

Cephalometric evaluation of a sample of Iraqi adults with normal occlusion using tetragon analysis

Ammar Sh. Ahmed, B.D.S., M.Sc. ⁽¹⁾

ABSTRACT

Background: This study aimed to determine the cephalometric values of tetragon analysis on a sample of Iraqi adults with normal occlusion.

Material and methods: Forty digital true lateral cephalometric radiographs belong to 20 males and 20 females having normal dental relation were analyzed using AutoCAD program 2009. Descriptive statistics and sample comparison with Fastlicht norms were obtained.

Results: The results showed that maxillary and mandibular incisors were more proclined and the maxillary/mandibular planes angle was lower in Iraqi sample than Caucasian sample.

Conclusion: It's recommended to use result from this study when using tetragon analysis for Iraqis to get more accurate result.

Key Words: Cephalometrics, Tetragon Analysis. (J Bagh Coll Dentistry 2014; 26(4):163-166).

الخلاصة

الخلفية: تهدف هذه الدراسة إلى تحديد معايير قياسات الرأس لعينة من العراقيين البالغين باستخدام تحليل مربع الإضلاع المواد والأساليب: تم تحليل قياسات الرأس الإشعاعية الجانبية لأربعين شخص عراقي (20 ذكور و 20 إناث) جميعهم يتمتعون بإطباق سني طبيعي باستخدام برنامج الأوتوكاد للرسم الهندسي إصدار 2009.

النتائج: أظهرت هذه الدراسة أن القواطع العلوية والسفلية في العينة العراقية مائلة للإمام أكثر والزوايا بين الفك العلوي والسفلي اصغر في العينة العراقية من العينة القوقازية.

الاستنتاجات: من المستحسن استخدام نتيجة هذه الدراسة عند استخدام تحليل التيتراكون للعراقيين للحصول على نتائج أكثر دقة. الكلمات الرئيسية: قياسات الرأس، تحليل مربع الأضلاع

INTRODUCTION

The innovation of X-ray by Roentgen in 1895 revolutionized the dental and medical career ⁽¹⁾. Broadbent and Hofrath in 1931 started a new era in orthodontics by presenting the cephalometer ⁽²⁾. Since then, it was used in orthodontics to study facial forms, development of norms, assessment of treatment prognosis and growth prediction for the individual patient allowing accurate evaluations of skeletal relations of patients with different types of malocclusion ⁽³⁾.

Many cephalometric analyses were evolved in an attempt to define the skeletal characteristics of a good face and good occlusion. Researchers world-wide have paid attention to the ethnic factor and tried to establish cephalometric values for various ethnic groups ⁽²⁾.

Comparative cephalometric studies have proven that differences in the craniofacial morphology exist among races and ethnic groups. Miyajima *et al.* ⁽⁴⁾ also noted that a patient might seek a treatment plan that is based in part on norms for his or her racial or ethnic group. On the other hand, Naranjilla *et al.* ⁽⁵⁾ study suggested the need to treat patients from different racial and ethnic groups differently using cephalometric norms specific to each group. It is important to compare a patient's cephalometric findings with the norms for his or her ethnic group for an accurate diagnostic evaluation, while considering his or her treatment goals and needs ⁽⁶⁾.

In 2000, Fastlicht ⁽⁷⁾ introduced the tetragon analysis to provide a clear picture of the maxilla-dento-mandibular structures within the craniofacial complex. Prakash and Shetty ⁽⁸⁾ applied this analysis on Indian with different occlusal relationships. This study is the first in Iraq that attempts to set the cephalometric values for a sample of Iraqi adults with normal occlusion using tetragon analysis.

MATERIALS AND METHODS

Sample

Digital true lateral cephalometric radiographs belong to forty individuals (20 males and 20 females) with an age ranged between 18-25 years were included in this study. These radiographs were obtained from the Department of Orthodontics; College of Dentistry, University of Baghdad. The criteria used for sample selection were:

1. Normal molar, canine and incisor relationship with normal overbite and overjet.
2. Well-aligned upper and lower dental arches with minimal dental crowding (1-2 mm.).
3. No history of previous orthodontic treatment, prosthodontic treatment or facial surgery.
4. No history of facial trauma.

Methods

Every lateral cephalometric radiograph was analyzed using AutoCAD program (2009) to measure the linear and angular measurement. Linear measurements were divided by scale for each picture to overcome the magnification while angles were not affected by magnification.

(1)Assistant Lecturer. Department of POP, College of Dentistry, University of Mustansyria.

Cephalometric landmarks

Landmarks used in this study were determined according to Rakosi⁽¹⁾:

1. Pt (Pterygomaxillary fissure)
2. N (Nasion)
3. S (Sella turcica)
4. Point A (Subnasale)
5. Point B (Supramentale)
6. Pog (Pogonion)
7. Go (Gonion)
8. Me (Menton)
9. ANS (Anterior nasal spine)
10. PNS (Posterior nasal spine)
11. Or (Orbitale)
12. Root apices and incisal edges of the most proclined maxillary and mandibular central incisors.

Linear measurements

1. N-Pog-UI: The distance from the maxillary incisal edge and N-Pog line
2. N-Pog-LI: The distance from the mandibular central incisor edges and N-Pog line.
3. UI-PP: A perpendicular line from palatal plane (PP) through incisal edge of the maxillary central incisor, the measurements defines how far incisors are erupted in relation to palatal plane.
4. LI-MP: A perpendicular line from mandibular plane (MP) through incisal edge of the mandibular central incisor. The measurements define how far incisors are erupted in relation to mandibular plane.

Angular measurements

The tetragon has four sides, forming four angles that always equal to 360° ⁽⁷⁾ (Fig. 1).

1. UI-PP: The angle between the palatal plane and the long axis of the maxillary central incisor.
2. UI-LI: The angle between the maxillary and mandibular incisors long axes.
3. LI-MP: The angle between the mandibular incisor long axis and the mandibular plane.
4. MP-PP: The angle between the mandibular plane and the palatal plane.
5. Others: SNA, SNB and ANB.

The Trigon has three sides, forming three angles that always equal to 180° ⁽⁷⁾ (Fig. 2)

6. Pt-Or/Pt-PNS: The angle between the Pt-Or plane and Pt-PNS plane called "upper Pt"
7. Pt-PNS/PP: The angle between the Pt-PNS and the palatal plane called "lower Pt"
8. Pt-Or/PP: The angle between the Pt-Or plane and the palatal plane.

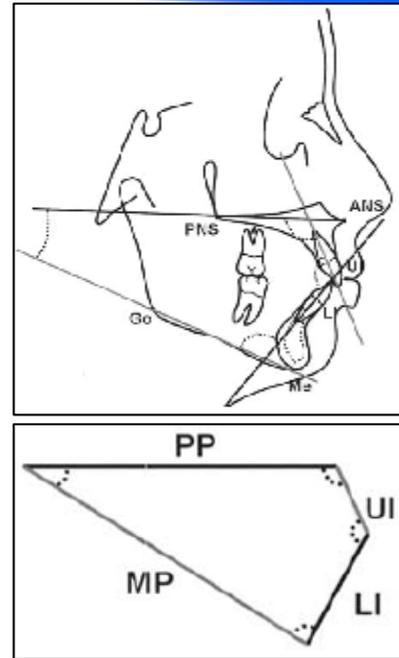


Figure 1. The Tetragon

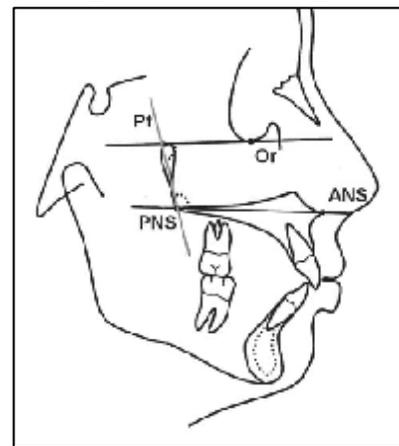


Figure 2. The Trigon

Statistical analyses

All the data of the sample were subjected to computerized statistical analysis using SPSS version 18 computer program. The statistical analyses included:

1. Descriptive Statistics: including means, standard deviations (S.D), minimum and maximum values and statistical tables.
2. Inferential Statistics: one sample t-test was used to compare between the data from this study with the norms from Fastlicht's study⁽⁷⁾.

In the statistical evaluation, the following levels of significance were used:

Non-significant	NS	$P > 0.05$
Significant	*	$0.05 \geq P > 0.01$
Highly significant	**	$0.01 \geq P > 0.001$
Very highly significant	***	$P \leq 0.001$

P= probability value.

RESULTS AND DISCUSSION

The tetragon analysis was introduced by Fastlich⁽⁷⁾ and based on two geometric constructs: the "Tetragon", a polygon that represents the maxillo-dento-mandibular complex, made up of reliable and familiar cephalometric landmarks - the palatal plane, the mandibular plane, and the axes of the maxillary and mandibular central incisors, and the "Trigon", a complementary triangle situated above the Tetragon and formed by one plane that is intrinsic to the Tetragon-the palatal plane (PNS-ANS) and two that are extrinsic--the pterygo-orbital plane (Pt -Or) and the pterygo-palatal plane (Pt-PNS).

The cephalometric standards for one ethnic group do not necessarily apply for other ethnic group⁽⁹⁾.

This study intended to establish the norm of the tetragon analysis for a sample of Iraqi population, thus using this analysis for Iraqi sample would be more accurate to describe the dento-skeletal deformity and to establish a treatment plane that respect the ethnic variation.

Regarding the tetragon, this study shows that upper and lower incisor are significantly proclined more than Fastlich's sample (Table 2), this came in agreement with Prakash and Shetty⁽⁸⁾, Al-Daghistany⁽¹⁰⁾, Nahidh⁽¹¹⁾ and Garma⁽¹²⁾.

The maxillary-mandibular plane angle is significantly lower than Fastlich's sample and near to that of Prakash and Shetty⁽⁸⁾ and Garma⁽¹²⁾. Nahidh⁽¹¹⁾ found that the lower facial height in Iraqi sample is smaller than Caucasian sample.

The trigon in this sample is rotated clockwise in comparison to Fastlich's sample⁽⁷⁾ (Table 2) and that is represented by the increase in Pt-PNS/PP angle. Prakash and Shetty⁽⁸⁾ reached to same findings.

Many differences were found in this study than the original study thus its recommended to use the norm from this study when using tetragon analysis to get more accurate result regarding Iraqi people.

As a conclusion, the tetragon, in conjunction with traditional cephalometric measurements such as SNA, SNB, ANB, and N-Pog, can also indicate whether the problem with the malocclusion lies in the mandible or the maxilla or both. Because the anterior planes of the tetragon represent the axial inclinations of the maxillary and mandibular central incisors and their positions in space. On the other hand, the tetragon can help the orthodontist and the maxilla-facial surgeon in his decision for planning the treatment when protraction, retraction and impaction of the premaxilla should be contemplated.

Table 1: Descriptive statistics for the measured variables

Variables		Mean	S.D.	Min.	Max.	
Angular measurements (°)	Tetragon	UI-PP	114.95	9.435	100	132
		UI-LI	121.1	11.963	96	143
		LI-MP	103.975	7.145	91	118
		MP-PP	19.7	5.832	13	26
	Trigon	Pt-Or/Pt-PNS	78.75	4.6	69	87
		Pt-PNS/PP	95.95	4.314	82	104
		Pt-Or/PP	5.475	3.427	1	13
	Others	SNA	83.75	3.341	78	90
		SNB	80.65	3.378	75	87
		ANB	3	0.841	2	4
Linear measurements (mm.)	N-Pog-UI	0.676	0.305	0	1.327	
	N-Pog-LI	0.440	0.294	0	1.05	
	UI-PP	2.703	0.53	0.002	3.34	
	LI-MP	3.933	0.713	0	4.789	

Table 2: Comparison between the Iraqi sample and Fastlicht's norm using one sample t-test

Variables	Norms of Fastlicht	Iraqi mean values	Mean difference	t-test	d.f.	p-value
UI-PP°	110	114.95	4.95	3.318	39	0.002 ***
UI-LI°	130	121.1	-8.90	-4.705	39	0.000 ***
LI-MP°	90	103.975	13.975	12.370	39	0.000 ***
MP-PP°	30	19.7	-10.300	-11.170	39	0.000 ***
Pt-Or/Pt-PNS°	85	78.75	-6.250	-8.592	39	0.000 ***
Pt-PNS/PP°	87	95.95	8.950	13.120	39	0.000 ***
Pt-Or/PP°	8	5.475	-2.525	-4.660	39	0.000 ***

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