



### A Clinical Review of Crossbite in an Orthodontic Population

*Depistage Clinique De L'occlusion Croisee Dans Une Population Orthodontique*

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#### ABSTRACT

**BACKGROUND:** Crossbite is a common occlusal anomaly. It may occur either anteriorly or posteriorly and may be either dental or skeletal in origin.

**OBJECTIVE:** To determine the pattern and frequency of crossbite occurrence in an orthodontic population.

**METHODS:** This was a retrospective study of 633 patients, 288 males (45.5%) and 345 (54.5%) attending a Lagos orthodontic clinic over a five-year period. Information obtained on each patient included age, sex and occlusal variables such as overjet, overbite and tooth-bone ratio.

**RESULTS:** Out of the 633 patients seen 189 (29.9%) were recorded to have at least one tooth in crossbite. Anterior crossbite occurred in 125 (66.1%) of the affected patients while posterior crossbite was recorded in 37 (19.6%). Patients presenting with anterior and posterior crossbite constituted 27 (14.3%) of patients. Unilateral crossbite was slightly more frequently than bilateral crossbite. A total of 445 teeth were recorded in crossbite with the permanent maxillary lateral incisor being the most frequently affected tooth constituting 33.9% of the teeth in crossbite. The number of teeth in crossbite per patient ranged from 1 to 8, a single tooth in crossbite being most commonly occurring. Crossbite was most frequently seen in patients presenting with Class I malocclusion.

**CONCLUSION:** Crossbite was a frequently occurring anomaly in the Lagos population, with anterior crossbite being more common. There appear to be gender or age difference in occurrence of crossbite in our population. *WAJM* 2011; 30(1): 24–28.

**Keywords:** Crossbite, Orthodontics, Lagos, Anterior Crossbite, Overjet, Tooth-Bone Ratio.

#### RÉSUMÉ

**CONTEXTE:** L'occlusion croisée est une anomalie occlusale fréquente. Il peut survenir de façon primitive ou secondaire et peut relever d'un origine dentaire ou squelettique.

**OBJECTIF:** déterminer le modèle et la fréquence d'apparition de l'occlusion croisée dans une population orthodontique.

**MÉTHODE:** c'était une étude rétrospective portant sur 633 patients, dont 288 de sexe masculin (45.5 %) et 345 de sexe féminin (54.5 %) traités dans une clinique orthodontique de Lagos, durant une période de cinq ans. Les informations recueillies sur chaque patient ont intéressé l'âge, le sexe et des variables occlusales comme le surplomb horizontal (overjet), le surplomb vertical et le rapport os-dent.

**RÉSULTATS:** Des 633 patients vus, 189 (29.9 %) ont été enregistrés pour avoir présenté au moins une dent en occlusion croisée. L'occlusion croisée antérieure est survenue chez 125 (66.1 %) des patients affectés tandis que celle postérieure a été notée dans 37 cas (19.6 %). La proportion de patients avec présentation simultanée d'occlusion antérieure et postérieure était de 27 cas soit 14.3 % de la population totale. L'occlusion croisée unilatérale était légèrement plus fréquente que la forme bilatérale.

Un total de 445 dents a été constaté en situation d'occlusion croisée avec l'incisive latérale maxillaire permanente qui est la dent le plus fréquemment affectée, constituant 33.9 % des dents en occlusion croisée. Le nombre de dents en occlusion croisée par patient était de 1 à 8 ; L'atteinte d'une seule dent était apparue le plus fréquemment. L'occlusion croisée de classe I était la forme la plus fréquente.

**CONCLUSION:** L'occlusion croisée est une anomalie survenant fréquemment dans la population de Lagos, avec une prédominance de la forme antérieure. Il semble y avoir une différence d'âge et de genre dans sa survenue au sein de notre population.

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**Mots-cles :** Occlusion croisee, orthodontie, lagos, occlusion croisee anterieure, surplomb horizontal, rapport os-dent

## INTRODUCTION

A crossbite is defined as an abnormal labiolingual or buccolingual relationship between maxillary and mandibular teeth when the teeth of both arches are in occlusion.<sup>1</sup> It can be further defined to specify the location in the mouth i.e. whether anterior or posterior and also whether a single tooth or groups of teeth are involved.<sup>2</sup>

The prevalence of crossbite has been reported to range from 7% to 22% in Western countries.<sup>3-6</sup> In Nigeria, the prevalence has been reported to range from less than 2% to 16% in young children and adolescents.<sup>7-10</sup> Crossbite has also been reported to occur more frequently in females.<sup>11</sup>

Anterior crossbite can be caused by dental or skeletal problems. The most common aetiological factor for non-skeletal anterior crossbite is lack of space for the permanent successors.<sup>12</sup> Multi-tooth anterior crossbite can be the result of functional shift due to incisor interference, which causes the mandible to be displaced forward to achieve maximum intercuspation.<sup>2</sup> Crossbite of all incisors is rare except the patient has a Class III jaw relationship.<sup>13</sup>

Posterior crossbite can range from a single tooth to bilateral constriction of the maxilla. Aetiologic factors giving rise to posterior crossbite have been classified into dental, skeletal and muscular.<sup>14</sup> Dental factors include a defective eruption sequence, lack of arch length, resulting in a buccal or lingual eruption path, prolonged retention of deciduous teeth and aberration in tooth anatomy.<sup>15</sup> Skeletal factors include problems in abnormal growth of the bones of the craniofacial complex due to genetic and environmental factors.<sup>16</sup> Muscular problems include mouth breathing resulting in a constricted maxilla or palatal tipping of the maxilla.<sup>17</sup> Other muscular problems include functional shift due to occlusal interferences, sucking habits<sup>18</sup> and abnormal pattern of mandibular closure.<sup>15</sup> A single tooth in posterior crossbite may or may not cause a mandibular shift on closure. Unilateral crossbite of the buccal segments is usually caused by mild bilateral constriction of the maxillary arches. In such cases, on closure, the mandible

shifts to one side producing non-coincident dental midlines.<sup>1</sup> This type of crossbite with functional shift is reported to occur in 85% to 95.7% of reported cases of crossbite.<sup>3,19</sup> Posterior crossbite caused by intra-arch asymmetry would cause no mandibular shift. In severe constriction, bilateral crossbite occurs without mandibular shift.<sup>16</sup>

Diagnosis of dental and skeletal crossbites must be made from a thorough clinical examination, an accurate set of study models, an arthopantomogram and lateral and postero-anterior cephalometric radiographs to discern the dental and skeletal relationship of the maxilla to the mandible.<sup>2</sup>

Early treatment of crossbite is recommended.<sup>2,3,19,20</sup> This allows for eruption of the permanent incisors into correct occlusion<sup>3</sup> and also prevents abnormal wear of teeth, untoward force to the periodontium, abnormal development of the alveolar ridges and unequal growth of the condyles.<sup>16</sup>

The purpose of this study was to assess and describe the frequency of crossbite in an orthodontic population attending a tertiary hospital in Lagos, Nigeria.

## SUBJECTS, MATERIALS, AND METHODS

This was a retrospective study of 633 patients [288 males (45.5%) and 345 females (54.5%)] attending the orthodontic clinic of the Lagos University Teaching Hospital over a 5-year period. Information on each patient was obtained from a standard orthodontic diagnosis sheet. A total of 189 patients who were recorded to have at

least one tooth in crossbite were included in this study.

Crossbite was classified as anterior or posterior, unilateral or bilateral.

*Anterior crossbite* is deemed present when one or more maxillary incisors or canines occlude lingually to their mandibular counterparts. *Posterior crossbite* is a relationship of the premolar/molar teeth where the buccal cusps of the upper teeth occlude lingual to the lower teeth. Crossbite is considered *unilateral* when it is present only on one side of the midline and *bilateral* when present on both sides.

## Data Analysis

The recorded data was analysed using Epi-info 3.32. software. Statistical level of significance using chi-square test was  $p < 0.05$ . Microsoft Excel 2003 was used for graphical illustrations.

## RESULTS

Of the 633 patients whose records were assessed 189 (29.9%) were recorded to have at least one tooth in crossbite. These included 85 (29.5%) males and 104 (30.1%) females. The age of the affected patients ranged from 1 year to 50 years with a mean age of 15.1 years (6.5) years. Table 1.

Crossbite in the patients attending the orthodontic clinic was more frequently seen in the anterior region (66.1%) than the posterior (19.6%),  $p < 0.05$ . Patients presenting with combined anterior and posterior crossbites constituted 14.3% of this population. The occurrence of unilateral crossbite (51.3%) was slightly more frequent than bilateral crossbite (48.7%). The difference however, was not significant (Table 2).

**Table 1: Relationship of Occurrence to Crossbite to Age and Sex**

Age Group(y)	Number (%)		
	Male	Female	Total
0-5	2(28.6)	2(22.2)	4(25.0)
6-11	20(22.2)	33(33.7)	53(00.0)
12-17	38(31.9)	33(28.4)	71(00.0)
18-25	21(40.4)	28(31.4)	49(00.0)
≥ 25	4(20.0)	8(24.2)	12(00.0)
<b>Total</b>	<b>85(29.5)</b>	<b>104(30.1)</b>	<b>189(00.0)</b>

Age,  $\chi^2 = 3.37$ ,  $p = 0.50$ ; Sex,  $\chi^2 = 0.03$ ,  $p = 0.86$ .

**Table 2: Distribution of Patients by Location and Symmetry of Teeth in Crossbite**

	Number (%)		Total
	Male	Females	
<b>Location</b>			
Anterior Only	58 (68.2)	67 (64.4)	125 (66.1)
Posterior Only	15 (17.6)	22 (21.2)	37 (19.6)
Anterior And Posterior	12 (14.1)	15 (14.4)	27 (14.3)
<b>Total</b>	<b>85 (100.0)</b>	<b>104 (100.0)</b>	<b>189 (100.0)</b>
<b>Symmetry</b>			
Unilateral	44 (51.8)	53 (51.0)	97 (51.3)
Bilateral	41 (48.2)	51 (49.0)	92 (48.7)
<b>Total</b>	<b>85 (100.0)</b>	<b>104 (100.0)</b>	<b>189 (100.0)</b>

Anterior vs Posterior  $\chi^2 = 83.6$   $P < 0.05$  Unilateral Vs Bilateral  $\chi^2 = 0.26$   $P = 0.6$

**Table 3: Distribution of Individual Teeth in Crossbite by Type of Dentition**

Primary Dentition	Number (%)
Central Incisor	9 (2.0)
Lateral Incisor	7 (1.6)
Canine	4 (0.9)
First Molar	3 (0.7)
Second Molar	5 (1.1)
<b>Total</b>	<b>28 (6.3)</b>
<b>Permanent Dentition</b>	
Central Incisor	113 (25.4)
Lateral Incisor	151 (33.9)
Canine	43 (9.7)
First Premolar	37 (8.3)
Second Premolar	37 (8.3)
First Molar	26 (5.8)
Second Molar	9 (2.0)
Third Molar	1 (0.2)
<b>Total</b>	<b>417 (93.6)</b>

A total of 417 teeth were recorded in crossbite which occurred in both primary and permanent dentitions. The permanent lateral incisor was the most frequently affected tooth constituting 33.9% of all teeth in crossbite, followed by the permanent central incisor which accounted for 25.4%. A total of 28 primary teeth were in crossbite with the primary central incisor constituting 2.0% of the total number of teeth in crossbite (Table 3).

The number of teeth in crossbite ranged from one to eight. A single tooth

in crossbite was most frequent occurring in 76 (40.2%) of patients, while 43 (22.8%) patients had two teeth in crossbite. Crossbite of three or more teeth was recorded in 37% of patients seen.

Table 4 shows that 146 (77.2%) of the patients presenting with crossbite had Angle's Class I malocclusion while 24 (12.7%) had Class III malocclusion. Crossbite was least frequently occurring among patients presenting with Class II malocclusion being recorded in only 17 (9.0%) of patients seen.

## DISCUSSION

Crossbite (both anterior and posterior) is an important occlusal variable which was seen to occur in almost a third of the orthodontic patient seen. This is a much higher prevalence than that in another study of a Nigerian orthodontic population.<sup>13</sup>

Dental anterior crossbites usually involve a single incisor and can be classified as a simple orthodontic problem. Simple anterior crossbites have been associated with gingival recession with resultant increased crown length of the opposing tooth.<sup>21</sup> Severe anterior crossbite is the result of a skeletal discrepancy that leads to Class III malocclusion.<sup>2</sup> The present study showed that anterior crossbites were significantly more frequently occurring than posterior crossbites. These findings concur with findings by daCosta<sup>8</sup>, Adegbite<sup>10</sup>, and Nnachetta<sup>22</sup> in prevalence studies on Nigerian schoolchildren.

Posterior crossbite has been reported to be one of the most prevalent transverse occlusal variations in the primary and mixed dentitions.<sup>20,23</sup> Smaller maxillary to mandibular dental arch width ratio and lower facial height were two variables most associated with a patient's likelihood of having skeletal posterior crossbite.<sup>11,24</sup> Dental asymmetry rather than skeletal asymmetry is the primary contributor to posterior crossbite<sup>12</sup>. The present study showed that posterior crossbite occurred in 10% of the total patients seen. This compares with a prevalence of one-three percent seen in the general Nigerian population.<sup>8,10,22</sup>

Early management of crossbite in the deciduous or early mixed dentition is advocated to allow for spontaneous correction of succedaneous teeth. Kutin and Hawes<sup>3</sup> showed that crossbite in the primary dentition is usually perpetuated into the successional unit of the permanent dentition, while a low rate of spontaneous correction (0-20%) was also reported in other studies.<sup>19,25</sup> It has also been reported that early treatment will eliminate the probability of alveolar ridge warp which can occur as a compensatory change to accommodate the malocclusion.<sup>26</sup> Untreated anterior and posterior crossbites have been found to be significantly related to the occurrence of temporomandibular joint disorder.<sup>27</sup>

Almost a third of the patients presenting with crossbite in this study were adults. Crossbite has been shown to lead to a progressive asymmetric compensation of the condylar fossa relationship and results in postural deviation of the mandible and dento-alveolar asymmetry which maintains the crossbite in this group.<sup>28</sup>

The majority of patients presenting with crossbite had Angle's Class I malocclusion. This finding is in agreement with that of another study,<sup>11</sup> However the female sex predilection which was observed the latter study was not observed in this one which showed no difference in frequency between the sexes. The absence of significant gender bias was also observed in other studies.<sup>3,10</sup> However, Trotman<sup>29</sup> observed crossbite twice as frequently in black males when compared to females.

**Table 4: Angle's Classification of Patients with Teeth in Crossbite**

Angle's Class	Number (%)		
	Male	Female	Total
Class I	74 (87.1)	72 (69.2)	146 (77.2)
Class II	3 (3.5)	14 (13.5)	17 (9.0)
Class III	6 (7.0)	18 (17.3)	24 (12.7)
<b>Total</b>	<b>85* (100.0)</b>	<b>104 (100.0)</b>	<b>187* (100.0)</b>

\* Two patients were not classified due to age at presentation;  $\chi^2 = 253.3$ ; Df= 2 P < 0.05

In this study the distribution of crossbite in individual teeth was similar to findings among the Nigerian population in a previous study which also reported that the maxillary lateral incisor as the most frequently occurring tooth in crossbite<sup>8</sup>. Lack of space with resultant lingual eruption of this tooth is a likely reason for its frequent occurrence. Proffit *et al*<sup>16</sup> have emphasized the need to focus on management of the total space situation and not just the presenting crossbite in these cases.

Various methods of crossbite correction have been suggested. These range from simple removable appliances incorporating springs or screws to the use of protraction masks in the anterior region<sup>2,12,30</sup>. In cases of posterior crossbite, treatment options include grinding, rapid maxillary expansion, slow expansion with a Quad Helix appliance or removable expansion plate and composite onlay<sup>23,31-33</sup>. Surgically assisted rapid maxillary expansion is considered a very good method for correcting transverse discrepancies of occlusion in older patients.<sup>34</sup> In severe skeletal-based crossbites orthognathic surgery may be required when growth is complete.<sup>2,12</sup>

It would be desirable to investigate further the extent to which the various aetiological factors contribute to crossbite. This information would increase the clinician's ability to make rational decisions regarding the prevention and treatment of posterior crossbite.

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