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MORPHOLOGICAL AND FUNCTIONAL TRAITS OF MALOCCLUSION IN 3-5 YEAR-OLDS IN MOSHI, TANZANIA

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ABSTRACT

Objective: To assess the morphological and functional traits of malocclusion.

Design: Cross-sectional study.

Setting: Moshi Municipality, Kilimanjaro region, Tanzania.

Subjects: Examination for occlusal traits was done on 372 randomly selected 3-5-year olds (157 males and 215 females).

Results: The overall prevalence of malocclusion was 26.9%. Females had significantly more occlusal anomalies than males. The flush terminal plane (93.8%) was the commonest anteroposterior relation. Excessive maxillary overjet and deep-bite occurred in 5.1% and 21.5% of the children respectively. Reverse overbite (1.9%), frontal open-bite (1.6%), lateral open-bite (0.8%) and posterior cross-bite (0.3%) were relatively rare. Harmful oral habits were uncommon in this population. The sample mean for inter canine width in the maxilla was 31.1mm (SD ± 2.72) and for the mandible 25.3mm (SD ± 2.46). Lack of natural spacing in the anterior segment of the maxilla occurred in 34.4% of the children and 33.6% in the mandible.

Conclusion: Generally, females had significantly more occlusal anomalies than males. The flush terminal plane was the commonest anteroposterior finding. Lack of natural spacing in the anterior segments and deep bite were common.

INTRODUCTION

Malocclusion may exert a negative influence on the general as well as the oral health of a child. Data indicate the occurrence of malocclusion to be universal; and traits vary between individuals and between ethnic groups (1, 2). Previous reports show that certain anomalies and traits in the primary dentition can appear in the permanent dentition (1). Early recognition of undesirable traits, anomalies and oral behaviour detrimental to the developing primary occlusion may enable simple interceptive measures (3), which in most cases do not need the services of an orthodontic specialist. Such intervention may prevent or alleviate full-fledged orthodontic treatment in the permanent dentition, which usually calls for specialist attention.

There are few studies on the occlusal status in the primary dentition of children in Tanzania and East Africa in general (1, 4). This makes it difficult to know to what extent interceptive orthodontics is necessary not only for clinical purposes but also for academic reasons. The purpose of this study, therefore, was

to assess the morphological and functional traits of malocclusion in 3-5-year-olds in Moshi, Tanzania.

MATERIALS AND METHODS

This was a cross-sectional study involving pre-primary school children aged 3-5 years (157 males and 215 females) in Moshi Municipality, Tanzania. Ethical clearance was sought from Tumaini University, Kilimanjaro Christian Medical College Ethics Committee in Moshi, Tanzania. A written informed consent was obtained from each of the parents/guardians of the children who were examined. The subjects were randomly selected from 57 pre-primary nursery schools in Moshi municipality. Each pupil aged 3-5 years was identified through a register and assigned a number for random selection. A sample of 372 children was obtained. This sample constituted 3.8% of all the 3-5-year-olds in Moshi municipality. The children were examined in a classroom using natural light and with the aid of ordinary mouth mirrors and miniature standardised plastic rulers. One examiner (DSR) carried out all examinations.

An assistant entered data in a pre-prepared form. The children were examined for prevalence of occlusal traits using the Bjork *et al.* (5) criteria with slight modification. The modification was in relation to the determination of anteroposterior second molar relation, intercanine widths, and spacing in the anterior segments and detrimental oral behaviour. Anteroposterior primary second molar relation was scored and grouped as a flush terminal plane, mild mesial step (< 2mm), severe mesial step (≥2mm) or distal step. Maxillary and mandibular intercanine widths were measured directly in the oral cavity using a miniature plastic ruler. Detrimental oral behaviour was examined by looking for clinical signs on a child as described in the literature (6). Digital sucking was examined by looking for the appearance of any sign of redness, exceptionally clean, short fingernails on the sucked digit. Mouth breathing was examined by placing a butterfly shaped piece of cotton above the upper lip below the nostrils. Down flutter of the cotton ruled out mouth breathing. Lip biting was examined by looking for any sign of reddened irritated area below the vermilion border of the lip being bitten or accentuated mentolabial sulcus in case of the lower lip being bitten. Parents / guardians questionnaire in regard to the oral behaviour of their children was administered to augment these observations (Table 1).

Data were fed in the computer for analysis using Statistical Package for Social Sciences (SPSS) version 12.1 (7) and Epidemiology Information Package (EpiInfo) (8). The Kappa test was used to evaluate intra-examiner reproducibility of the qualitative variables (9) and the related t-test for quantitative variables. Each tenth subject examined was subjected by the recorder for re-examination on each day of examination. A total of 44 subjects were re-examined by the end of data collection. ANOVA, Chi-square test and Fisher's exact test were used to evaluate for any significant differences between males and females on the mean intercanine widths and the prevalence of occlusal traits. A p-value <0.05 was considered significant.

RESULTS

Figure 1 illustrates the distribution of examined subjects according to age and gender. The intra-examiner reproducibility test for qualitative variables produced a Kappa score of 0.9 indicating high reproducibility. There was no significant difference in the reproducibility for quantitative variables (p>0.05). The overall prevalence of malocclusion (inversion maxillary incisors, rotated tooth, bilateral distal step, bilateral severe mesial step, excessive maxillary overjet, mandibular overjet, increased deep-bite, frontal open-bite, lateral open-bite, posterior cross-bite and scissor-bite) was 26.9% (Figure 2). Females had significantly higher occlusal anomalies than males (P<0.05). The bilateral flush terminal plane was found

in the majority of the children (93.8%). Excessive maxillary overjet (5.1%), reverse overbite (1.9%), lateral open-bite (0.8%), frontal open-bite (1.6%) and posterior cross-bite (0.3%) were uncommon. Excessive deep bite (21.5%) was relatively common and occurred more significantly in females than in males (P<0.05) (Table 2).

Figure 1
Overall distribution of occlusal anomalies in 372 children

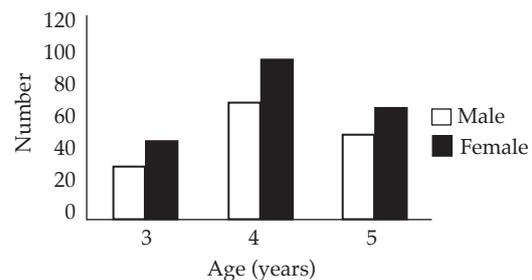


Figure 2
Distribution of children examined for morphological and functional traits of malocclusion by age and gender (n= 372)

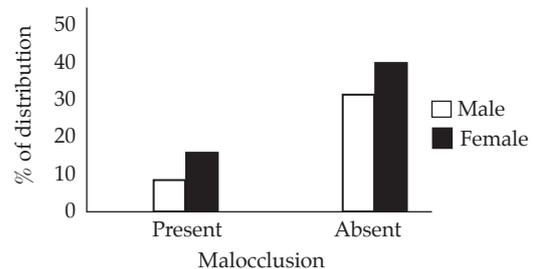


Table 1
Parent's/guardian's questionnaire administered to augment the criteria used in scoring oral habits for 3-5 year old children in Moshi Tanzania

- I. Is your child still sucking his/her digit these days?
 Yes
 No
 Has never sucked
- II. Does your child breath through the mouth at all times?
 Yes
 No
 Do not know/ I have not observed
- III. Does your child bite or suck the lips most of the time?
 Yes
 No
 Do not know/ I have not observed

Table 2
Prevalence of morphological malocclusion traits in Moshi children (157 males, 215 females) (n = 372)

Occlusal trait	Gender				Total		P-value
	Male		Female		No. (%)		
	No.	(%)	No.	(%)	No.	(%)	
Inversion maxillary incisors	2	0.5	4	1.1	6	1.6	1.00
Rotated tooth (estimated 15°)	1	0.3	4	1.1	5	1.3	0.40
Malformation	1	0.3	1	0.3	2	0.5	1.00
Distal step (right and left)	2	0.5	2	0.5	4	1.1	1.00
Unilateral mild mesial step (<2mm)	1	0.3	2	0.5	3	0.8	1.00
Bilateral mild mesial step (<2mm)	3	0.8	3	0.8	6	1.6	0.70
Bilateral severe mesial step (≥2mm)	6	1.6	0		6	1.6	*0.00
Unilateral flush terminal plane	2	0.5	4	1.1	6	1.6	1.00
Bilateral flush terminal plane	144	38.7	205	55.1	349	93.8	**0.00
Maxillary overjet (≥6mm)	7	1.9	12	3.2	19	5.1	0.63
Mandibular overjet (>0mm)	2	0.5	5	1.3	7	1.9	0.70
Deep-bite (≥50% overlap)	25	6.7	55	14.8	80	21.5	**0.03
Frontal open-bite (>0mm)	2	0.5	4	1.1	6	1.6	1.00
Lateral open-bite	1	0.3	2	0.5	3	0.8	1.00
Cross-bite (posterior)	1	0.3	0		1	0.3	0.042
Scissor-bite	1	0.3	0		1	0.3	0.042

Statistical difference between males (M) and females (F) * P< 0.05, M>F, **P<0.05, F>M (Statistics: Chi-Square test and fisher's exact test)

Abnormal maxillary labial frenum was encountered in 2.7% of the sample (Table 2). The data for oral habits are presented in Table 3. Table 4 shows the distribution of intercanine width and spacing in the anterior segments. The sample mean for intercanine width in the maxilla was 31.1mm (SD ±2.72) and 25.3mm

(SD±2.46) in the mandible. There was a significant gender difference in this trait whereby males exhibited a higher mean intercanine width than females in both jaws (P<0.05). Lack of natural spacing in the anterior segments of the maxilla (34.4%) and mandible (33.6%) was encountered frequently.

Table 3
Abnormal maxillary labial frenum and functional malocclusion traits in children (157 males, 215 females) (n=372)

Identified feature	Gender				Total	
	Male		Female		No. (%)	
	No.	(%)	No.	(%)	No.	(%)
Abnormal maxillary labial frenum	4	1.1	6	1.6	10	2.7
Digital sucking	1	0.3	7	1.9	8	2.2
Mouth breathing	2	0.5	0	0.0	2	0.5
Lip sacking or biting	0	0.0	1	0.3	1	0.3

Table 4

Distribution of intercanine width (mm) and lack of natural spaces in the anterior segments of maxilla and mandible in Moshi children (157 males, 215 females) (n=372)

	Gender				P-value
	Male		Female		
	No.	(%)	No.	(%)	No. (%)
Mean maxillary intercanine width	31.6		30.8		31.1 0.002
Mean mandibular intercanine width	25.6		25.1		25.3 0.022
Lack of natural space (maxilla)	49	13.2	79	21.2	128 34.4 0.27
Lack of natural space (mandible)	46	12.4	79	21.2	125 33.6 0.00

DISCUSSION

The sample in the present study constituted about 4% of all the 3-5-year-olds in Moshi municipality. The sample was selected through strict sampling procedures and would, therefore, be considered reasonably representative of children in this age-group. Only 174 (46.8%) of the parents/guardians responded to the questionnaire. Due to technical difficulties, no study models were taken in this study. The effect of this was probably the over-estimation or under-estimation of some specific occlusal traits. In spite of these shortcomings, however, the criteria adapted for this study allowed most of the occlusal traits in the deciduous teeth and signs of oral habits to be reasonably registered. As much as possible the use of sharp instruments unfamiliar to the children was avoided in the clinical examination. The intercanine width was, therefore, measured using a miniature standardised plastic ruler. However, since children could not allow the ruler to be placed in the posterior part of their oral cavity, the inter-molar width was not measured.

The percentage of children found with malocclusion was 26.9% which was lower than those found in Kenyans (51%) of similar age (4); and South Africans (53.3%) of slightly higher age group (10). In regard to specific inter- and intra-arch occlusal traits, some important observations were evident. The results indicate that majority of the children (93.8%) had bilateral flush terminal planes in the primary second molar relationship. Bilateral severe mesial step, distal step and mild mesial step occurred in 1.6%, 1.1% and 1.6% respectively. Findings of the flush terminal plane in this study were far higher than those reported for Kenyan and South African children (4, 10) but concurred with a previous study on Tanzanian children

(1) where it was reported that the occurrence of flush terminal plane is higher in Africans than in Caucasian children. The distal step of the primary second molar was found in 1.1% of the children. Bishara *et al.* (11) reported that all distal steps in the deciduous dentition develop to Class II tendency or full Class II molar relationship in the permanent dentition. Consequently it can be expected that the occurrence of the distal molar occlusion in the permanent dentition of children in Moshi will be correspondingly low.

The occurrence of increased maxillary overjet (5.1%) and anterior cross-bite (1.9%) were lower compared to those reported in Kenyan children of a similar age group (13%, and 5% respectively) (4). However, deep-bite was found in 21.5% of the present population. This was much higher than the 13% reported in Kenya (4). Although the prevalence of deep-bite can be expected to decrease somewhat from the deciduous to permanent dentition, this malocclusion trait needs to be monitored and if necessary intercepted beginning in the mixed dentition stage. Frontal open-bites occurred in 1.6% of the children. These findings were very low compared with those previously reported in Nairobi (12%), South Africa (10.3%) and Nigeria (5.3%) (4, 10, 12). Similarly these figures were low compared to previous findings (11%) in a group of Tanzanian and Finnish children (1). The differences in these studies are probably related to ethnic variation of this trait or differences in the prevalence of oral habits. Although the occurrence of the posterior cross-bite and scissor-bite was very low in this population (0.3%), these traits usually need mandatory interceptive orthodontic treatment. The rarity of these traits was comparable to those recorded in South Africa (10) as well as Nigeria (12).

Generally there was a low prevalence of spacing in the anterior segments in both jaws. Since spaced anterior segments in the deciduous dentition normally develop into non-crowded anterior segments in the permanent dentition (13), it is likely that many of these children will later exhibit a degree of crowding in the anterior segments in the permanent dentition. This would be aggravated by loss of deciduous molars due to caries and subsequent failure to carry out space management due to multiple reasons including scarcity of personnel.

Abnormal maxillary labial frenum, digital sucking, mouth breathing and lip sucking / biting were rare. Digital sucking has been reported to be rare amongst African children (14, 15). The mean intercanine arch width in the upper and lower jaws in the present population was higher and the prevalence of posterior cross-bite lower than the data reported for Caucasians (16). Oral habits such as digital sucking and pacifier use, which are relatively common in the developed countries, have been shown to reduce the transverse dimensions of the maxilla (16, 17). In the present study there was a very low prevalence of digit sucking and the use of pacifiers is very rare in Moshi. This may be one reason for the large number of children without disharmony in the transverse dimensions in this study. Although this study has shown a moderate overall prevalence of malocclusion, it is important to point out that most of the occlusal anomalies in the deciduous dentition often manifest as malocclusion in the permanent dentition. The findings, therefore, suggest a moderate burden for preventive and interceptive orthodontic treatment. Interceptive measures would likely include management of deep-bites, space and deleterious oral habits. However, seen against the lack of integrated community paediatric oral health care in Moshi, children with malocclusion or anticipated malocclusion that could otherwise benefit from preventive and interceptive orthodontic care will remain unattended.

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