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Prevalence and Factors Associated with Crossbites and Openbites

Soft Skills in Orthodontics

Orthodontic Treatment of Severe Anterior Crowding and Crossbite

Anterior Open Bite correction using Passive Self Ligating System: A Case Report

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Occlusal Traits of Primary School Children and the Need for Early Orthodontic Intervention

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Abstract

Background: Early orthodontic treatments (EOT) are started in primary or mixed dentition; they can be preventive, interceptive or corrective depending on the clinical presentation. The purpose of this study was to assess the need for early orthodontic intervention in primary school population in Lagos.

Methods: This study was a cross-sectional descriptive study. The sample comprised 421 primary children in Lagos state, between the ages of 6-8 years. The occlusion of the study subjects was assessed using the Dental Aesthetic Index (DAI).

Results: Male children constituted 55.3%, while females made up 44.7% of the studied population. The majority of the children had dmft scores <1 (97% Angles class I molar relationship was the predominant molar relationship (89.1%), followed by class II 6.4%) and class III (4.5%). About a quarter of the children had one form of oral habit. Most of the children (77%) were found to have little or no need for orthodontic intervention (DAI score < 25). Elective treatment was desirable in 17% (DAI score 25-30), while in 5% treatment was either highly desirable or mandatory. It was also discovered that 90% of children with anterior open bite had DAI scores >25 and 48% of the children who had one form of habit also had DAI scores >25.

Conclusion: The prevalence of malocclusion observed in the study population was 22.8%. Most of the children within this age group, who required early orthodontic intervention, had oral habits, anterior open bite, or dento-alveolar disproportion.

Key words: early orthodontic intervention, dental aesthetic index, school children

ORIGINAL ARTICLE

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Introduction

The American Association of Orthodontists recommends that a child's first visit to the Orthodontist should be at age seven, to assess whether a child will require Orthodontic intervention and if the child will benefit from early orthodontic treatment[1]. The treatment could be preventive in form of extractions of retained deciduous teeth, placement of space maintainers in premature loss of primary teeth, with a risk of mesial drifting of adjacent teeth, use of mouth guards and counselling in case subjects with oral habits such as digit, lip or tongue sucking and in some cases habit breakers[2]. It could also be interceptive in the form of myofunctional therapy in cases of Class II malocclusion with mandibular retrognathism, arch expansion, extraction to relieve moderate to severe crowding as seen in serial extraction. It could also be corrective; such as management of overbite discrepancies and management of cross bites[2,3].

The aims of early orthodontic interventions are creation and maintenance of adequate space for the eruption of permanent teeth, management of craniofacial growth alterations such as clefts, management of obstructive sleep apnea, correction

of harmful habits and ensuring the proper relationship between the jaws [4-6]. Early orthodontic treatment may help prevent the need for permanent teeth extraction and jaw surgeries[6]. Overall, early orthodontic treatment helps to improve function, improve occlusal stability and most importantly, help improve aesthetics and self esteem[7].

Early orthodontic intervention has been a topic of controversy for many years, especially because an early start means the patient is exposed to a long period of treatment and this has been found to affect compliance[7]. Others have queried the outcome, especially in uncertain growth prediction[8]. Nonetheless, it has been accepted that there are instances where early intervention is beneficial such as managing functional crossbite, excessive overjet, and constricted arches. Moreover, some orthodontic problems are easier to treat if found early, rather than waiting for all the permanent teeth to erupt[9,10].

A study reported by Kolawole et al in 2018, to assess the prevalence of oral habits and malocclusion in children aged 1 – 12, showed that up to 13% of children within this age group were engaged in one form of oral habit and already had features of malocclusion present[11]. Another study by Correa-Faria, in 2014, involving 381 Brazilian children aged between 3-5 years, revealed that malocclusion was present in over 30% of the population.[12]

The aim of this study was to assess the occlusal features in young primary school children, establish the prevalence of dental features that indicate a need for early orthodontic intervention. Although several studies on the prevalence of malocclusion have been done in the Nigeria population, very few of them captured the primary and mixed dentition stage; hence the need for this study; thus providing effective strategies for either moving a patient's treatment from medically necessary to elective or preventing a patient in the elective treatment category from deteriorating to necessary treatment category.

Materials and Methods

The study was a cross-sectional questionnaire-based study, involving 421 young primary school pupils in Lagos state, between the ages of 6-8 years. Ethical approval for the study was obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital. Permission was sought and obtained from the school management prior to the commencement of the study. Informed Consent was sought from the parents or guardians of the children and assent from the children.

Students were considered eligible participants for the study if they met the following criteria:

1. Children with no history of previous tooth extraction, or any form of orthodontic treatment. Their consent forms were properly filled out and returned to the school.
2. Aged 6-8years
3. No severe dentofacial anomalies such as cleft lip and palate or special needs.
4. Had not been hospitalized for major medical conditions or surgeries in the past 6 months.

All information was obtained from the consent/information forms filled out by the children's parents or guardians before the study.

Only pupils whose consent forms were properly filled out and returned to the school were recruited into the study.

One of the investigators explained in detail the purpose of the study and afterwards the children were examined

Section A of the questionnaire captured socio-demographic data, while Section B supplied information about occlusal features seen in the participants.

Demographic information (age, gender) was obtained for each subject. Oral examinations were carried out in natural light using tongue depressors and sterile gloves. The teeth present were recorded as well as the oral hygiene and malocclusion assessed using the Simplified Greene and Vermillion Oral Hygiene Index and Dental Aesthetic Index (DAI) (Appendix I) respectively.

The Dental Aesthetic Index (DAI) is a weighted occlusal index that assesses 10 occlusal characteristics[13]. The sum of these occlusal characteristics added to a constant (a value of 13) gives the DAI score[13]. Scores obtained range from 0 to 100, with 36 being the cut-off point for handicapping malocclusion, hence mandatory orthodontic treatment need[13].

The ability of this orthodontic index to assess dental aesthetics aids to determine/demonstrate malocclusion capable of causing psychosocial handicap[13]. DAI index is advantageous, besides being easy and fast for application in epidemiological studies, it is recommended by the World Health Organization for oral health surveys, facilitating international standardization of research[13].

Subjects with DAI scores of 0-25 were considered to have no/mild malocclusion with little or no need for treatment. Individuals with a score of 26 to 30 had definite malocclusion with the elective need for treatment. Scores of 31-35 were considered severe with orthodontic treatment highly recommended, while a score of 36 and above was considered handicapping malocclusion and treatment was mandatory.[11] All participants with a score greater than 25 were therefore considered to have a malocclusion in this study.

Data analysis was carried out using Statistical Package for Social Sciences (SPSS) software Version 23. The results were presented using frequencies, percentages and proportions for categorical variables. Chi-square and Fischer's exact tests were used to test the association between variables. Statistical significance was set at $p<0.05$

Results

A total of four hundred and twenty-one subjects were recruited for the study. The subjects' age ranged from 6 to 8 with a mean age of 6.9 years. The 7-year-olds were however the most predominant (38.5%). The males accounted for a higher proportion of the study population (55.3%) compared to the females (44.7%) and primary 3 pupils accounted for a majority of the study population (44.1%) (Table 1).

Table 1: Socio-demographic variables.

Socio-demographic variables	Frequency(n=421)	Percentage (%)
Age(years)		
6	152	36.1
7	162	38.5
8	107	25.4
Gender		
Male	233	55.3
Female	188	44.7
Class		
Primary 1	92	21.9
Primary 2	143	34.0
Primary 3	185	44.1

The malocclusion of the study participants was assessed using the Dental Aesthetic Index. Most children had a DAI score less than 25 (77.4%), showing mild to no malocclusion. Approximately 17% of children had DAI scores ranging from 25-30 and the remaining 5.5% had DAI scores above 31 (severe malocclusion). (Figure I)

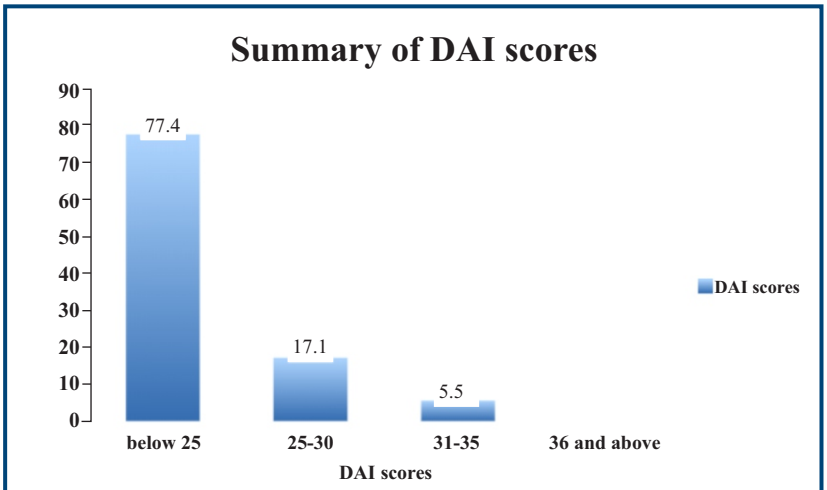

Fig 1: Dental Aesthetic Score of the Study Population

The most predominant DAI score within the age groups and across the gender is DAI < 25. DAI score 25-30 was evenly distributed within the age groups but had more males across the gender. More 6-year-olds had DAI score 31-35 than any other age group and more males than females had DAI score 31-35.

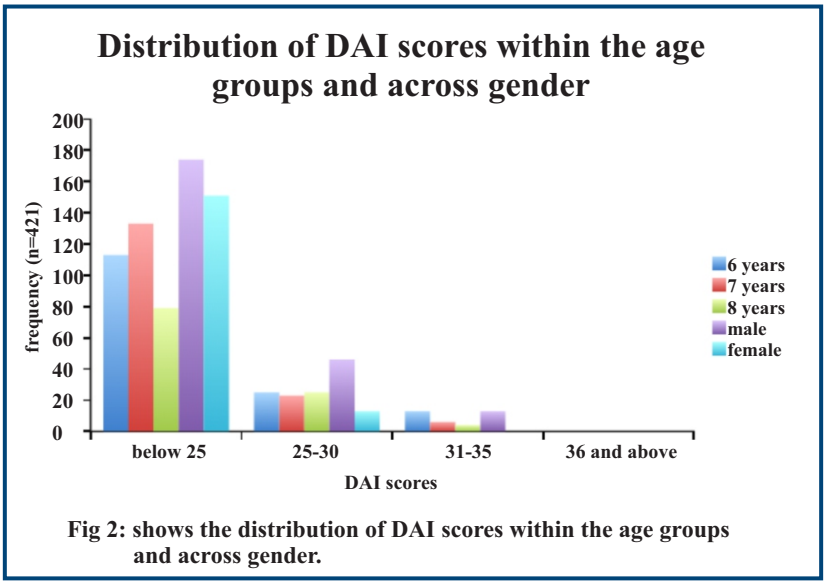

Fig 2: shows the distribution of DAI scores within the age groups and across gender.

Table 2: The distribution of molar relationships within the age groups.

Molar relationship	Age (N (%))			P-value
	6 yr	7yr	8yr	
Class I	135(32.1)	149(35.4)	91(21.6)	
Class II	10(2.4)	6(1.4)	11(2.6)	0.503
Class III	6(1.4)	7(1.7)	6(1.4)	

Class 1 molar relationship was the most prevalent type of molar relationship in all the age groups.

Table 3: Relationship between the presence of oral habits and severity of malocclusion

Presence of Habits	DAI scores (N%)			P-value
	BELOW 25	25-30	31-35	
No	258(61.44)	24(5.46)	10(2.37)	0.007
Yes	67(15.96)	49(11.64)	13(3.13)	

Table 3 shows the prevalence of oral habits in the study population and its relationship with the prevalence of malocclusion. A total of 30.7 % of the participants had one form of oral habit. The relationship between the presence of habit and severity of malocclusion was found to be statistically significant (p=0.007)

Table 4: Relationship between oral habits and overbite characteristics.

Overbite	Presence of Habits (N (%)		P-value
	Yes	NO	
Normal	58(13.80)	184(43.71)	
Increased	17(4.03)	32(7.60)	
Decreased	19(4.50)	61(14.41)	
Reversed	15(3.60)	8(1.90)	
Anterior Open Bite	20(4.80)	7(1.66)	**< 0.001**

About 55% of the study population had overbite discrepancies.
There is a strong association between overbite discrepancies in the form of a reduced overbite, increased overbite or anterior open bite, and the presence of oral habits (P <0.001)

Table 5: Relationship between overjet and severity of the malocclusion.

Overjet	DAI scores (N%)			P-value
	BELOW 25	25-30	31-35	
Normal	218(51.79)	33(7.72)	6(1.46)	
Increased	53(12.56)	14(3.32)	5(1.19)	
Reduced	55(13.06)	25(5.83)	12(2.85)	
Reversed	0(0.00)	1(0.23)	0(0.00)	**< 0.001**

Discussion

This study involved 421 children between the ages of 6 to 8 years, within a mean age of 6.9years. There were more males (55.3%) than females (44.7%). These children were all in early mixed dentition, having all first permanent molars and permanent incisors erupted.

Overall, Class I molar relationship (89.1%) was found to be the predominant molar relationship. This is similar to the study carried out by Ajayi[14] among Nigeria children, where class I molar relationship was found to be the most predominant; 80.9%[14.] Another study was done by Thilander[15] and Silva[16] on Columbian and Latino children respectively. In these studies[15,16], the predominance of class I molar relationship was found to be as high as 95%. Class II molar relationship was found in 6.4% of the population and 4.5% had a class III molar relationship. The most prevalent skeletal pattern found was class 1 skeletal pattern (92.2%), while 4.5% of the study population had class 2 skeletal patterns and 3.3% had class 3 skeletal patterns. For the dmft scores; 87.2% of the children had a dmft score of 0, 8.5% of children had a dmft score ranging from 1-2, while 4.3% had a dmft score 3 and above.

The tooth-bone ratio found in both maxillary and mandibular arches showed a prevalence of mild spacing (30%), which is expected in this age group as the jaws are growing and intercanine width is increasing; this is similar to findings by Bishara et al.,[17] There was a greater prevalence of moderate to severe spacing in the maxilla (16.2%). This may be explained by the fact that the intercanine width increase in the maxilla is almost twice as much as that of the mandible[16]. There was a greater incidence of crowding in the mandible (21.2%) This could be a result of early mixed dentition and might resolve on its own after exfoliation of deciduous incisors.

Overjet examination revealed that 60.96% of the children had normal overjet, while 21.74% had reduced overjet and 17.07% had increased overjet. This is in contrast to the result of a study by Onyeaso who found that increased overjet was more prevalent than reduced overjet.[18] A total of 39.04% of study participants had overjet discrepancies and this was associated with more severe malocclusion (DAI>25) compared to those with normal overjet ($p < 0.001$). A higher percentage of overjet discrepancies were found in the 7- and 8-year-old and were more of increased overjet. This, however, may have a more physiologic than pathologic component, as it corresponds with the timing of the 'ugly duckling' stage of dentition. Increased overjet is one of the occlusal traits seen in digit and tongue sucking habits. The higher incidence of oral habits in the 7 to 8- year-old age group could also be contributory to the increased overjet seen in the group.

Concerning overbite characteristics, 55.1% of children in the study were found to have a normal overbite, while 44.9% of the study subjects had overbite discrepancies, with the association between overbite discrepancies and severity of malocclusion found to be statistically significant ($p=0.007$). This could be because the study population is in early mixed dentition, with the permanent teeth in various stages of eruption. There is a strong association between oral habits and overbite discrepancies. Also, the presence of transitional open bites seen in the mixed dentition stage may be contributory.

The most predominant type of overbite discrepancy found in this study group was decreased overbite at 14.4%. This is similar to studies done by Tauscher[19], on 6-8-year-old German children, though a much higher prevalence was recorded (55.3%). This could be because the study participants were in an early mixed dentition stage and anterior teeth may not be fully erupted. This study is in contrast to a similar study carried out by Onyeaso and Sote,[18] in Nigerian primary school children, where increased overbite was found to be the more prevalent type of vertical jaw discrepancy.

About 13.54% were found to have deep bite, this is similar to a study done by Onyeaso where increased

overbite was found to be 16%[19]. Prevalence of anterior open bite was found to be 4.8% which is lower compared to similar studies done in Columbian children by Thilander [1], where the prevalence of anterior open bite was found to be 9%.

In the study population, 77.4% of children had little orthodontic treatment needed (DAI score below 25), while 22.6% needed orthodontic treatment (DAI score> 25). This is similar to a study done by Tausche, et al[19], on 6-8-year-old German children, where the prevalence of malocclusion was found to be 26.2%.

Prevalence of oral habits was found to be 24%. This is in contrast to a study done by Onyeaso, et al on 7-10-year-old Nigerian children,[20] where prevalence was found to be as high as 49.9%, with 26.2% requiring orthodontic treatment [5], while in this study 48% were found to need orthodontic treatment.

The relationship between oral habits and the severity of malocclusion was found to be statistically significant (p=0.007). This is not surprising as oral habits are known to be a significant aetiological factor in the development of malocclusion[6].

Anterior open bite and increased overjet were also found to be higher amongst participants who had oral habits, this is similar to studies done by Kolawole et al[21], which reported higher DAI scores, increased overjet, and anterior open bite in children with oral habits.

Conclusion

In Conclusion, the study observed a prevalence of malocclusion of 22.8% with need for orthodontic intervention in the primary school population studied. Common occlusal traits observed were overjet and overbite anomalies. Oral habit was a common finding in this age group with a need for orthodontic intervention.

Authors' Contributions

Umeh OD contributed to conceptualization, study design, literature search, data collection, statistical analysis and manuscript preparation and manuscript review.

Ben-Okoye contributed to study design, literature search, data collection and manuscript preparation

Isiekwe IG contributed to study design, literature search, data collection, statistical analysis and manuscript review

Sanu OO contributed to study conceptualization, literature search, data collection and manuscript review

Utomi IL contributed to study design, literature search, data collection and manuscript review

DaCosta OO contributed to literature search, data collection and manuscript review

All authors approved the final copy of the manuscript

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Conflict of Interest

None declared

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Dental aesthetic index scoring

1.	Number of missing visible teeth (incisors, canines, and premolars in maxillary and mandibular arch)	6
2.	Crowding in the incisal segment (0 = no segments crowded, 1 = 1 segment crowded, 2 = 2 segments crowded)	1
3.	Spacing in the incisal segment (0 = no spacing, 1 = 1 segment spaced, 2 = 2 segments spaced)	1
4.	Midline diastema, in millimetres	3
5.	Largest anterior maxillary irregularity, in millimetres	1
6.	Largest anterior mandibular irregularity, in millimetres	1
7.	Anterior maxillary overjet, in millimetres	2
8.	Anterior mandibular overjet, in millimetres	4
9.	Vertical anterior open bite, in millimetres	4
10.	Anteroposterior molar relationship, largest deviation from normal either left or right (0 = normal, 1 = ½ cusp mesial or distal, 2 = 1 full cusp or more mesial or distal)	3
11.	Constant	13
Total		DAI score