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# Overbite Depth Indicator (ODI) and Anteroposterior Dysplasia Indicator (APDI) Cephalometric Norms for an Adult Nigerian population.

Isiekwe IG<sup>a</sup>, Ayenakin O<sup>b</sup>, Koledoye OA<sup>b</sup>

## Abstract

**Background:** Vertical and sagittal jaw relationships have been evaluated in the past using the Overbite Depth Indicator (ODI) and the Anteroposterior Dysplasia Indicator (APDI) measurements, respectively. These values have been studied in different populations, but there is a paucity of data among Nigerians. The aim of this study was to determine the mean ODI and APDI values in a young adult Nigerian population and to compare this with the values for Black American and Caucasian populations.

**Methods:** The cephalometric radiographs of 73 young adult Nigerians aged 18-25 years, with normal occlusion and no prior orthodontic treatment, were used. All radiographs were manually traced to determine the value of the ODI and APDI angles. The mean values for both angles were computed. Students' t-tests were used to assess for gender differences and to compare the mean ODI and APDI values between the Nigerian population studied, with African American and Caucasian populations, respectively.

**Results:** The mean age of the study participants was  $21.67 \pm 2.3$ . The mean ODI and APDI angles recorded were  $69.39^\circ \pm 7.2^\circ$  and  $82.51^\circ \pm 4.7^\circ$ , respectively. There were no significant gender differences recorded for both angles.

**Conclusion:** Findings from this study showed the values for ODI/APDI were slightly similar in overall range to those of the African American population, even though the mean values were slightly lower in the Nigerian population.

**Keywords:** Overbite Depth Indicator, Anteroposterior Dysplasia Indicator, Cephalometric norms, Nigerians,

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## Introduction

Orthodontic treatment involves the correction of anomalies in the teeth and jaws. It requires comprehensive consideration of all the dental and skeletal features of an individual to arrive at a proper diagnosis. Therefore, successful orthodontic treatments rely largely on various standardized diagnostic measures to develop an objective assessment of the underlying aetiology of

malocclusion and to properly plan treatment. The cephalometric radiograph is still the most reliable diagnostic tool used in clinical diagnosis of discrepancies of the face and jaws<sup>1</sup>

Cephalometric radiographs have been found to provide a means of accurately evaluating the relationships of different parts of the face that best fits the description of the average facial form of ideal occlusion. Imaging is a standard aspect of a patient's clinical records in orthodontic diagnosis and treatment planning<sup>1</sup>. The ability to incorporate the various hard and soft tissue cephalometric values into treatment consideration has become increasingly important in recent years<sup>22</sup>

The measurement of vertical and sagittal skeletal relationships form an important aspect of cephalometric assessment in orthodontic diagnosis and treatment planning. In the past, vertical jaw

relationships were assessed with Downs mandibular plane angle (FMA), Y-axis, Steiner mandibular plane angle (SNMP), facial angle and several others.<sup>3</sup> The Frankfort plane was used as a reference plane and one of the problems regarding these analyses was related to difficulty in identifying the landmarks.<sup>3</sup> In order to overcome this deficiency and facilitate diagnosis, Kim,<sup>4</sup> studied cephalograms of 119 subjects with ideal occlusion and introduced the overbite depth indicator (ODI) to assess the skeletal relationship in the vertical plane. The ODI is the sum of two interplanar angles that showed the highest correlation with incisor overbite. It describes the skeletal trends towards open bite or deep bite.<sup>3</sup>

Indeed several parameters of orthodontic value have been defined to assess sagittal relationships. The ANB angle which was introduced by Riedel in 1952, the Wits appraisal and McNamara analysis have all been used to assess sagittal skeletal relationships in the past.<sup>5,6,7</sup> Studies show the differences measured by the ANB are not always indicative of the relationship of the apical base.<sup>8</sup> Indeed, the values of the ANB angle are affected by the steepness of the S-N plane, variation in the position of point A due to root position, exceptionally long or short mandible, and facial height.<sup>9</sup> Jacobson<sup>10</sup> also stated that errors could occur in the ANB measurement due to displacement of the nasion or rotation of the jaws which led to the development of Wits appraisal. Wits appraisal provided a simple method of measuring the severity of anteroposterior dysplasia of the jaw on the lateral cephalometric film, by drawing perpendicular lines from the A and B points to the functional occlusal plane.<sup>6,10</sup> However, this also posed some challenges, particularly in determining the functional occlusal plane in mixed dentition, in patients with anterior open bites, occlusal cants or missing teeth.<sup>11</sup> Kim and Vietas<sup>12</sup> developed the anteroposterior dysplasia indicator (APDI) after studying the cephalograms of 102 subjects with normal occlusion, and 874 subjects with different dental malocclusions based on Angle's classification. They described the APDI as the sum of three measurements: the facial angle, the A-B plane, and the palatal plane in relation to the Frankfort horizontal. More recently, the APDI was found to be geometrically equal to the angle formed by the A-B plane and the palatal plane.<sup>13</sup>

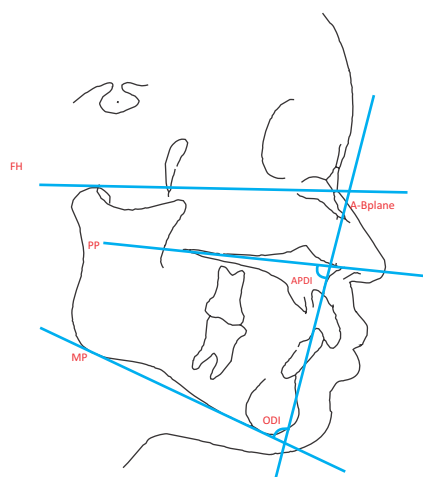
Different studies have shown that the ODI and APDI values vary in different populations.<sup>3,12,14,15 16</sup> These studies reflect the ethnic variations for both measurements. Furthermore, the values are

particularly significant in the diagnosis and treatment planning of vertical and sagittal discrepancies.. The paucity of data on these angles in the Nigerian population makes it a crucial area of research, as these values will be of significant benefit in orthodontic treatment planning for Nigerians. Thus, this study aimed to develop normative values for ODI and APDI in a young adult Nigerian population and to compare these values with established values for Caucasians and African Americans.

## Materials and Methods

This was a retrospective cross-sectional study carried out at the Orthodontic unit of the Child Dental Health Department of the Lagos University Teaching Hospital (LUTH), Nigeria. The radiographs for this study had previously been used to assess the soft tissue profile of undergraduate students at the University of Lagos.<sup>17,18</sup> The subjects were made up of second-year to final-year medical, dental, and pharmacy students of the College of Medicine, University of Lagos, Idi-araba, Lagos, Nigeria. The first step of the selection process involved clinical examinations and interviews to determine those who met the selection criteria: Nigerians with Nigerian grandparents; 18 to 25 years; symmetrical face and a harmonious facial profile, no previous orthodontic or prosthodontic treatment and no craniofacial deformities or history of trauma. Female subjects who were pregnant or likely to be pregnant were excluded from the study. The sample population consisted of 73 Nigerian adults (29 Males and 44 Females).

All the radiographs were hand-traced under a well-illuminated view box by two calibrated examiners (OA and OAK). Four planes and their landmark points were identified to measure the ODI and APDI variables. The AB plane (from point A to point B), the Mandibular plane (line from gonion to menton), the Frankfort Horizontal plane FH (a line from orbitale to porion), and the Palatal Plane PP (line from the anterior nasal spine to the posterior nasal spine) were traced (Figure 1). As previously described by Kim,<sup>4</sup> the ODI was defined as the sum of the angle formed by (1) the AB plane and the mandibular plane with the angle formed by the (2) palatal plane (PP) and Frankfort horizontal<sup>20</sup>. Subtraction of the angle formed by FH and PP was done from the ODI where PP sloped upwards and anteriorly in relation to the FH. On the other hand, the relative value of the PP-FH angle was added to ODI, where the Palatal Plane



**Figure 1:** Lateral cephalometric radiograph illustrating the planes used to determine the ODI and APDI variables. Abbreviations: A-B plane indicates A-point to B-point plane; APDI, Anteroposterior Dysplasia Indicator; FH, Frankfort horizontal plane; MP, mandibular plane; ODI, Overbite Depth Indicator; PP, palatal plane

sloped downwards and anteriorly to the Frankfort Plane. The APDI was defined as the angle formed by the AB plane and the Palatal Plane angle<sup>19</sup> (Figure 1).

To assess intra-examiner reliability, 5 radiographs were randomly selected and traced one week after. The concordance correlation coefficient was used to measure intra-observer reliabilities. Descriptive statistics included mean, median, standard deviation, and range values for ODI and APDI measurements. Student's t-test was used to assess the mean ODI and APDI values for gender differences. One-way analysis of variance and the Turkey tests were used to compare mean ODI and APDI values recorded in this study with those reported for African American and Caucasian populations.

## Results

Reliability tests showed a positive correlation between the measurements recorded by both investigators who traced the cephalograms for the ODI and APDI measurements, with values of  $r=0.844$ ,  $p=0.002$  and  $r=0.903$ ,  $p=0.000$  recorded respectively for both measurements. A very high level of intra-examiner reliability was also recorded by the investigators for both measurements ( $r>0.8$ ).

The mean age of the respondents was  $21.67 \pm 2.3$  years. The gender distribution was 60.3% (29) females and 39.7% (44) males. Table 1 shows the age distribution of the study participants.

The mean ODI values recorded for Nigerian adult males and females were  $68.9 \pm 8.0$  and  $69.66 \pm 6.6^0$  respectively. There were no significant gender differences recorded. Furthermore, the mean APDI values recorded for male and female adults were  $82.91^0 \pm 5.2^0$  and  $82.24^0 \pm 4.0^0$  and no significant gender differences were reported. (Table 2)

When compared with the mean ODI in African Americans and Caucasians (Table 3), the mean ODI recorded in this study ( $69.39 \pm 7.2$ ) was similar to that reported for African Americans<sup>16</sup> ( $70.98^0$ ) but significantly lower than that reported for Caucasian populations ( $74.5^0$ )<sup>4</sup>. In addition, the mean APDI angle recorded in this study was significantly higher than that recorded in African Americans<sup>16</sup> ( $78.18$ ) and similar, although slightly higher than the mean value reported in Caucasians<sup>4</sup>.

**Table 1. Age and gender distribution of participants**

| Age group (Years) | Frequency (n=73) | Percentage |
|-------------------|------------------|------------|
| 18-20             | 23               | 31.5       |
| 21-22             | 25               | 34.2       |
| 23-24             | 14               | 19.2       |
| >24≤25            | 11               | 15.1       |
| Mean±SD           | 21.67±2.3        |            |
| Gender            |                  |            |
| Male              | 29               | 39.7       |
| Female            | 44               | 60.3       |

**Table 2. Mean comparison of ODI and APDI according to gender**

|      | Male      | Female    | t-value | p-value |
|------|-----------|-----------|---------|---------|
| OI   | 68.99±8.0 | 69.66±6.6 | -0.388  | 0.699   |
| APDI | 82.91±5.2 | 82.24±4.5 | 0.592   | 0.55    |

**Table 3. Comparison of the mean values of ODI with Nigerian, African American, and Caucasian values.**

| ODI Values comparison   | Mean value (degrees) | Sample size | F value (p) |
|-------------------------|----------------------|-------------|-------------|
| Current study           | 69.39 ±7.2           | 73          | 0.0000      |
| Previous Nigerian study | 66.85 ± 4.46         | 50          |             |
| African American Study  | 70.98 ± 5.8          | 160         |             |
| Caucasian Study         | 74.5±6.07            | 119         |             |

One-way ANOVA and Post-Hoc Turkey tests: At 95% CI revealed the following:

Current study compared to previous Nigerian study<sup>20</sup> by Adediran *et al*: p=0.0996

Current study compared to African American study<sup>16</sup>: p=0.2858

Current study compared to Caucasian study<sup>4</sup>: (Kim, 1974) \*p=0.000

Previous Nigerian study<sup>20</sup> (Adediran *et al*) compared to African American study<sup>16</sup>: \*p=0.0002

Previous Nigerian study<sup>20</sup> (Adediran *et al*) compared to Caucasian study<sup>4</sup>: \*p=0.0000

African American Study compared with a previous Nigerian study<sup>20</sup> \*p=0.0000

\*p<0.05

**Table 4. Comparison of mean values of APDI with African American and Caucasian values.**

| APDI Values comparison | Mean value (degrees) | Sample size | F value (p) |
|------------------------|----------------------|-------------|-------------|
| Current study          | 82.51±4.7            | 73          | 0.000       |
| African American       | 78.18                | 160         |             |
| Caucasian              | 81.4±3.8             | 102         |             |

One-way ANOVA and Post-Hoc Turkey tests at 95% CI

Current study compared to African American<sup>16</sup> \*p=0.0000

Current study compared to Caucasian study p=0.1976

African American<sup>16</sup> study compared to Caucasian study \*p=0.0000

## Discussion

ODI and APDI cephalometric variables have been studied in various populations.<sup>3,4,13,15,16,20</sup> The studies

carried out in these populations have validated the diagnostic efficiency of both variables. However, there is limited data on normative cephalometric

values or cephalometric analysis of Nigerian patients using both variables.

One of the few studies carried out to assess ODI values in a Nigerian population is the study by Adediran *et al.*<sup>20</sup> The mean value of the ODI value recorded in that study for a population with normal occlusion was  $66.85^0 \pm 4.46^0$  and this is closely related to the value recorded in our current study of  $69.39^0 \pm 7.20^0$ . This is underscored by the absence of a significant difference between the mean ODI values recorded in both studies. The findings from that study also indicated that the Nigerian population studied had a tendency towards a deep bite and that the ODI was able to sufficiently differentiate between patients with anterior open bites and normal controls. However, because a larger sample was used in the current study of 73 people compared to 50 people in the study by Adediran *et al.*,<sup>20</sup> it may be argued that the mean values obtained in this study may be more representative of the normative values of ODI for Nigerians.

An ODI value below the normative value indicates a greater tendency towards an open bite while values greater than the normative range reflect a tendency towards a skeletal deep bite.<sup>4</sup> This also explains the markedly lower mean ODI values recorded for patients with anterior open bites in the study by Adediran *et al.*<sup>20</sup> ( $63.13^0 \pm 6.71^0$ ), compared with the mean values recorded in this study. Thus, the findings from this study further demonstrate that the ODI value is a reliable cephalometric variable for the assessment of vertical discrepancies in Nigerians.

The ODI values obtained in this study were also closely related to the values that had been reported for African Americans by Obamiyi *et al.*<sup>16</sup> and this is most likely because of the racial similarities between both groups. The significantly lower values reported in our study compared with the normative values reported by Kim<sup>4</sup> for Caucasians highlight the fact that racial differences can affect the ODI value. Similar findings

have also been reported in other populations such as African Americans<sup>16</sup>, Latin Americans<sup>14</sup>, Koreans<sup>21</sup> and Iraqis<sup>22</sup>. Furthermore, the findings from this study show a greater tendency towards deep bite in the Nigerian population as was previously reported by Adediran *et al.*<sup>20</sup> This greater tendency towards a deep bite observed in the Nigerian population compared to Caucasians may also be associated with the bimaxillary proclination present in Nigerians, which has been previously reported.<sup>17,18,23</sup>

APDI has been reported to be an excellent parameter for the assessment of sagittal relationships.<sup>14</sup> This has also been validated by studies carried out in several populations.<sup>3,13-16,24</sup> The mean APDI values reported in this study were closely related and slightly higher than the original values reported by Kim and Veitas ( $81.4^0 \pm 3.8^0$ ). However, it is interesting to note that the mean value for APDI obtained in this study was significantly higher than that reported for African Americans by Obamiyi *et al.*<sup>16</sup> This may be because of the differences in the age groups of the study population of both studies. The study by Obamiyi *et al.*<sup>16</sup> was conducted on children aged 7-14 years, while our study was conducted on an adult population aged 18-25 years. The difference observed may be due to the significant changes that occur in the APDI with increasing age due to growth.<sup>25</sup> Thus, it is not surprising that the mean APDI values recorded in this study were also similar to the mean value reported by Caballero-Purizaga *et al.*<sup>14</sup> in a Latin American population with a mean age of 23.66 years. In addition to developing normative values for the APDI, there is a need for further studies in the Nigerian population to test the efficacy of the APDI in differentiating different sagittal relationships i.e Class I, Class II, and Class III skeletal relationships as has been done in other populations.<sup>3,14,15,22,24</sup>

The absence of significant gender differences for the mean ODI and APDI values observed in this study has also been reported in other studies.<sup>14,16</sup> The

findings from this study may also indicate that increasing age may affect mean APDI values more significantly than the ODI values, based on the comparisons made earlier between the mean APDI recorded in this study and that reported in other studies.

This study also has some limitations. The use of a larger sample size could have yielded more representative normative values for both variables. In addition, there is a need to test the efficacy of both variables in the cephalometric assessment of vertical and horizontal skeletal discrepancies in Nigerians using a larger study population. However, the findings from this study have provided a baseline for future studies and normative values that can be used for orthodontic treatment planning in the Nigerian population.

## Conclusion

This study has established the normative values for ODI and APDI in a young adult Nigerian population as  $69.39^0 \pm 7.2^0$  and  $82.51^0 \pm 4.7^0$  respectively. The ODI value recorded in this study was closely related to that reported in an African American population but significantly less than that reported among Caucasians. However, the APDI values recorded in this study were slightly higher but similar to those reported in Caucasians and significantly higher than the value reported in African Americans. The differences in the APDI values in the populations studied were attributed to differences in the age groups of the study populations.

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**Conflict of Interest:** None declared

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## (CONSORT) statements

Each manuscript should be accompanied with a structured abstract (divided into background, methods, results and conclusions) in no more than 250 words. Four to five key words to facilitate indexing should be provided in alphabetical order along with the abstract. The text should be divided in sections on introduction, methods, results, discussion and conclusion.

Acknowledgment section may be included where necessary. Number of tables and figures should be limited to the very relevant ones and may be compressed if necessary. The typical text length for such contributions is 2500-3 500 words (excluding title page, abstract, tables, figures, acknowledgments and references).

## Brief Report

Short accounts of original studies are published as brief reports. The text should be divided into sections, i.e., abstract, introduction, methods, results and discussion.

Abstract should be of 100-150 words highlighting the aims, methods and main results along with 3-4 key words.

The text should contain no more than 1500 words, 3 illustrations or tables and up to 20 references, preferably recent publications.

## Review Article

State-of-the-art review articles or systematic, critical assessments of literature are also published. Normally a review article on a subject already published in the West African Journal of Orthodontics is not accepted for a period of 3 years.

The typical length for review articles is 2000-3000 words, excluding tables, figures, and references.

Authors submitting review manuscripts should include a structured abstract of around 200 words describing the need and purpose of review, methods used for selection, extraction and synthesis of data, and main conclusions.

Clinical cases highlighting uncommon malocclusion condition, orthodontic treatment techniques are published as case reports. Single case reports are usually not accepted, unless some new or unusual aspect regarding aetiopathogenesis, diagnosis or management is brought out that adds to the existing body of knowledge. The text should not exceed 1000 words and is divided into sections, i.e., abstract, introduction, case report and discussion. The number of tables/figures should be limited to 2. Ten recent references are acceptable. A maximum of 3 or 1 author is permitted from the principle and each of the associated departments respectively. Thus, case reports from only one investigative department can have a maximum of 3 authors.

## Letter to Editor(s)

Letters commenting upon a recent article in the West African Journal of Orthodontics are welcome.

Such letters should be received within 6 months of the article's publication. At the editorial board's discretion, a letter may be sent to authors! experts for comments and both letter and reply may be published together. Letters may also relate to other topics of interest to orthodontists and others, and/or useful clinical observations. Letters should not be more than 400 words. The number of authors should not exceed 2, including the authors' reply in response to a letter commenting upon an article published in this journal.

## Images Section

A short text of about 150 words depicting the condition with color photographs (vide infra) is needed.

Normally only clinical photographs are accepted but accompanying skiagrams or pathological images could also be considered for publication.

Photographs should be of high quality, clearly identify the condition and preferably add to the existing knowledge.

## Personal Viewpoint

Such articles are published on topical orthodontic issues including social aspects. It is expected that the authors have sufficient credible experience on the subject for giving viewpoints. These should not exceed 1500 words.

## Notes, News and Events of Interest

Announcements for conferences, symposia, meetings or courses may be sent for publication in advance. The announcements should provide title, date(s) and place of the event and contact address, telephone, and email

occur for other reasons, such as personal relationships, academic competition and intellectual passion. If any of the authors have accepted reimbursement for attending symposium, a fee for speaking, fee for organizing educational reach, funds for a member of the staff of consultation fees from an organization that may in: way gain or lose financially from the result of the study, review, editorial or letter, a competing interest would be deemed to exist. If any of the authors had been employed by an organization that may in any way gain or lose financially from the publication, or if any of them hold stocks or shares in such an organization, competing interest would be deemed to exist. If competing interest exists, the author(s) must disclose them while submitting the manuscript.

### **Abstract and Key Words**

The second page should carry an abstract in case of original article (250 words), review article (200 words), brief report (100-150 words), and case report (50 words), respectively. For original article and reviews, the abstract should be structured as detailed earlier. For brief reports, the abstract should state the purpose of the study, basic methodology, main findings (giving specific data and statistical significance) and key conclusion(s). Below the abstract, authors should provide 3-5 key words for indexing; terms from the Medical Subject Headings (MESH) list of Index Medicus should be used. The basic structure of a paper follows the well known acronym IMRAD, which stands for Introduction (what questions was asked), Methods (how was it studied), Results (what was found) and Discussion<sup>4</sup>.

### **Introduction**

The introduction must clearly state the question that the author(s) tried to answer in the study. It may be necessary to briefly review the relevant literature. Only cite those references that are essential to justify the proposed study.

### **Materials and Methods**

The methods section should describe, in a logical sequence, how the study was designed (e.g., how randomization was done), carried out (e.g., how subjects were chosen or excluded, ethical considerations, accurate details of materials used, exact drug dosage and form of treatment, etc.) and data were analyzed (e.g., an estimate of the power of the study, exact test used for statistical analysis, etc.). For standard methods, appropriate references are sufficient, but if standard methods are modified these should be clearly brought out.

Authors should provide complete details of any new methods or apparatus used (manufacturer's name and address in parentheses).

### **Ethics**

When reporting experiments on human subjects, authors should indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1964, as revised in 2000.

They should indicate whether the study was approved by the Institutions' Ethical Committee, and whether informed consent was obtained from the study participants. They should not use patients' names, initials, or hospital numbers, especially in illustrative material. This journal reserves the right to reject a manuscript on ethical grounds, on the basis of recommendations of its "Ethical Committee", even if the research has been cleared by the institutional ethical committee. Moreover, when reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed.

### **Statistics**

Authors should describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results. When possible, they meet to quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Actual P values are provided rather than stating as just  $<0.05$  or  $>0.05$  etc. References for the design of the study and statistical methods should be to standard works when possible (with pages stated) rather than to papers in which the designs or methods were originally reported. Any general-use computer programs used should be specified and statistical terms, abbreviations, and most symbols be defined.

### **Results**

This section should include only relevant, representative data and not all information collected during the study. Major findings should be presented clearly and concisely. Text, tables, and illustrations should be used sensibly while avoiding repeating in the text all the data depicted in the tables or illustrations and emphasizing or summarizing only important observations. Tables and figures should be restricted to those needed to explain the argument of the paper and to assess its support. It is necessary to cite the tables in the text and type them on separate sheets. It may also be useful to mention what the study did not find.

## Discussion

Discussion ordinarily should not be more than one third of the total length of the manuscript. This section should include a summary of the major findings, their relationship to other similar studies, limitations of methods and implications of these findings in future research. Conclusions should be linked to the goals of the study. Unqualified statements and conclusions which are not completely supported by the data should be avoided. Authors should also refrain from making statements on economic benefits and costs unless their manuscript includes economic data and analyses.

## Acknowledgements

In acknowledgements section, it is suitable to list all contributors who do not meet the criteria for authorship, such as a person who provided purely technical help, writing assistance, or a department head who provided only general support. Financial and material support should also be acknowledged.

Groups of persons who have contributed materially to the paper but whose contributions do not justify authorship may be listed under a heading such as "clinical investigators" or "participating investigators", and their function or contribution should be described, for example, "served as scientific advisers", "critically reviewed the study proposal", "collected data", or "provided and cared for study patients". A written consent is required from all the persons acknowledged, indicating their acceptance for the same.

## Contributions to joint-authorship

In the case of multiple author-ship, authors are expected to state clearly their contributions to the paper being considered for publication in terms of study initiation, design including methodology, data collection, analysis and final write-up. The editorial board reserves the right to remove any author's name if the contribution is insignificant.

## References

References should be numbered consecutively in the order in which they are first mentioned in the text.

References are identified in text, tables, and legends by Arabic numerals in parentheses. References cited only in tables or in legends to figures should be numbered in accordance with the sequence established by the first identification in the text of the particular table or figure.

The titles of journals should be abbreviated according to the style used in Index Medicus. Authors are required not to use abstracts, unpublished observations and personal communications as references. References to papers accepted but not yet published should be designated as "in press"; authors should obtain written permission to cite such papers as well as verification that they have been accepted for publication.

The references must be verified by the author against the original documents. The Uniform Requirements style (the Vancouver style) is based largely on an American National Standards Institute (ANSI) standard style adapted by the NLM for its databases.

## Journal Article

List all authors when 6 or less. When 7 or more, list only first six and add et al. Ngan P, Yiu C, Hu A, Hagg U, Ei SHY, Gunel E. Cephalometric and occlusal changes following maxillary expansion and protraction. *Eur J Orthod* 1998; 20: 237-254.

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(accessed August 1, 2004).

### Tables

Each table should be typed in double-space on a separate sheet of paper. Tables not submitted as photographs must be numbered consecutively (Arabic numerals) in the order of their first citation in the text, with a brief but self explanatory title for each.

Each column should have a short or abbreviated heading. Explanatory matters are placed in footnotes, not in the heading. In footnotes all nonstandard abbreviations that are used in each table should be explained adequately. Statistical measures of variations should be identified such as standard deviation and standard error of the mean. Be sure that each table is cited in the text. If data are used from another published or unpublished source, it is necessary to obtain permission and acknowledge them fully.

### Figures and Instructions

Figures should be professionally drawn and photographed; freehand or typewritten lettering is unacceptable. Instead of original drawings, X-ray films, and other material, sharp, glossy, black-and-white photographic prints of high quality are necessary, usually 127x 173 mm (5x7 in) but no larger than 203x254 mm (8x10 in) For color illustrations negatives or positive transparencies are provided, along with color prints. It is preferable to have the photograph in portrait form rather than in landscape form to fit easily into one column. Letters, numbers and symbols in photographs should be clearly legible.

Each figure should have a label pasted on its back indicating the number of the figure, author's name, and an arrow to mark the top and left side of the figure.

It is unacceptable to write on the back of figures or scratch or mark them by using paper clips, and to bend figures or mount them on cardboard. If photographs of individual/people are used, either the subjects must not be identifiable or their pictures must be accompanied by written permission to use the photograph. It is advisable to cover the eyes unless specifically need to be shown. If a figure has been published, the original source should be acknowledged and written permission from the copyright holder be obtained to reproduce the material. Figures should be numbered consecutively (Arabic numerals) according to the order in which they have been first cited in the text.

### Legends for Illustrations

Legends for illustrations should be typed or printed out in double-space, starting on a separate page, with Arabic numerals corresponding to the illustrations.

When symbols, arrows, numbers, or letters are used to identify parts of the illustrations, each of them must be identified and explained in the legend. The internal scale should be explained and the method of staining in photomicrographs be identified.

### Units of Measurement

Measurements of length, height, weight, and volume should be reported in metric units, i.e., meter(m), gram(g), or liter(l) or their decimal multiples.

Milliliter or deciliter should be expressed as ml or dl.

Red and white blood cell counts are to be expressed as  $63 \times 10^6 / \text{mc l}$  and  $\times 10^6 / \text{mc}$  respectively. Temperatures should be given in degrees Celsius and blood pressures in millimeters of mercury (mmHg). All hematological and clinical chemistry measurements should be reported in the conventional system or in terms of the International System of Units (SI).

### Abbreviations and symbols

Only standard abbreviations are used in the text while avoiding abbreviations in the title and abstract.

The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement. Year, month, day, hour, minute and second should be abbreviated as yr, mon, d, h, mm, and s in tables respectively.

## References

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## Appendix 1:

### Declaration of Originality and Transfer of Copyright

(Please download from Nigerian Association of Orthodontists (NAO) website <https://www.nao-ng.org/>)

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