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Overjet as a Predictor of Skeletal Base Discrepancy among Nigerians with Malocclusion

Ifesanya JU[a], Adeyemi AT[b], Otuyemi OD[c]

Abstract

Background: Overjet is an invaluable tool in the clinical assessment of orthodontic patients. In contrast to other clinical assessment tools, which are largely subjective in nature, overjet is an objective measureable tool that can be readily obtained from the patient's mouth or study models, provided the latter are properly oriented from a static record of the patient's occlusion. This study aimed to assess prediction of sagittal skeletal base discrepancy using overjet in the three classes of malocclusion among a sub-set of Nigerians.

Method: A cross sectional study of 120 subjects in subsets of 40, each for the three classes of malocclusion was carried out. Overjet was measured from the study cast and a wax record of subjects' occlusion. A lateral cephalometric radiograph was taken for all subjects. The ANB angle and Wits appraisal using three reference planes was also obtained for all subjects.

Results: When the class of malocclusion was not considered, overjet had good correlation with the ANB angle and Wits appraisal irrespective of the reference planes used to obtain it (ñ=0.733; 0.687; 0.724;0.703)p<0.01. In the three classes however, high correlation was found only in class III malocclusion(ñ=0.789; 659;0.664;0.603)p<0.01. Linear regression analysis also showed overjet to be a good predictor of sagittal skeletal base discrepancy.

Conclusion: Overjet is a good predictor of skeletal base discrepancy among people with class I and III malocclusion in this environment.

Key words: Overjet, ANB angle, Wits appraised, skeletal bex

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Introduction

Clinical assessment is an important aspect of diagnosis and management in orthodontics. It is often combined with facial profiling, photogrammetric and radiographic investigations in both two, and more recently, in three dimensional planes[1]. These may reveal the underlying problems involved in malocclusion[2,3]. Clinical assessments also reveal malocclusions in the vertical dimension such as anterior open bite, lip incompetence, gummy smiles, as well as long and short vertical face heights[1,3]. Any combination of anomalies may be associated with Class I, II, or III malocclusions[4]. Other clinical methods such as the bi-digital palpation of the deepest points along the bony outline of maxilla and mandible in the midline and the mental re-positioning method are largely subjective due to soft tissue interposition and differential length of digits of different examiners. Another important clinical parameter for assessing sagittal relationship of the upper to the lower jaw is the overjet and this can be measured directly in the patient's mouth or obtained from the dental cast[5]. Though overjet is basically a dental measure of sagittal discrepancy, it has the advantage of being an objective measure of antero-posterior (AP) skeletal discrepancy. The cause of overjet anomalies can be skeletal, dental or a combination of both[6]. The decision to treat a patient either surgically or not can be based on the overjet, and generally, surgery is accepted as a more successful treatment when overjet is greater than 10mm[7]. Overjet is reported to be an unreliable measure of jaw relationship in the sagittal plane, as skeletal relationships do not always correspond with

dental relationships[5]. The most frequent disagreement has been found in Class I dental relationships[8] and in subjects with Angles class III malocclusion[9]. Overjet anomalies among Nigerians have been widely reported in the literature with between 24 to 27% of the population having increased overjet and 6-7% with reversed overjet[10,11]. This study aimed to assess prediction of sagittal skeletal base discrepancy using overjet in the three classes of malocclusion among a sub-set of Nigerians.

Method

Approval was obtained from the Institutional Ethical Reviews Board. One hundred and twenty orthodontic patients of the Orthodontic clinic of the University College Hospital, Ibadan were assessed. A data extraction form was used to obtain socio-demographic data and findings from an intra-oral examination including dental and occlusal relationships and other orthodontic features. Upper and lower arch impressions (using alginate impression material and disposable plastic trays) for study models of all participants were taken. Participants' bite were registered in wax with subjects in centric occlusion. This helped to articulate the casts correctly for overjet measurement. Lateral cephalometric radiographs of all participants were taken using the Pan-Blue-Oris machine (Blue-X Imaging S.R.L BLD XP PAN CEPH METRIC 71680000700: S/no 2402kk0164 ASSAGO, ITALY) with participants' head held in a cephalostat, looking forward with the Frankfort horizontal plane parallel to the floor and the teeth in complete intercuspation. The distance from mid-sagittal plane of each participant to the source of radiation and the film was maintained at 150cm and 15cm respectively. Soft and hard tissue tracings were obtained manually on a 0.003 inch matte finish acetate tracing paper and a sharpened 2H pencil over a light viewing box in a dark room. The ANB angle and Wits appraisal using the functional and bisected occlusal planes (FOP and BOP), as well as the maxillo-mandibular plane angle bisector (MM° bisector) were obtained(fig. 1).

Data was analyzed using the IBM statistical package for social sciences SPSS version 19. Measures of central tendency were obtained. Pearson's bivariate analysis was used to determine the relationship between overjet and the radiologic parameters while linear regression analysis was used to asses overjet as a predictor of sagittal base discrepancy. Statistical significance was set at $p<0.05$.

Results

The mean age was 18.8± 6.5 years. Fifty-seven(47.5%) of the subjects were males, 63(52.5%) were females. The mean values for overjet, ANB and Wits appraisal are presented in table I.

When the class of malocclusion was not considered, overjet had high correlation with the ANB angle and all reference planes for the Wits appraisal [ñ=0.733(ANB); 0.687(BOP); 0.724(FOP) ;0.703(MM° bisector)]$p<0.01$. However, in the different classes of malocclusion, Pearson's bivariate correlation showed that overjet had a low correlation with the ANB angle (rho=0.25: p=0.14), BOP Wits appraisal (rho= 0.21: p= 0.21) and MM° bisector Wits appraisal (rho= 0.24: p=0.16) class I malocclusion. Only the FOP Wits appraisal had a moderate correlation with overjet and this was statistically significant

Table 1: Mean overjet , ANB and Wits Appraisal accross the malocclusion group.

	Class I	Class II	Class III
Overjet (mm)	3.71± 2.71	8.23± 2.87	-1.46± 2.05
ANB°	3.29± 2.64	7.10± 2.74	-0.65± 3.96
BOP Wits appraisal(mm)	-0.15± 3.85	5.86± 3.33	-4.07± 3.82
FOP Wits appraisal (mm)	-3.61± 3.95	2.46± 4.14	-8.03± 4.50
MM° bisector Wits appraisal (mm)	-4.71± 4.11	1.19± 3.54	-10.69± 4.46

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(rho= 0.42: p= 0.01). Similarly in class II malocclusion, overjet had low correlation with FOP (rho= 0.28: p= 0.10) and MM° bisector Wits appraisal (rho= 0.210: p= 0.23), but moderate correlation with the ANB angle (rho= 0.47: p= 0.006) and BOP Wits appraisal (rho= 0.51: p= 0.004). In contrast to the above, in class III malocclusion, overjet had moderate correlation with all wits appraisal modalities {BOP (rho= 0.60: p<0.01); FOP (rho= 0.68: p< 0.01); MM° bisector (rho= 0.67: p< 0.01)}, but a high correlation with the ANB angle (rho= 0.77: p< 0.01). This is shown in figure 2.

Figure 1. The different planes used in the study

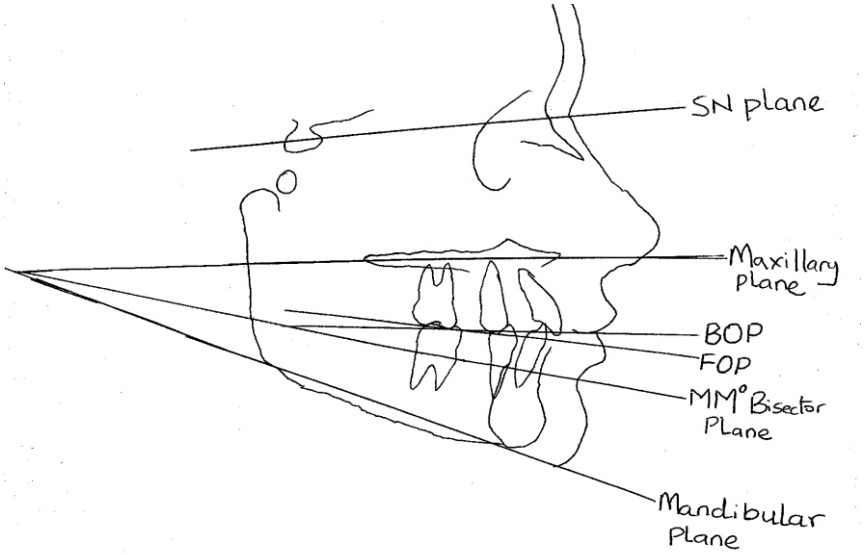
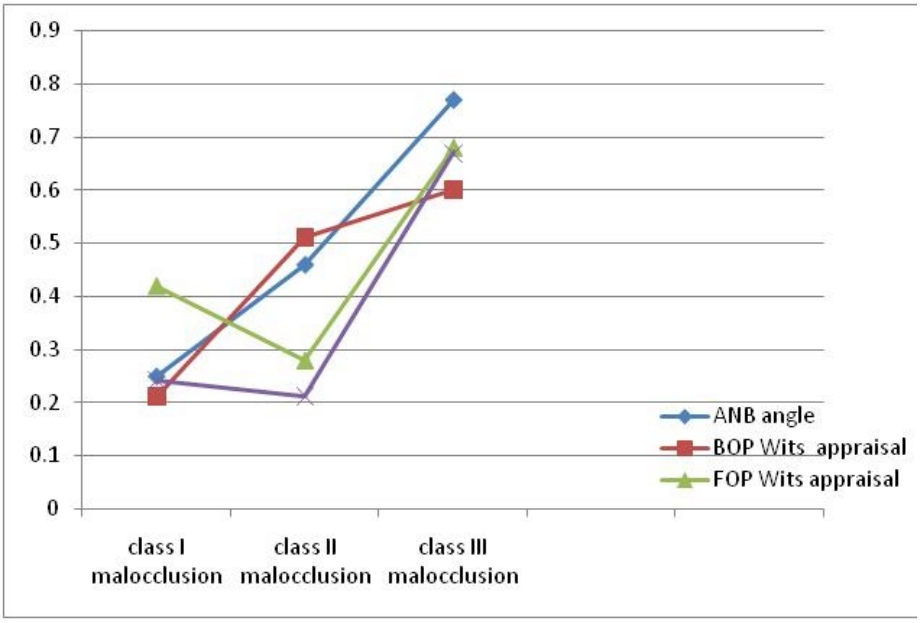


Fig 2. Correlation between overjet and ANB angle, BOP, FOP and MM° bisector Wits appraisal.



Linear regression analysis was used to assess overjet as a predictor of skeletal base relationship using the various radiographic modalities. Overall, it was observed that overjet was a good predictor of skeletal base relationship whether the ANB angle or the Wits appraisal was the basis for classification of skeletal pattern ($p<0.05$ in all cases). However, when the regression model was used to assess each malocclusion subgroup, overjet was a good predictor of skeletal base discrepancy when any type of Wits appraisal was used to classify subjects with class I and III malocclusion ($p<0.05$). When the ANB angle was used to classify class III patients overjet was also a significant predictor of skeletal pattern. However, overjet could not accurately predict skeletal base in class II patients whether the ANB or the Wits appraisal was used to classify them($p>0.05$). The level of significance of prediction of skeletal pattern in the three classes of malocclusion using overjet is shown in table 2.

Table 2: P-values of sagittal skeletal discrepancy prediction using the overjet from linear regression model

	ANB angle	BOP Wits appraisal	FOP Wits appraisal	MM° bisector Wits appraisal
Overall	0.001	0.001	0.001	0.001
Class I	0.856*	0.004	0.002	0.016
Class II	0.540*	0.276*	0.890*	0.956*
Class III	0.008	0.004	0.001	0.001

**Not significant*

Discussions

The overall positive correlation between overjet and sagittal discrepancy is expected because overjet, the ANB angle and Wits appraisal are all direct and indirect measures of sagittal skeletal discrepancies[12]. However, it has been reported that the relationship between dental and skeletal sagittal discrepancy is poor[5] and this was verified in this study where low to moderate correlation was found in subjects with class I and II malocclusion.

Similar to findings from a previous study among subjects with class I malocclusion[5], positive correlation between overjet and ANB angle and Wits appraisal have been observed in this study. This correlation was however low and statistically insignificant and the clinical value of this relationship is not certain. For class II division 1 malocclusion, a previous study[13] showed that overjet had moderate correlations with the FOP and BOP Wits appraisal. This study differs from the aforementioned in that low and insignificant correlation was found with the FOP Wits appraisal in class II subjects, though a moderate significant relationship was observed with the BOP Wits appraisal. Since class II malocclusion is usually associated with an increase in overjet and the BOP is obtained from incisor position, this is not unexpected. Studies relating overjet and radiological assessment of sagittal skeletal discrepancies in class III malocclusion were not found. Overjet however had a significant statistical and positive correlation with all the radiographic methods in this study group. It was however best combined with the ANB angle rather than any of the Wits appraisal modalities.

With respect to prediction of skeletal pattern from overjet among our study subjects, we found that it is best used among subjects with classes I and III malocclusion. This differs from findings by Zupanèlè *et al*[5]., who concluded that overjet best predicts skeletal base pattern among class II subjects. Since class II and III malocclusion present more often with overjet discrepancy than class I

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malocclusion, it stands to reason that overjet should have better predictive value in either of the former than in the latter. The underlying skeletal discrepancy in either class II or III malocclusion may be a confounder to the use of overjet for skeletal base prediction and extreme caution must be exercised in the absence of cephalometric analysis.

Overjet appeared to be a good predictor of sagittal skeletal discrepancy with both the ANB angle and BOP Wits appraisal when class of malocclusion is not differentiated. This buttresses it's significant clinical value. The fact that there was no singular radiological method with which overjet could predict sagittal skeletal relationship consistently in all classes of malocclusion highlights the point that overjet alone is not reliable in assessment of malocclusion. Al-Hammad *et al.* have proposed the use of dentoskeletal overjet as a measure of AP skeletal base discrepancy[12]. This method which incorporates dento-alveolar compensation into the measurement of sagittal skeletal base discrepancy had previously been advocated by Sperry[14]. This method has not been validated in the Nigerian population. Finally, one must bear in mind that using a single means of either clinical or radiological assessment for all classes of malocclusion is not without fault.

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Contributors

Ifesanya U was partly responsible for the study design acquisition analysis and interpretation of data, writing and final approval.

Adeyemi AT. was partly responsible for the study design acquisition analysis and interpretation of data, writing and final approval.

Otuyemi O. D. was partly responsible for the study, interpreting and editing and final approval of the study.

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