

# POSTERIOR ANTERIOR (PA) CEPHALOMETRIC ASSESSMENT FOR SAUDI ADULT MALE POPULATION

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## ABSTRACT

*The aim of the following study was to assess dental, skeletal and dental to skeletal measurements of Ricketts parameter using PA cephalogram in Saudi male population. Standard PA cephalographs of 100 esthetically pleasing faces without any craniofacial deformity were taken from the radiology archive and digitally analysed for the Ricketts analysis (RA). Different linear and angular variables such as the dental, skeletal and dental to skeletal were measured. Descriptive analysis has been done. To check the difference between different parameters with different ethnics, mean differences has been calculated. Mandibular and maxillary inter molar width were 53.17±3.13 and 55.33±3.08 respectively. Dental midline and skeletal midline discrepancy were 0.53±0.85 and 1.32±3.65 respectively. This study has measured PA cephalometric dental, skeletal and dental to skeletal values for the Saudi adult male using RA. Dental and skeletal asymmetries are revealed which is a common finding even in individuals who have normal facial features.*

**Key Words:** Posterior anterior cephalographs; Ricketts analysis; Saudi

## INTRODUCTION

Beautiful face is subjective and beauty is in the eye of the beholder. This is not an exact science but is a specific proportion system that includes facial height, width, and symmetry and broadly consistent with individual's facial form, morphology and balance. Patient might has several problems and desires need to be carefully addressed since they may vary from unrealistic expectations to a lack of concern even in the presence of greater deviations. The advisability of management should be carefully considered with mild dental, skeletal and soft tissue deviations.

Spectrum of methods have been used in literature to assess facial morphology, one of the most required

diagnostic aid for asymmetry evaluation is PA cephalogram. Numerous PA cephalometric analysis systems have been recommended.<sup>1-3</sup> Only RA1 is supplemented by a wide-ranging set of norms, suggesting age specific changes from adolescence to adulthood.<sup>4</sup> Ethnic disparities have been established in selected width measurements among Chinese, Japanese, American Whites, Kuwaiti, Turkish and Austrian.<sup>5-8</sup> Chinese sample was relatively large, only adults were included without occlusal selection criteria. In addition, similar disparities have been established between Egyptians and other racial groups.<sup>9</sup> The Egyptian subjects was also limited to adults.

Till date based on literature search no studies has been conducted in Saudi population using PA cephalogram RA, hence, rationale of this study is to establish the standard norms. The prime aim of this study was to descriptively present the PA cephalometric variables of dental, skeletal and dental to skeletal measurements for Saudi adult male, and to compare these values with available analysis of other published reports.

## MATERIALS AND METHODS

This research was approved by the Ethics Committee of Jouf University (LCBE#Jouf University#9-16-8/39). All personal information of the participants was anonymized prior to analysis and was kept confidential. In this study, Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines are followed. One hundred Saudi male adults PA

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cephalogram are used for the measurements. G-power computing tool for the appropriate Sample size calculation was used and estimated from the effect size. The average age of the subjects was  $25 \pm 4$  (Mean  $\pm$  SD) years. The PA cephalogram of the subjects were selected on the basis of inclusion criteria from the radiology archive of College of Dentistry, Jouf University.

The inclusion criteria of the subjects consisted of -

1. without any history of previous orthodontic treatment
2. having no craniofacial deformity
3. without any skeletal abnormality or deformity or surgery
4. both parents and grandparents being Saudi without any interracial marriage (confirmed by demographic data from the clinical record).

In this retrospective study, digital tracings of all PA radiographs were done by a single investigator. Digital measurement was done in a standard manner using 3D OnDemand software (Seoul, Korea). Normative data of variables measured given by Ricketts, which is helpful in determining the vertical, transverse, skeletal and dental problems. In this report, the analyses employed according to the Ricketts method PA cephalogram measurements<sup>1,4</sup> are shown in Figure 1. It has the following components: a. Dental relations, b. Skeletal relations, c. Dental to skeletal, d. Jaw to cranium, and e. internal structures. In this report, first 3 components were assessed. The details of the PA measurements of RA are shown in Table 1.

### Statistical analysis

The collected data were verified and analyzed by SPSS software version 20 (Chicago, IL, USA), and the descriptive analysis were carried out.

### Normal test and error assessment

The Kolmogorov-Smirnov test showed normality of distribution of the obtained data. To test the level of error involved in the present study,<sup>20</sup> PA cephalometric radiographs were randomly selected, and the measurements were repeated three-week apart by one calibrated examiner. Dahlberg's formula ( $ME = \sqrt{\sum(x1-x2)^2/2n}$ ) was used to determine the method-error, which did not exceed 0.68 mm for the linear variables, 0.93 degree for the angular variables. The combined error for any of the variable was small and considered to be within acceptable limit.

### RESULTS

Descriptive statistics of the Saudi adult males were generated; comparative statistics between the Saudi and original RA data were presented.

The mean measurement values representing dental, skeletal and dental to skeletal parameters are shown in Table 2.

The disparities between two groups are shown in figure 2 and table 3 refers to the comparison of the differences among five different population. Seven out of 18 parameters of RA showed >5mm differences in comparison to present data (Figure 2 and Table 3). However, in relation to Turkish population, only 1 parameter showed >5mm difference (Mandibular width).

### DISCUSSION

The prime aim of this study was to evaluate the dental, skeletal and dental to skeletal parameters based on PA cephalometric radiographs of Saudi adult males.

Comprehension and analysis of facial asymmetry parameters are indispensable in several fields of medicine and dentistry, especially among specialists like plastic surgeons, maxillofacial surgeons, orthodontists,

TABLE 1: DETAILS OF THE MEASUREMENTS USING POSTERIOR ANTERIOR CEPHALOMETRIC RADIOGRAPH

Variables	Description
Mandibular intermolar width	distance from most prominent lateral point on the buccal surface of the right mand first molar (L6) to most prominent lateral point on the buccal surface of the left mand first molar (6L) along the occlusal plane.
Maxillary intermolar width	distance from most prominent lateral point on the buccal surface of the right maxillary first molar (U6) to most prominent lateral point on the buccal surface of the left maxillary first molar (6U) along the occlusal plane
Molar relationship right	distance from U6 to L6 along the occlusal plane
Molar relationship left	distance from 6U to 6L along the occlusal plane
Denture midline	distance from midpoint between the maxillary central incisors at the level of the incisal edges (U1) to midpoint between the mand central incisors at the level of the incisal edges (L1) along the occlusal plane
Nasal width	distance from most lateral aspect of the right piriform aperture (NC) to most lateral aspect of the left piriform aperture (CN)

Maxilla width	distance from intersection between the lateral contour of the maxillary alveolar process and the lower contour of the right maxillozygomatic process of the maxilla (JR) to intersection between the lateral contour of the maxillary alveolar process and the lower contour of the left maxillozygomatic process of the maxilla (JL)
Mandibular width	distance from lateral and inferior border of the right antegonial notch (AG) to lateral and inferior border of the left antegonial notch (GA);
Maxillary–Mandibular difference: the difference between the distances from AG to GA and JR to JL	
Facial width	distance from most lateral aspect of the centre of the right zygomatic arch (ZA) to most lateral aspect of the centre of the left zygomatic arch (AZ)
Frontal convexity right	distance JR to the line connecting AG and intersection between right zygomatico-frontal suture and orbit (ZR)
Frontal convexity left	distance JL to the line connecting GA and intersection between left zygomatico-frontal suture and orbit (ZL)
Maxillary–Mandibular midline	angle between anterior nasal spine- most inferior aspect of the mandibular symphysis (ANS–ME) and the perpendicular to ZL–ZR
Postural symmetry	the difference between angle ZL–GA–AZ and angle ZR–AG–ZA
Occlusal plane tilt	the difference between distances from line bisecting buccal cusp tip of the right maxillary first molar (UC) to ZL–ZR and buccal cusp tip of the left maxillary first molar (CU) to ZL–ZR
Molar to jaws right	distance L6 to JR–AG
Molar to jaws left	distance 6L to JL–GA
Denture to jaw midline	distance L1 to ANS–ME

TABLE 2: DETAILS OF THE MEASUREMENTS USING POSTERIOR ANTERIOR CEPHALOMETRIC RADIOGRAPH

		Variable	Mean	SD	Minimum	Maximum
Dental	Width	Mand intermolar width (mm)	53.17	3.13	47.20	58.20
		Max intermolar width (mm)	55.33	3.08	49.10	60.40
	Relationship	Molar relationship left (mm)	2.06	0.83	-0.70	3.20
		Molar relationship right (mm)	2.56	1.17	-3.00	4.10
Skeletal	Symmetry	Midline discrepancy (mm)	0.53	0.85	-1.00	8.00
	Width	Nasal width (mm)	31.32	4.32	23.00	38.10
		Max width (mm)	65.34	8.32	49.80	79.60
		Mand width (mm)	81.20	9.07	9.40	95.80
		Mand–max difference (mm)	21.20	6.56	9.00	32.80
		Facial width (mm)	127.39	8.21	109.00	143.00
	Relationship	Frontal convexity, left (mm)	14.31	2.85	7.20	18.70
		Frontal convexity, right (mm)	13.27	2.78	6.30	17.10
	Symmetry	Midline discrepancy (Degree)	1.32	3.65	-5.90	6.30
		Postural symmetry (mm)	3.17	3.32	-4.00	8.60
Dental to Skeletal		Occlusal plane tilt (mm)	1.49	2.34	-3.70	4.20
		Molar to jaw, left (mm)	11.89	2.93	5.70	16.10
		Molar to jaw, right (mm)	11.12	2.76	5.60	15.20
		Denture to jaw midline (mm)	-0.30	0.84	-2.00	1.30

TABLE 3: MEAN DIFFERENCES OF THE MEASUREMENTS USING POSTERIOR ANTERIOR CEPHALOMETRIC RADIOGRAPH BETWEEN SAUDI, RICKETTS, KUWAITI, TURKISH AND AUSTRIAN POPULATION

Measurements	Saudi vs Ricketts	Saudi vs Kuwaiti	Saudi vs Turkish	Saudi vs Austrian
Mand intermolar width	3.074	1.174	-1.526	-0.426
Max intermolar width	2.425	1.225	-1.475	0.125
Molar relationship left	0.555	0.155	0.355	×
Molar relationship right	1.056	0.456	1.156	×
Midline discrepancy	0.526	0.33	×	×
Nasal width	5.122	2.322	1.522	3.522
Max width	5.938	2.638	4.038	3.538
Mand width	5.497	-1.203	-9.003	-1.603
Mand-max difference	4.903	1.503	×	×
Facial width	10.99	1.59	-1.01	×
Frontal convexity, left	5.106	2.606	0.706	×
Frontal convexity, right	4.067	2.067	-0.833	×
Midline discrepancy	1.315	1.015	×	×
Postural symmetry	3.174	2.674	×	×
Occlusal plane tilt	1.485	1.485	0.985	0.085
Molar to jaw, left	6.087	1.387	2.487	×
Molar to jaw, right	5.315	0.515	1.515	×
Denture to jaw midline	-0.296	-0.1	×	×

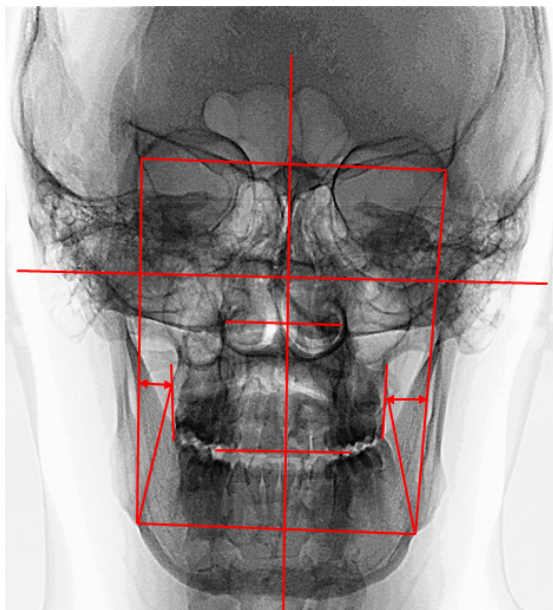


Fig 1: Ricketts analysis of posterior anterior cephalogram of an in the sample

and prosthodontists.

To determine the lateral skeletal and dentoalveolar components of a normal occlusion and malocclusion, extensive cephalometric analysis procedures have been used in subjects of different races.<sup>10-42</sup> As an aid in orthodontic diagnosis, treatment planning and follow-up Orthodontist make routine use of lateral cephalograms

for every comprehensive case, elucidating the accepted value of the analysis. However, precise diagnosis of disparities in width measurements, asymmetries and occlusal cants may also require a PA cephalometric estimation.

Dental measurements of the adult Saudi male dental related PA cephalometric values are larger in the then the Ricketts<sup>1,4</sup> original measurements. However, with some disparities, the values are quite similar with Kuwaiti<sup>5</sup>, Turkish<sup>7</sup> and Austrian population data. Ricketts<sup>1,4</sup> original data doesn't show any midline discrepancy, however, Saudi adult showed 0.53 mm and Kuwaiti<sup>6</sup> population had -0.2mm.

In relation to skeletal measurement, RA<sup>1,4</sup> standard data and Saudi adult male data were different. Almost all measurement of Saudi adult male is larger than the RA data.<sup>1,4</sup> These differences may be due to only male data were analyzed for Saudi population. In contrast with the Kuwaiti<sup>6</sup> RA results, Saudi adult has little larger values, however, mandibular width measurement of Kuwaiti<sup>6</sup> and Turkish<sup>7</sup> adult is larger than Saudi adults.

In relation to facial width measurement, the maximum differences have been revealed. Saudi adult has larger value then the Ricketts measurement, however, proximate with Kuwaiti<sup>6</sup> and Turkish<sup>7</sup> population measurement.

Out of 4 parameters of dental to skeletal RA, 3

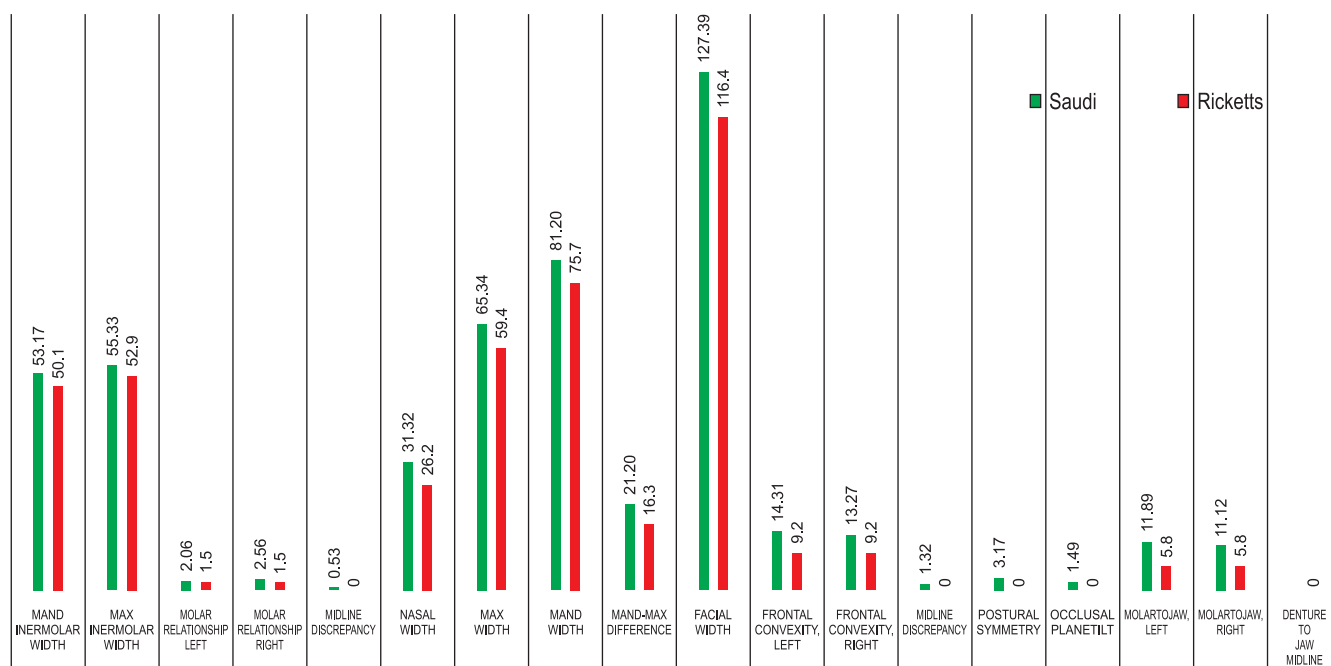


Fig 2: Mean value comparison between Saudi and Ricketts analysis of posterior anterior cephalogram

parameters measured values are larger in Saudi adult male in comparison with Ricketts original values.<sup>1,4</sup> However, these values are quite similar with Kuwaiti data. Denture to jaw midline value of RA = 0, however, Saudi and Kuwaiti 6 adult data has discrepancy of -0.3 and -0.4 mm respectively.

This study revealed for the first time PA cephalometric RA in Saudi adult male with the limitation of unavailability of female data. We recommend as a part of future study to include female data and explore any gender disparities.

## CONCLUSIONS

Based on results following conclusion can be drawn. The present data established means and ranges of commonly used PA cephalometric parameters of RA of adult Saudi male. Exact comparable information from different ethnic groups are very limited. However, the findings suggest 12/18 parameters are considerably larger than those proposed in Ricketts' analysis. The findings also suggest 5/18 parameters are considerably larger than Kuwaiti population and 13/18 were quite similar. The finding is very much similar with Turkish data, however 3/13 parameters showed larger disparities.

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|-----------------------------|--|
| 1 Ibad Ullah Kundi:         | Statistical and data analysed & drafted the article.                   |
| 2 Harshal Kumar:            | Conception and design of research, literature search, data collection. |
| 3 Muhammad Nadeem Baig:     | Proof reading and review for intellectual content.                     |
| 4 Mohammad Khursheed Alam:  | Data interpretation and manuscript editing.                            |
| 5 Yousaf Anad M Alashraray: | Data collection, helped in article layout.                             |
| 6 Easa Msbh S Al Sharari:   | Data collection.   |