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Cephalometric Comparisons of Dento-occlusal and Skeletal patterns of Adolescents from three West African countries of Nigeria, Ghana and Senegal.

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Abstract

Background: **The aim of this study was to determine and compare dento-occlusal and skeletal patterns among 12-16 year old Nigerian, Ghanaian and Senegalese adolescents. The results were further compared with published Caucasian norms.**

Method: **Lateral Cephalometric radiographs of 300 volunteers aged 12-16 years from Nigeria, Ghana and Senegal were taken and analysed to determine the dental, occlusal, and skeletal patterns.**

Results: **There were 165 females and 135 males with a female to male ratio of 1.2:1.0. Their mean age was 13.96± 1.58 years. Among the seven dento-occlusal values investigated, only upper incisor to maxillary plane was statistically significantly different within the countries studied ($p< 0.05$).**
As for skeletal variables, SNA, SNB, SN/MnP, MxP/MnP, LAFH, TAFH, TPFH, UPFH, LPFH, UAFH angles shows significantly statistically difference ($p< 0.05$) among the adolescents from the 3 countries.

Conclusion: **There were differences in the comparative analysis of dento-facial cephalometric patterns of 12-16 year old adolescents from Nigeria, Ghana and Senegal.**
Differences also are noted in the dento-skeletal pattern of West African adolescents compared to published Caucasian norms. This study provides a useful data for skeletal parameters for diagnostic, treatment planning and research purpose in the West African sub-region.

Keyword: **Cephalometry, Dento-occlusal, Adolescents, West Africans**

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Introduction

Several authors have conducted studies to determine the cephalometric values and norms of the dentofacial profile of various ethnic groups, countries and tribes.[1-10] Cephalometric norms in Chinese, Turkish, Arabian, Icelandic and Korean populations have also been published[11-15] and other patterns exist among blacks in the U.S.A and diasporas.[2,16,17,18,19] In Africa, cephalometric norms of Kenyan children (Kikuyu) have been established in comparison with white children using values from 56 children.[20] In South Africa, Jacobson carried out the famous Wit's appraisal of jaw disharmony in 25 males and 25 females to evaluate the anteroposterior relationship of the jaws.[21]

There are very few reported studies on cephalometric values in the West African sub-region. In Nigeria in particular, with a population of about 160 million people, cephalometric skeletal values of ethnic Yoruba, Igbo and Hausa-Fulani children have been evaluated and compared for diagnostic evaluation, treatment planning and research purposes.[6-10] Similarly, Isiekwe and Sowemimo evaluated some of the soft tissue values in normal Nigerian adult population and compared them with values in unrepaired clefts patients.[4] Similar cephalometric measurements were evaluated that showed variations in the values obtained. In Senegal, recent studies were concerned with cephalometric features of orthodontic patients by Diouf et al[22] or normal subjects,[23,24] meanwhile, there exist another study among Ivorians by Agnerroh-Eboi et al[25]. Only very few studies have actually compared the cephalometric values of various West African countries. For instance, a comparative study between Senegalese and Camerounians were

conducted by Bacon and Mathis and among ethnic groups from Ivory Coast, Senegal and Chad by Beugre et al.[26,27]

With the proposed common market and currency within the West African sub-region, which allows for easy movement of people across this sub-region, the establishment of values will be an important tool to set standards for treatment of orthodontic patients. Towards these ends this study was undertaken to compare the Cephalometric value of adolescent from Nigeria, Ghana and Senegal and set normative values for these people.

Materials and Methods

This was a cross-sectional multinational comparative study carried out at the Orthodontic units of Obafemi Awolowo University Teaching Hospitals complex, Ile-Ife, Osun State, Nigeria, University of Ghana Dental School, Korle-Bu, Accra, Ghana, and school of Dentistry, University Cheikh Anta Diop, Dakar, Senegal. The study sample comprised of 100 untreated volunteer adolescents each from Nigeria, Ghana and Senegal aged 12-16 years presenting in the Dental clinics for orthodontic treatment.

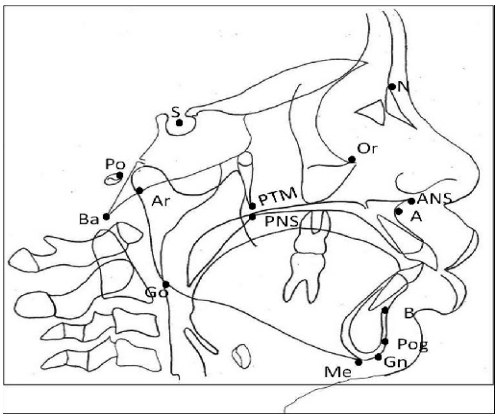
Inclusion Criteria for this study were class 1 incisal occlusion (British Standard Institution {BSI}),[28] nationality by birth of countries involved in this study, no prior orthodontic treatment nor prosthetic replacement of teeth, and absence of craniofacial malformations. Ethical approval for the study was received from the Ethics Committee of the 3 universities. Verbal and written consent were obtained from the adolescents as well as their parents before radiographs were taken.

The equipment used was The Pan-Blue-Oris Machine (Blue-X-Imaging SRL BLD XP PAN CEPH METRIC ASSAGO, ITALY) in Nigeria, the Panoura Ultra (model: XP50, 10Ma, Ibaraki, Japan) in Ghana and the Rotograph 230 EUR in Senegal.

The cephalometric films obtained were traced on 0.003" matte finish acetate sheets by the first author (FAD).

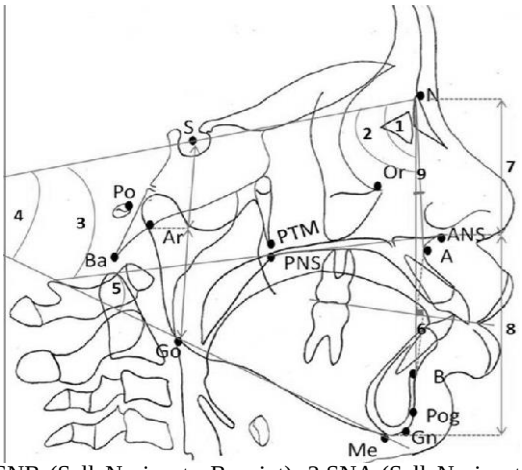
The reference points and lines used in the cephalometric analysis were based on those introduced by Krogman and Sassouni; and Jacobson and Jacobson and are shown in Figures 1, 2 and 3.[29,30].

Figure 1 Cephalometric landmarks



S(Sella);**ANS**(Anterior nasal spine); **Ar**(Articulare); **Ba**(Basion); **Go**(Gonion); Gn(Gnathion); Me(Menton); Or(Orbitale); PNS(Posterior nasal spine); Pog(Pogonion); Po(Porion); Point A(Subspinale); Point B(Supramentale); PTM (Pterygomaxillare)

Figure 2:Linear and angular skeletal measurements.



1.SNB (SellaNasion to B point); 2.SNA (SellaNasion to A point); 3.SN/MxP(Sella-nasion to maxillary plane angle); 4.SN/MnP(Sella-nasion to mandibular plane angle); 5.Mx/MnP(Maxillary plane to Mandibular plane angle); 6.OA-OB(Wits appraisal); 7.UAFH(Upper anterior facial height); 8.LAFH(Lower anterior facial height); 9.ANB angle; 10.TPFH(Total posterior facial height) or S-Go (Sella to Gonion).

1. Ui-FP (Maxillary incisor to Francfort plane angle); 2.Ui-MxP(Maxillary incisor to palatal plane angle); 3. Li-MnP(Lower incisor to mandibular plane angle); 4.UI/LI(Inter-incisal angle); 5.OB(Overbite); 6.OJ(Overjet); 7.Li to N-Pog(Lower incisor to N-Pogonion)

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From these landmarks, both linear and angular dental and skeletal measurements were made. (Table I)

Table I: Skeletal cephalometric landmarks used in this study

Landmark name	Abbreviation	Definition
Sella.	S	The geometric centre of the pituitary fossa.
Anterior nasal spine	ANS	The anterior tip of the sharp bony process of the maxilla at the lower marg in of the anterior nasal spine.
Articulare	Ar	A point at the junction of the posterior border of the ramus and the inferior border of the posterior cranial base (occipital bone).
Basion	Ba	The lowest point on the anterior rim of the foramen magnum.
Gonion	Go	point on the curvature of the angle of the mandible located by bisecting the angle formed by lines tangent to the posterior ramus and inferior border of the mandible.
Gnathion	Gn	A point located by taking the midpoi nt between the anterior (pogonion) and inferior (menton) points of the bony chin.
Menton	Me	The lowest point on the symphysial shadow of the mandible seen on a lateral cephalogram.
Nasion	N	The most anterior point on the frontonasal suture in the midsagittal plane.
Orbitale	Or	The lowest point on the inferior rim of the orbit.
Posterior nasal spine	PNS	The posterior spine of the palatine bone constituting the hard palate.
Pogonion	Pg	Is the most anterior point on the chin.
Porion	Po	The most superiorly positioned point of the external auditory meatus located by using the ear rods of the cephalostat.
Subspinale	Point A	Is the most posterior midline point in the concavity between the ANS and the prosthion (the most inferior point on the alveolar b one overlying the maxillary incisors).
Supramentale	Point B	Is the most posterior midline point in the concavity of the mandible between the most superior point on the alveolar bone overlying the mandibular incisors (infradentale) and the Pog.
Pterygomaxillare	PTM	Is the contour of the pterygomaxillary fissure formed anteriorly by the retromolar tuberosity of the maxilla and posteriorly by the anterior curve of the pterygoid process of the sphenoid bone. The lowest point of the opening is used on each cephalogram.

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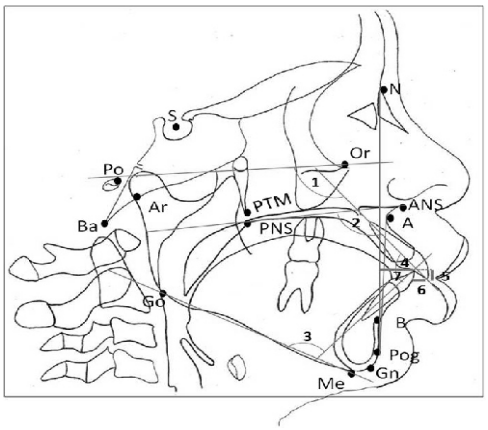
Figure 3 Linear and angular Dental measurements.



To determine the reliability of the cephalometric method, 10 randomly selected cephalometric radiographs from each group were traced and measured twice with a 2-week interval by the same investigator. Random error (S) and systematic errors were then evaluated.

Statistical analysis

The Statistical Package for Social Science software (SPSS), Version 16, Chicago III was used for data entry, editing and analysis. Means and standard deviations were computed for all quantitative variables. Frequency distributions were generated for nominal or ordinal variables. Student t-test was used for comparison of the mean cephalometric values for boys and girls. Analysis of Variance (ANOVA) was used for comparing mean values of dento-occlusal and skeletal patterns in the three study locations and Bonferroni was used as post hoc tests.

Random error (S) was calculated according to Dahlberg's formula[31]: $S = \sqrt{\sum d^2 / 2n}$, where d is the difference between the two measurements and n is the number of tested radiographs and systematic errors were evaluated with paired t-tests.

Statistical significance was set at $P < 0.05$.

Results

The whole sample comprised 165 females and 135 males with a mean age of 13.96± 1.58 years. The mean age and standard deviation (SD) for Nigeria, Ghana and Senegal were 13.9 (1.7) years; 14.5 (1.5) years and 13.5 (1.5)

Table II: Comparison of means and standard deviation (SD) of dento-occlusal measurements of subjects grouped according to the countries

Dento-occlusal measurements	Nigeria X (SD) n = 100	Ghana X (SD) n = 100	Senegal X (SD) n = 100	Total n = 300	Nigeria versus Ghana (p value)	Nigeria versus Senegal (p value)	Senegal versus Ghana (p value)
UI-MxP (degrees)	119.88 (7.09)	120.94 (7.13)	114.57 (7.73)	118.40 (7.81)	0.921	<0.001**	<0.001**
LI-MnP (degrees)	96.63 (8.39)	98.74 (7.98)	97.31 (7.31)	97.5 (7.93)	0.181	1.000	0.607
UI/LI (degrees)	114.39 (12.24)	112.76 (10.12)	116.18 (12.88)	114.40 (11.85)	0.990	0.854	0.125
LI-APo (mm)	6.60 (3.26)	6.45 (3.04)	6.25 (3.56)	6.43 (3.28)	1.000	1.000	1.000
LI-NPo (mm)	10.59 (4.29)	9.98 (3.32)	10.47 (4.46)	10.34 (4.05)	0.867	1.000	1.000
Overjet (mm)	2.63 (0.48)	2.77 (0.48)	2.73 (0.44)	2.71 (0.47)	0.113	0.410	1.000
Overbite (mm)	2.63 (0.48)	2.56 (0.51)	2.54 (0.50)	2.54 (0.50)	0.973	0.035 *	0.366

*= statistical significant, p< 0.05
**= highly statistically significant, p< 0.001

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years respectively. There was a general female preponderance of subjects across the three countries with greater female to male ratio in the Nigerian group.

The random errors on all variables did not exceed 0.5mm and 0.70 respectively for linear and angular measurements and the systematic errors paired t test analysis did not reach significance for any of the variables.

Means and standard deviations of dento-occlusal measurements of subjects grouped according to the country of origin are displayed in Table II.

It appears that upper incisor to maxillary plane angle shows significant difference between groups, the Senegalese having lowest values and the Ghanaians the highest. Comparisons of skeletal variables are shown in Table III.

Table III: Comparison of means and standard deviation (SD) of skeletal measurements of subjects grouped according to the countries

Skeletal measurements	Nigeria X (SD) n = 100	Ghana X (SD) n = 100	Senegal X (SD) n = 100	Total n = 300	Nigeria versus Ghana (p value)	Nigeria versus Senegal (p value)	Senegal versus Ghana (p value)
SNA (degrees)	87.53 (5.41)	88.60 (4.02)	84.37 (4.48)	86.83 (4.99)	0.320	<0.001**	<0.001**
SNB (degrees)	82.15 (5.24)	83.34 (3.83)	78.28 (3.96)	81.25 (4.88)	0.169	<0.001**	<0.001**
ANB (degrees)	5.38 (2.12)	5.37 (2.24)	5.99 (2.21)	5.58 (2.20)	1.000	0.151	0.140
Wits (mm)	3.18 (3.45)	3.58 (2.55)	2.65 (2.43)	3.13 (2.86)	0.965	0.568	0.065
SN/MxP (degrees)	7.13 (4.24)	6.20 (3.80)	7.46 (4.08)	6.93 (4.07)	0.316	1.000	0.086
SN/MnP (degrees)	35.83 (6.98)	33.76 (5.77)	39.10 (5.01)	36.23 (6.35)	0.045*	<0.001**	<0.001**
MxP/MnP (degrees)	29.09 (5.70)	27.84 (5.78)	32.09 (4.98)	25.76 (5.76)	0.328	<0.001**	<0.001**
LAFH (mm)	70.01 (7.32)	68.42 (5.89)	62.82 (5.94)	68.41 (6.50)	0.240	0.001 **	0.234
UAFH (mm)	53.72 (5.49)	52.48 (4.35)	51.07 (4.08)	52.42 (4.79)	0.187	<0.001*	0.102
LAFH/TAFH (%)	56.40 (3.05)	56.52 (2.30)	56.65 (2.72)	56.52 (2.70)	1.000	1.000	1.000
LPFH (mm)	48.09 (7.46)	47.06 (5.10)	42.96 (6.14)	46.03 (6.67)	0.749	<0.001**	<0.001**
UPFH (mm)	47.45 (5.10)	48.02 (4.04)	45.91 (3.72)	47.12 (4.40)	1.000	0.037 *	0.002 *
PFH (mm)	95.60 (9.63)	94.08 (10.99)	88.89 (7.84)	92.85 (9.96)	0.788	<0.001**	<0.001**
TAFH (mm)	124.04 (10.69)	120.90 (8.52)	117.89 (8.26)	120.94 (9.53)	0.005*	<0.001**	0.065

*= statistical significant, p< 0.05 **= highly statistically significant, p< 0.001

With respect specifically to anteroposterior dimension, SNA and SNB showed significant difference between Nigerians and Senegalese on one hand and between Senegalese and Ghanaian on the other hand (p<0.001) but ANB did not.

As for vertical dimension, the same groups differed significantly with respect to angular measurements (SN/MnP and MxP/MnP). The

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Table IV: Comparison of dento-facial measurements of male and female subjects when the 3 groups are combined

Overjet (mm)	2.71 (0.47)	2.77 (0.45)	2.66 (0.48)	t = 1.997 df = 298 p = 0.043 *
Overbite (mm)	2.54 (0.50)	2.53 (0.51)	2.55 (0.49)	t = -0.413 df = 298 p = 0.680
UI-MxP (degrees)	118.40 (7.81)	118.78 (7.19)	118.21 (8.30)	t = 0.630 df = 298 p = 0.529
LI-MnP (degrees)	97.5 (7.93)	98.35 (8.07)	96.90 (7.77)	t = 1.575 df = 298 p = 0.116
UI/LI (degrees)	114.40 (11.85)	112.84 (11.54)	115.78 (11.97)	t = -2.135 df = 298 p = 0.034 *
LI-Apo (mm)	6.43 (3.28)	6.88 (3.31)	6.06 (3.22)	t = 2.184 df = 298 p = 0.030 *
LI-NPo (mm)	10.34 (4.05)	10.77 (4.19)	9.99 (3.91)	t = 1.671 df =298 p = 0.096
SNA (degrees)	86.83 (4.99)	86.76 (5.08)	86.89 (4.93)	t = -0.220 df = 298 p = 0.826
SNB (degrees)	81.25 (4.88)	81.23 (4.89)	81.27 (4.89)	t = -0.063 df = 298 p = 0.950
ANB (degrees)	5.58 (2.20)	5.52 (2.26)	5.62 (2.16)	t = -0.383 df = 298 p = 0.702
SN/MxP (degrees)	6.93 (4.07)	6.61 (4.24)	7.18 (3.91)	t = -1.214 df = 298 p = 0.226
SN/MnP (degrees)	36.23 (6.35)	36.34 (6.34)	36.13 (6.37)	t = 0.273 df = 298 p = 0.785
MxP/MnP (degrees)	25.76 (5.76)	30.16 (5.77)	29.27 (5.74)	t = 1.332 df = 298 p = 0.184
Wits (mm)	3.13 (2.86)	3.43 (2.77)	2.89 (2.91)	t = 1.647 df =298 p = 0.101
LAFH (mm)	68.41 (6.50)	70.03 (7.03)	67.09 (5.73)	t = 3.997 df = 298 p < 0.001 **
UAFH (mm)	52.42 (4.79)	53.38 (5.08)	51.63 (4.40)	t = 3.192 df = 298 p = 0.002 *
LAFH/TAFH (%)	56.52 (2.70)	56.58 (2.70)	56.48 (2.70)	t = 0.332 df = 298 p = 0.740
LPFH (mm)	46.03 (6.67)	47.57 (7.40)	44.78 (5.73)	t = 3.675 df = 298 p < 0.001 **
UPFH (mm)	47.12 (4.40)	48.11 (4.69)	46.32 (3.99)	t = 3.567 df = 298 p = 0.001 **
PFH (mm)	92.85 (9.96)	94.98 (11.79)	91.11 (7.78)	t = 3.404 df = 298 p = 0.001 **
TAFH (mm)	120.94 (9.53)	123.60 (10.23)	118.77 (8.34)	t = 4.506 df = 298 p < 0.001 **

*= statistically significant, p< 0.05 **= highly statistically significant, p< 0.001

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Table V: Cephalometric standard values from previous studies compared with that of West African Adolescents (this study)

Author	Date	SNA	SNB	ANB	UI/MX	LI/MN	UI/LI	MMPA
Bjork	1947	82	78	4	110	91	131	28
Downs	1948	81	78	3	112	91	131	28
Riedel	1950	82	80	2		93	131	
Steiner	1953	83	80	1		93	130	
Ballard	1956	81	77.5	3.5	109	93	131	27
Riedel	1957			3	107	94	136	23
Taylor & Hitchcock	1966	81	78	3	110	97	127	26
Peck & Peck	1970	82	80	2	107.5	95	133.5	24
Riolo et al	1974	81	78	3	111	94	129	26
Bolton	1975	84	81	3	104.5	91	140.5	24
Bishara	1981	81.5	79	2.5	106.5	97	131	25.5
Mills	1982	81	78	3	109	93	131	27
McNamara	1988	83.5	81	2.5	113.5	93.5	134	19
MacAllister & Rock	1982	81	78	3	108	91	134	27
Overall mean		81.8	79	2.8	109	93.3	132.4	24.9
Present Study	2012	86.83	81.25	5.58	188.4	97.5	114.4	-

From : Hamdan and Rock, 2001

vertical linear measurements also showed significant differences mainly between Senegalese and any of the other 2 groups.
When the 3 groups are combined, the analysis of the difference of the skeletal and dental variables according to gender show significant differences only in very few measurements (Table IV). Table V shows the comparison of the findings of the present study with that of published Caucasian norms. Overall, it appears that black subjects have larger values except for Inter-incisal angle which is lower.

Discussion

This study provides a useful platform for comparing cephalometric dento-occlusal and skeletal values among adolescents in the West African sub-region, using 12-16 year old, from Nigeria, Ghana and Senegal. Even though this research work was carried out across three countries, efforts were made to ensure standardization of instruments and records.

In this study, seven dental and occlusal parameters of adolescents were determined. The results reveal that there were some similarities and differences in those obtained from the different countries studied. The upper incisor to maxillary plane angle is higher in the Ghanaian and Nigerian than the Senegalese adolescents. The lower incisors to mandibular plane angle follow the same trend although the difference did not reach significance. Globally, the values of the angles between both the upper and lower incisors relative to their supporting structure are similar to that reported in other African studies.[4,10,27] However, they are found to be higher than values derived from Caucasian populations[32,33,34,35,36] This relative African bi-maxillary protrusion appears to be more pronounced in Ghanaians and Nigerians than in Senegalese. The findings that upper and lower incisors are more proclined in black than in Caucasian subjects have been repeatedly reported in many studies .[9,16,32,] Other racial groups (Filipinos, Arabians, Asians etc.) have also been reported to display similar dental patterns.[11,13] Apart from racial variations, no causative factors have been suggested. However, bimaxillary protrusion has been linked to soft tissue behaviour (tongue thrusting) or size (macroglossia) in many studies .[37] But it is not known that this account for the differences noted between blacks and Caucasians.

Seven antero-posterior skeletal parameters were determined in the present study, revealing differences and some similarities among the groups. The Wits values among the

adolescents from Nigeria, Ghana and Senegal were similar when compared. These values were however higher than the report from South African blacks.[21] The Wits appraisal of jaw disharmony is another method used to measure the degree or severity of jaw disharmony. This present study observed that the position of the maxilla to mandible is more anterior which is in agreement with other studies which showed that blacks tend to have more prognathic maxilla than Caucasians.[2,9,20,22] A linear estimation of reported limit of the apical base differences in normal occlusion, as determined by the Wits appraisal, suggest a distance between -6.5 and +6.5mm for children of African descent and -4.5 and +4.0mm for adults of European descent.[19]

The Sella-nasion-A point angle (SNA) assessed in this present study showed significant differences in the values obtained between Nigerian and Senegalese adolescents; and between Senegalese and Ghanaian adolescents. The Nigerian children have a lower SNA compared to the Ghanaians. The mean SNA in this study is higher than that obtained from American children of African descent[2] and Caucasians[1,33] but similar to that obtained in Nigerian children and Kikuyi children in Kenya.[7,9,10,20] The reason for variations in the SNA of adolescents in this study may be due to age variation and geographical location. But this needs to be further investigated.

The Sella-nasion-B point angle (SNB) determined in this study higher in the Ghanaian than the Nigerian adolescents. The mean SNB is similar to that obtained by Utomi (1998) and Ajayi (2005) among Nigerian children; however this is higher than the values obtained among most Caucasian population.[8,9,36,38] The Senegalese adolescents had the lowest SNB value compared to the Nigerian and Ghanaians.

The mean maxillary to mandibular plane angle obtained in this present study showed significant differences between Nigerian and Senegalese adolescents; and between Senegalese and Ghanaian adolescents. The Senegalese adolescents had the highest mean amongst the countries studied. The possible reason for this observation may be the fact that the Senegalese adolescents have a more straight profile like the Caucasians. The mean maxillary to mandibular plane angle in this present study is less than that obtained by Downs and Ballard but similar to that by Bishara although these studies were among Caucasians.[1,34,39] It is however similar to that obtained by Hameed et al among class I skeletal base patients in Pakistanis.[40] The Frankfort mandibular plane angle and Mandibulomaxillary plane angle are similar angles used as an assessment of facial heights, which is an indicator of either increase or decrease anterior facial height. This present study shows that the lower anterior facial height is reduced in West Africans compared to Caucasians.

The mean SN to mandibular plane angle in this present study showed significant differences between the countries. These values are however less than the values among Pakistanis.[40] The adolescents from the three West African countries thus have a larger anterior facial height than the Pakistanis. The reason for this observation may be due to difference in genetic makeup. The mean vertical skeletal relationships measured in this study revealed that the upper anterior facial height, the lower anterior facial height, the lower posterior facial height, the upper posterior facial height and total (posterior and anterior) facial heights were related to gender. The total mean lower anterior facial height determined in this study is 68.41±6.50mm, however the values obtained among the countries studied differ from one another, with the Nigerian adolescents (70.01±7.32mm) being the highest and Senegalese adolescents, the lowest (62.82±5.94). The mean is higher than 60.85±5.03mm that was obtained in Nigerian children by Folaranmi of the same age group.[10] The value obtained among the Senegalese adolescents in this study was in agreement with the Nigerian children in Folaranmi study.[10]

The total upper anterior facial height mean in this study shows differences among the various countries. Folaranmi obtained a mean of 47.69±4.84mm which is far below that obtained in this present study.[10] The possible reason for this observation may be due to differences in sample selection. The subjects in this present study were selected base on class I incisal relationship and not Angles class I.[28] The Nigerian adolescents (53.72±5.49mm) are the highest among the nations studied. The reason for this observation may be due to longer facial heights among Nigerians.[4,42]

The ratio of lower anterior facial height to total anterior facial height showed some form of semblance among the three West African countries. The value is in agreement with (55.99±3.84%) obtained by Folaranmi and 55 % in Caucasian children and 55.55±6.77% in Pakistanis by Hammed et al.[10,40,41] The knowledge of the anterior facial proportions is important in defining facial aesthetics. A short upper anterior facial height often suggest a skeletal problem with an anterior open bite that may necessitate a surgical rather than a purely orthodontic intervention for treatment. The mean total anterior facial heights in this study are high but similar to that obtained by Isiekwe and lower to 108±5.54mm from Folaranmi study in Nigerian children.[10,41] This may explain the differences observed in the value of anterior upper and lower facial heights observed in this study. A higher value of total anterior facial height was evaluated in the Nigerian adolescents (124±10.69mm) compared to Ghanaian (120.0±8.52mm) and Senegalese (117.89mm) adolescents. This shows significant difference in the mean total anterior facial heights in these countries. Geographical location and racial differences of the subjects may be a reason for this observation; the Ghanaians and Nigerian adolescents had a more convex facial profile compared to the Senegalese which is straighter.

Conclusions

- This study had determined and compared the dento-occlusal and skeletal cephalometric variables of West African adolescents from 3 different countries (Nigerian, Ghanaian and Senegalese). The findings were further compared to that reported for caucasian subjects. Overall, it appears that few significant differences exist between Nigerians and Ghanaians on one hand and the Senegalese on the other hand.
- The dento-facial cephalometric data provided by this study should be used in the management of patients for diagnosis, treatment planning and treatment evaluation of adolescents in the West African sub-region.
- Comparison of these values with that reported earlier for Caucasian subjects reveal substantial differences that may be taken into account when establishing treatment plan for these subjects.

Contributors

Fadeju AD, was responsible for study design acquisition, analysis and interpreting the data writing and final approval of the study.

Otuyemi, OD, was responsible for the concept, study design, acquisition, analysis, interpreting and editing and final approval of the study.

Ngom PI, was responsible for study design, writing & editing.

Newman Nartey M. was responsible for data acquisition and editing while

Amoah K. was also responsible for data acquisition and editing.

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