Malocclusion and early orthodontic treatment requirements in the mixed dentitions of a population of Nigerian children

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ABSTRACT

Introduction: The aims of this study were to establish the prevalence of dental features that indicate a need for early intervention and to ascertain the prevalence of different methods of early treatment among a population of Nigerian children in mixed dentition.

Methods: Occlusal relationships were evaluated in 101 children in mixed dentition between the ages of 6 and 12 years who presented at the Orthodontic Unit, Department of Child Dental Health, Lagos University Teaching Hospital over a 2 years period. The need for different modes of early orthodontic treatment was also recorded.

Results: Anterior tooth rotations (61.4%) and increased overjet (44.6%) were the most prevalent occlusal anomalies. Others included deep bite (31.7%), reverse overjet (13.9%), and anterior open bite (14.8%). Severe maxillary spacing and crowding were exhibited in 12.0% and 5.0%, respectively. About a third (35.7%) of the subjects presented with crossbite while lip incompetence was observed in 43.6% of the subjects. About 44% of the subjects also presented with various oral habits with digit (15.8%) and lip sucking (9.9%) being the most prevalent. Subjects were recommended for treatment with 2 by 4 fixed orthodontic appliances (22.3%), habit breakers (20.7%), removable orthodontic appliances (16.5%), and extractions (15.7%).

Conclusions: Increased overjet and anterior tooth rotation were the majority of occlusal anomalies seen, which are not only esthetically displeasing but may also cause an increased susceptibility to trauma to these teeth. Treatment options varied from extractions only to the use of appliance therapy.

Key words: Early orthodontic treatment, malocclusion, Nigeria

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INTRODUCTION

The early treatment of (nonskeletal and skeletal) orthodontic anomalies in the deciduous and early mixed dentition is intended to prevent the development of pronounced anomalies in the late mixed and permanent dentition with the ultimate aim of reducing or even eliminating the need for later orthodontic treatment.[1] Early orthodontic treatment is usually initiated during the mixed dentition stage through the referral system.[2] This referral system is much more organized and effective

in the Western world than in Nigeria, where although some patients do present in the orthodontic clinic for early treatment through a referral, many more do so on the instance of their parents, relatives, or guardians.[3,4] Early intervention performs the same function as interceptive orthodontics and prevents or reduces progression to full-blown malocclusion later in life and also excludes factors which would interfere with regular development of the dental arches.[2] This fact is, however, debatable in literature with some research ascertaining that is very efficient, while other authorities debate the usefulness of early treatment.[5]

Evidence of the efficiency of early orthodontic measures is just as rare as studies providing serviceable information on the incidence of tooth malalignments and malocclusions in the deciduous and early mixed dentition, some of whose findings are in any case highly divergent.[1]

However, early orthodontic treatment has been found to improve both psychosocial development and masticatory function in children. Posterior crossbites which impede function, anterior crossbites resulting in traumatic occlusion and damage to the lower anterior teeth, anterior open bites which cause esthetic distress as well as masticatory dysfunction are some of the many indications for early treatment. Also, prevention of trauma to the anterior teeth of individuals with severe Class II malocclusions with accompanying increased overjets is indication for early orthodontic treatment.[6,7]

To advocate for facilities and the training of appropriate manpower to carry out early orthodontic treatment, it is important to ascertain the level of orthodontic treatment need among any population. This will enhance the formulation of appropriate policies and also allow for appropriate advocacy to be carried out.

The aims of this study were to establish the prevalence of dental features that indicate a need for early intervention and to ascertain the prevalence of different methods of early treatment among a population of children in mixed dentition.

METHODS

This study was carried out over a period of 2 years comprising all patients in mixed dentition that presented at the Orthodontic Unit of the Lagos University Teaching Hospital. The sample comprised a total of 101 patients, 46 (45.5%) males and 55 (54.5%) females between the ages of 6 and 12 years who were presenting to an orthodontist for the first time.

Patients were seated in a dental chair with overhead dental lighting. Each child was examined with the teeth in centric occlusion. Each patient was examined both extraorally and intraorally for facial and occlusal anomalies and accordingly the need for early orthodontic treatment. The clinical findings

were recorded on a prepared data sheet. Informed consent was provided by the accompanying parent or guardian.

Criteria for Diagnosis

Anteroposterior relations were classified using Angle's classification:

Class I: The mesiobuccal cusp of the upper first permanent molar occluded in the buccal groove of the lower first permanent molar.

Class II: The mesiobuccal cusp of the upper first permanent molar occluded, at least, half a unit mesial to the buccal groove of the lower first permanent molar.

Class III: The mesiobuccal cusp of the upper first permanent molar occluded, at least, half a unit distal to the buccal groove of the lower first permanent molar.

Anterior crossbite was recorded when the upper anterior teeth occluded lingual to the lower anterior teeth while posterior crossbite was recorded when the mandibular molars or premolars occluded buccal to their opposing teeth.

Overbite was recorded as reduced/decreased when the maxillary central incisors overlapped less than a third of the labial surface of the mandibular incisors and deep/increased when the maxillary central incisors overlapped more than a half of the labial surface of the mandibular incisors. Other variables assessed included overjet and oral habits.

Tooth size-arch length disproportion which manifested as crowding or spacing was graded as follows: Mild 0–3 mm, moderate 4–6 mm, and severe >7 mm.

Statistical Analysis

Tabulation of data and consequent analysis was done using the Statistical Package for Social Sciences (SPSS) Version 17.0 (SPSS Version 17.0 for Windows, SPSS, Inc., Chicago, Illinois, USA). Descriptive statistics and frequencies were ascertained. Level of significance was set at $P < 0.05$.

RESULTS

The mean age of the studied population was 8.08 ± 1.63 years. The age by gender distribution of participants is shown in Table 1.

The participants had varying Angle's molar relationships as assessed using the first permanent molars [Table 2].

Table 3 shows the degree of spacing and crowding of the subjects. About a quarter (25.7%) of the subjects had well-aligned maxillary anterior teeth whereas 12.0% and 5.0% had severe spacing and crowding, respectively. In the mandibular arch, 33.3% of the participants had well-aligned anterior teeth while 14.1% had severe crowding and 2.0% had severe spacing.

The overjet and overbite values are shown in Table 4. Overjets ranging from 4 mm to 16 mm were recorded in the participants. 44.6% had increased overjet (>4 mm) with 19.8% presenting with overjet >7.0 mm while 13.9% of subjects had negative overjet. The subjects also exhibited deep bite (31.7%), reduced bite (18.8%), and anterior open bite (14.8%).

35.7% of the subjects presented with anterior and posterior crossbite while 61.4% had rotated teeth. Lip incompetence was also seen in 43.6% of the subjects [Table 5].

Various oral habits were indulged in by the subjects (44, 43.6%) as depicted in Table 6. A majority of the children were involved in digit sucking (16, 15.8%).

Various treatment requirements were recorded; in some cases (19.8%), multiple treatment types were required in a single patient. In both male and female patients, habit breakers were required by 25 children (20.7%), in male patient treatment by 2 × 4 appliances in both arches (where required in 19.2%) and removable appliances (in 17.3%) and in female patients by removable appliances (in 15.9%) and serial extractions (11.6%). The various treatment needs of this population are recorded in Table 7.

DISCUSSION

This study examines the occlusion and the need for treatment of a 101 children aged 6–12 years old who presented at the

Table 1: Distribution of participants according to age and gender

Age (years)	Male, *n* (%)	Female, *n* (%)	Total, *n* (%)
6	5 (10.9)	10 (18.2)	15 (14.8)
7	10 (21.7)	20 (36.4)	30 (29.7)
8	10 (21.7)	13 (23.6)	23 (22.8)
9	8 (17.4)	6 (10.9)	14 (13.9)
10	6 (13.0)	1 (1.8)	7 (6.9)
11	6 (13.0)	2 (3.6)	8 (7.9)
12	1 (2.2)	3 (5.5)	4 (4.0)
Total	46 (45.5)	55 (54.5)	101 (100)

Table 2: Molar relationships of participants

Molar relationship	Male, *n* (%)	Female, *n* (%)	Total, *n* (%)	P
Angle's Class I	39 (84.8)	44 (80.0)	83 (82.2)	0.458
Angle's Class II	6 (13.0)	7 (12.7)	13 (12.9)	
Angle's Class III	0 (0.0)	3 (5.5)	3 (2.9)	
Asymmetric	1 (2.2)	1 (1.8)	2 (2.0)	
Total	46 (45.5)	55 (54.5)	101 (100)	

Table 3: Degree of spacing and crowding among participants

Variable	Male	Female	Total, *n* (%)	P
Mixed dentition (maxillary anterior teeth)				
Well-aligned	10 (21.7)	16 (29.1)	26 (25.7)	0.300
Mild crowding	4 (8.7)	9 (16.4)	13 (13.0)	
Moderate crowding	3 (6.5)	8 (14.5)	11 (11.0)	
Severe crowding	2 (4.3)	3 (5.4)	5 (5.0)	
Mild spacing	14 (30.4)	11 (20.0)	25 (25.0)	
Moderate spacing	5 (10.9)	4 (7.3)	9 (9.0)	
Severe spacing	8 (17.4)	4 (7.3)	12 (12.0)	
Total	46 (45.5)	55 (54.5)	101 (100.0)	
Mixed dentition (mandibular anterior teeth)				
Well-aligned	16 (35.6)	17 (31.5)	33 (33.3)	0.579
Mild crowding	4 (8.9)	6 (11.1)	10 (10.1)	
Moderate crowding	8 (17.8)	13 (24.1)	21 (21.2)	
Severe crowding	5 (11.1)	9 (16.7)	14 (14.1)	
Mild spacing	6 (13.3)	7 (13.0)	13 (13.1)	
Moderate spacing	4 (8.9)	2 (3.7)	6 (6.1)	
Severe spacing	2 (4.4)	0 (0.0)	2 (2.0)	
Total	46 (45.5)	55 (54.5)	101 (100.0)	

Table 4: Overjet and overbite values of participants

Variable	Male, *n* (%)	Female, *n* (%)	Total, *n* (%)	P
Overjet				
Negative (<−0.5 mm)	5 (10.9)	9 (16.4)	14 (13.9)	0.418
Reduced (<2.0 mm)	3 (6.5)	4 (7.2)	7 (6.9)	
Normal (2.0-4.0 mm)	12 (26.1)	23 (41.8)	35 (34.6)	
Increased (5.0-7.0 mm)	12 (26.1)	13 (23.6)	25 (24.8)	
Increased (>7.0 mm)	14 (30.4)	6 (10.9)	20 (19.8)	
Total	46 (45.5)	55 (55.5)	101 (100)	
Overbite				
Normal	13 (28.3)	22 (40.0)	35 (34.7)	0.236
Reduced	7 (15.2)	12 (21.8)	19 (18.8)	
Increased	16 (34.8)	16 (29.1)	32 (31.7)	
Anterior open bite	10 (21.7)	5 (9.1)	15 (14.8)	
Total	46 (45.5)	55 (54.5)	101 (100)	

Table 5: Frequency of crossbite, scissors bite, tooth rotation, and lip positions of participants

Variable	Male *n* (%)	Female *n* (%)	Total	P
Crossbite				
Anterior	13 (28.3)	18 (32.7)	31 (30.7)	0.234
Posterior	1 (2.2)	4 (7.3)	5 (5.0)	
Absent	32 (69.6)	33 (60.0)	65 (64.3)	
Total	46 (45.5)	55 (54.5)	101 (100)	
Tooth rotation (anterior)				
Present	29 (63.0)	33 (60.0)	62 (61.4)	0.852
Absent	17 (37.0)	22 (40.0)	39 (38.6)	
Total	46 (45.5)	55 (54.5)	101 (100)	
Lip position				
Competent	18 (39.1)	33 (60.0)	51 (50.5)	0.056
Incompetent	26 (56.5)	18 (32.7)	44 (43.6)	
Potentially competent	2 (4.3)	4 (7.3)	6 (5.9)	
Total	46 (45.5)	55 (54.5)	101 (100)	
Scissors bite				
Present	4 (8.7)	2 (3.6)	6 (5.9)	0.266
Absent	42 (91.3)	53 (96.4)	95 (94.1)	
Total	46 (45.5)	55 (54.5)	101 (100)	

Table 6: Frequency of oral habits of patients

Oral habits	Male *n* (%)	Female *n* (%)	Total *n* (%)	*P*
Nil	26 (56.5)	31 (56.3)	57 (56.4)	0.751
Digit sucking	6 (13.0)	10 (18.2)	16 (15.8)	
Tongue thrust	4 (8.7)	3 (5.5)	7 (6.9)	
Lip sucking	4 (8.7)	6 (10.9)	10 (9.9)	
Cheek biting	1 (2.2)	0 (0.0)	1 (1.0)	
Tongue sucking	1 (2.2)	2 (3.6)	3 (3.0)	
Pen biting	1 (2.2)	0 (0.0)	1 (1.0)	
Nail biting	1 (2.2)	0 (0.0)	1 (1.0)	
Combined habits	2 (4.4)	3 (5.5)	5 (4.9)	
Total	46 (45.5)	55 (54.5)	101 (100)	

Table 7: Treatment requirements of population*

Treatment needs	Male *n* (%)	Female *n* (%)	Total *n* (%)
Extractions	4 (7.7)	4 (5.8)	8 (6.6)
Serial extractions	3 (5.8)	8 (11.6)	11 (9.1)
Removable appliances	9 (17.3)	11 (15.9)	20 (16.5)
Habit breakers	11 (21.2)	14 (20.3)	25 (20.7)
2×4 appliance (one arch only)	5 (9.6)	7 (10.1)	12 (9.9)
2×4 appliance (both arches)	10 (19.2)	5 (7.4)	15 (12.4)
Functional appliance	2 (3.8)	1 (1.4)	3 (2.5)
Arch expansion	2 (3.8)	5 (7.4)	7 (5.8)
Space maintenance	1 (1.9)	3 (4.3)	4 (3.3)
Face mask	0 (0.0)	3 (4.3)	3 (2.5)
Mouthguard	0 (0.0)	1 (1.4)	1 (0.8)
Periodic review	5 (9.6)	5 (7.4)	10 (8.3)
Counseling	0 (0.0)	2 (2.8)	2 (1.6)
Total	52 (100)	69 (100)	121 (100)*

*Some patients had multiple treatment requirements

Orthodontics Unit, Lagos University Teaching Hospital, Nigeria, over a period of 2 years.

Early orthodontic treatment is effective and desirable in specific situations. However, the evidence is equally compelling that such an approach is not indicated in many cases for which later, single-phase treatment is more effective.[5] The demand for such treatment is indicated by the number of patients that seek care.[8] In a study in University College Hospital, Ibadan 50% of the patients attending the orthodontic clinic were in the mixed dentition category showing a high level of demand or referral.[9] Commonly, this care is sought by parents and guardians of children with various types of malocclusion. It was of interest to note that there were more female (54.5%) than male (45.5%) children attending the clinic, which is a common finding in our environment and worldwide and underscores the importance attached to the esthetics of the girl child. Treatment emphasis in the mixed dentition is mainly on correction of morphological and functional anomalies.[8]

Increased overjet was a predominant occlusal anomaly seen in children attending the clinic. These malocclusions are not only esthetically displeasing but cause an increased susceptibility to

trauma to these teeth,[10] which further indicates the necessity for early orthodontic treatment. This finding, however, is contrary to that found in German children where lateral and anterior crossbite were most prevalent, and only 1.4% had increased overjets.[1] In another study carried out in Lagos University Teaching Hospital, the most prevalent malocclusions among orthodontic patients were upper and lower anterior segmental crowding.[8] This finding, however, may be due to the larger sample size studied and the fact that the study included patients of all ages while this study was limited only to the patients in mixed dentitions. However, a systematic review of orthodontic treatment for children with prominent upper front teeth showed that early treatment is no more effective than treatment in adolescence.[11]

Anterior crossbite was observed more frequently than posterior crossbite. This was also recorded in other local studies.[9,12,13] However, in many Caucasian studies, posterior crossbite is reported to occur more frequently than anterior.[14,15] The finding of the present study is in agreement with a study[15] on a group of black and white American schoolchildren which reported that anterior crossbite occurred 4 times more frequently in black American children than white. This finding is noteworthy because there is a general consensus in the international literature that early therapy is indicated in cases of anterior and lateral crossbite.[1] Some researchers have concluded that prevention of progression of malocclusion is a justifiable reason for early treatment.[10] This may also prevent asymmetric alveolar bone growth and disturbances in the permanent dentition. Severity of crossbite and reverse overjet have also been found to increase with age, thus early treatment prevents progression of such malocclusions.[16]

Overall, almost half of the patients seen indulged in oral habits. Studies[17-19] of the general populace have reported a prevalence of oral habits ranging from 9.9 to 34.1% in Nigerian children of varied ages with digit sucking being reported as the most common oral habit. Digit sucking was also the most prevalent oral habit in this population (15.8%) and is a major cause of increased overjet and anterior open bite which was observed in 44.6% and 14.8% of the population, respectively, thus habit breakers were the most recommended treatment option for this population (20.7%). Contrary to our findings, in Portuguese children, 11.3% were observed to have anterior open bite majorly due to pacifier sucking.[20] However, pacifier use has been reported as not being very popular in our environment[21] which is probably the reason for the children resorting to digit sucking. Due to the influence of oral habits in growing patients, some therapeutic protocols with fixed or removable appliances should be followed to eliminate, improve or, at least, control the increased vertical dimension.[22] Research has proven that nonnutritive sucking habits during the primary dentition stage play a key role in determining anterior open bite.[22] Habit breakers are essentially important in the prevention and early management of anterior open bite. The high prevalence of digit sucking may also be due to the socioeconomic changes

in our society whereby many more mothers work outside of the home and the children turn to digit sucking for psychological comfort. This has been confirmed by a previous study[20] which reported that the digit sucking habit was seen more frequently in mothers in high cadre occupations. However, these habits need to be eliminated early using the appropriate protocols, including habit breakers to reduce the risk factors of developing malocclusions.[21]

Less than 16.5% of the children required removable appliances which include the use of labial bows to reduce overjets and bite planes to reduce deep bite in the mixed dentition. This is not surprising due to the large proportion of the children that had increased overjets and anterior tooth rotations as well as anterior crossbites. Partial-fixed orthodontic appliances (2 × 4 appliances) were also used to correct varied anomalies.

Treatment in the early mixed dentition has been found to be an effective method of restoring normal occlusion and eliminating the need for further orthodontic treatment.[14] Advantages of early orthodontic treatment include improvement of the oral environment at a young age, enhancement of self-esteem, improvement of long-term stability, and less time in full (adolescent) treatment. [23,24] Early management of anterior and posterior crossbite has been recommended to prevent craniofacial asymmetry and to improve function and esthetics.[25,26] Only a few spontaneous corrective changes can be expected without active intervention. [14,16] It also inhibits or, at least, reduces the severity and the progression of the malocclusion.[2,27] The entire malocclusion may be better addressed at an early age rather than only addressing one or two problems and postponing the majority of the orthodontic correction until the permanent dentition.[28] Meanwhile, more than one-third of Nigerian children have been found to be in need of early orthodontic treatment making this even more pertinent.[12]

Early orthodontic treatment should take various factors into consideration including the severity of the malocclusion, its impact on the neuromuscular system, prevention of asymmetric alveolar bone development, and disturbances in the permanent dentition.[2,5] Such care should be encouraged especially in a country like Nigeria due to the numerous benefits that can be derived from it and also for economic reasons where many cannot afford the cost of comprehensive orthodontic services. The need for early orthodontic treatment and the benefits of one-phase versus two-phase treatment has been broadly discussed.[29-31] It is our belief that the need for treatment should depend on the severity of the malocclusion and the effect on the neuromuscular and skeletal system.

CONCLUSIONS

Increased overjet and anterior tooth rotation made up the majority of occlusal anomalies seen. Oral habits, which included digit and lip sucking, were a common source of great concern to parents. Recommended treatment options varied from extractions only to the use of appliance therapy, which comprised habit breakers, removable appliances, and segmental fixed appliances.

Recommendations
We recommend that more orthodontic specialists should be trained and more awareness should be created to treat patients who present for early treatment.

We also recommend that continued education should be given to general dental practitioners and pediatric dentists in orthodontic diagnosis and the use of removable appliances, habit breakers, and space maintainers.

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Conflicts of Interest
There are no conflicts of interest.

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