -4.5 for females) (26) are different than the current findings. Possible reason for that might be race and dentofacial characteristic differences.

Statistical assessment indicated that there are no significant differences between males and females in either ANB or Wits values. This finding is in accordance with the previous studies (1,3,4).

Wits norms for Cappadocian Turkish males and females were developed, however no statistically significant difference was found between sexes. Our results can be used for diagnosis and treatment planning of Cappadocian Turkish patients.

REFERENCES

1. *Bishara SE, Fahl JA, Peterson LC. Longitudinal changes in the ANB angle and Wits appraisal: clinical implications. Am J Orthod 1983;84:133–139.*
2. *Baik CY, Ververidou M. A new approach of assessing sagittal discrepancies: the Beta angle. Am J Orthod Dentofacial Orthop 2004;126:1005.*
3. *Yang SD, Suhr CH. F-H to AB plane angle (FABA) for assessment of anteroposterior jaw relationships. Angle Orthod 1995;65:223–231.*
4. *Huang WJ, Taylor RW, Dasanayake AP. Determining cephalometric norms for Caucasians and African Americans in Birmingham. Angle Orthod 1998;68:503–512.*
5. *Riedle RA. Esthetics and its relation to orthodontic therapy. Angle Orthod 1950;20:168–178.*
6. *Chang HP. Assessment of anteroposterior jaw*

relationship. Am J Orthod Dentofacial Orthop 1987;92:117–122.

7. *McNamara JA Jr. A method of cephalometric evaluation. Am J Orthod. 1984;86:449–469.*
8. *Richardson M. Measurement of dental base relationship. Eur J Orthod. 1982;4:251–256.*
9. *Jacobson A. The ‘‘Wits’’ appraisal of jaw disharmony. Am J Orthod 1975;67:125–138 (reprinted Am J Orthod Dentofacial Orthop 2003;124:470–479).*
10. *Jacobson A. Update on the Wits appraisal. Angle Orthod 1988;58:205–219.*
11. *Basciftci FA, Uysal T, Buyukerkmen A. Craniofacial structure of Anatolian Turkish adults with normal occlusions and wellbalanced faces Am J Orthod Dentofacial Orthop 2004;125:366–372.*
12. *Basciftci FA, Uysal T, Buyukerkmen A. Determination of Holdaway soft tissue norms in Anatolian Turkish adults. Am J Orthod Dentofacial Orthop 2003;123:395–400.*
13. *Erbay EF, Caniklioğlu CM, Erbay SK. Soft tissue profile in Anatolian Turkish adults: part I. Evaluation of horizontal lip position using different soft tissue analyses. Am J Orthod Dentofacial Orthop 2002;121:57–64.*
14. *Del Santo M Jr. Influence of occlusal plane inclination on ANB and Wits assessments of anteroposterior jaw relationships. Am J Orthod Dentofacial Orthop. 2006;129:641–648.*
15. *Gazilerli Ü. Normal kapanışlı 13-16 yaşlar arasındaki Ankara çocuklarında Steiner normları Doktora tezi, Ankara Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara 1976.*
16. *Gazilerli Ü . Türk çocukları için Downs ve Tweed ölçümleri (abstract in English). Ankara Üniversitesi Diş Hekimliği Fakültesi Dergisi 1981;8:115–136.*
17. *Göyenc¸ Y, Karadede MI, Şener E, Baran S. Dişsel Cl I, iskeletsel Cl I, Cl II, Cl III ilişkili bireylerde yumuşak doku değişimleri (abstract in English). Türk Ortodonti Dergisi 1992;5:117–125.*
18. *Erbay EF, Caniklioğlu CM. Soft tissue profile in Anatolian Turkish adults: part II. Comparison of different soft tissue analyses in the evaluation of beauty. Am J Orthod Dentofacial Orthop 2002;121:65–72.*
19. *Sağlam AMS, Gazilerli Ü. Analysis of Holdaway soft tissue measurements in children between 9 and 12 years of age. Eur J Orthod 2001;23:287–294.*
20. *Gazilerli Ü, Işcan HN. Değişik cins ve iskeletsel sınıflamalarda Holdaway yumuşak doku ölçümlerinin değişimi (abstract in English). Ankara Üniversitesi Diş Hekimliği Fakültesi Dergisi 1980;7:167–174.*
21. *Giray B. Büyüme ile Holdaway yumuşak doku ölçümünün değişimi (abstract in English). Ankara Üniversitesi Diş Hekimliği Fakültesi Dergisi 1985;12:27–37.*
22. *Uysal T, Sari Z. Posteroanterior cephalometric norms in Turkish adults. Am J Orthod Dentofacial Orthop 2005;127:324–332.*
23. *Uysal T, Malkoc S. Submentovertex cephalometric norms in Turkish adults, Am J Orthod Dentofacial Orthop 2005;128:724–730.*
24. *Oktay H. A comparison of ANB, WITS, AFBF, and APDI measurements. Am J Orthod Dentofacial Orthop 1991;99:122–128.*
25. *Lux CJ, Burden D, Conradt C, Komposch G. Age-related changes in sagittal relationship between the maxilla and mandible. Eur J Orthod 2005;27:568–78. Epub 2005 Aug 10.*
26. *So LL, Davis PJ, King NM. "Wits" appraisal in southern Chinese children. Angle Orthod 1990;60:43–48.*