

Occlusal characteristics in groups of Tanzanian and Finnish urban schoolchildren

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Occlusal characteristics and prevalence of occlusal anomalies vary in different populations and ethnic groups,¹⁻¹⁴ and differences have been found, especially with regard to the sagittal relationship of the dental arches and crowding of teeth.

In Africa, Garner and Butt¹¹ reported a very high prevalence (17%) of mesial bite among the Kikuyus in Kenya. Also in some groups of Nigerian and Kenyan children the prevalence of mesial occlusion has been found to be higher than in European children,^{2-6,9-10} whereas distal occlusion and crowding of the dentition have generally been reported to be more prevalent among Caucasian than among African children.^{2-7,9-12} However, variations in the diagnostic criteria and methods used in different studies distinctly decrease the reliability of comparisons between studies. Occlusion has been investigated among different ethnic groups using the same methods and criteria in only a few studies.¹⁵

Widespread orthodontic treatment in the industrialized countries has created methodological problems for epidemiological studies of malocclusion. In Africa, however, orthodontic treatment is extremely rare and variation in both occlusion and in prevalence of dentofacial anomalies can be studied. Comparable information about the prevalence of malocclusion in different ethnic groups is still needed, however, as well as information about occlusal variation in populations where orthodontic treatment has affected the original status of occlusion.

The objective of this study was to investigate occlusal characteristics and anomalies according to age, sex, ethnic origin and previous orthodontic treatment in groups of children and adolescents in Tanzania and Finland.

Materials and methods

The study was carried out in Dar es Salaam, Tanzania and in Hyvinkää, Finland. The Tan-

Abstract

The occurrence of different occlusal and space anomalies was studied in groups of 642 Tanzanian and 458 Finnish schoolchildren. Similar diagnostic criteria and methods were used in both countries. The Finnish children had significantly higher prevalences of distal occlusion and crowding and a lower prevalence of anterior openbite than the Tanzanian children. The proportion of subjects with no occlusal or space anomalies was considerably higher among the Tanzanians than among the Finns, 55% and 12% to 22%, respectively. The distinct differences found in occlusion of Tanzanian and Finnish children in this study seem to reflect differences in hereditary or environmental factors, which are expressed as craniofacial or dentoalveolar differences between these ethnic groups.

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Key Words

Occlusion • Malocclusion • Ethnic group

Table 1

Distribution of the Tanzanian and Finnish children and adolescents according to age, sex and ethnic group.

Age/yr	Tanzanian		Finnish pt*		Finnish	
	boys	girls	boys	girls	boys	girls
5-10	0	0	29	57	0	0
11	1	4	21	16	0	0
12	24	28	8	14	0	5
13	65	81	29	27	35	38
14	100	92	27	19	40	36
15	56	43	41	28	57	44
16	55	45	26	58	42	82
17	24	9	14	19	23	36
18	14	0	10	6	11	9
**	0	0	3	6	0	0
Total	339	302	208	250	208	250

*Finnish pt (pretreatment) = the Finnish group before treatment.

**Age unidentified due to missing pretreatment casts.

zanian sample consisted of 6th and 7th grade pupils from five primary schools in Dar es Salaam. All the children in those grades who were present at school during the days of the survey were examined, a total of 642 adolescents. The Finnish subjects were selected from all the junior high schools, two senior high schools and the trade school in Hyvinkää. One class for each age group from every school was examined for a total of 458 adolescents. In the Tanzanian group children and adolescents ranged in age from 11 to 18 years; the Finnish subjects were 12 to 18 years old. All the Finnish children were Caucasian. The Tanzanian children were primarily black Africans with a few children of Asian origin.

Previous orthodontic treatment:

None of the Tanzanian children had received orthodontic treatment while 162 individuals (35%) of the Finnish sample had undergone such treatment. Of the treated group, 10 persons (6%) were undergoing treatment with appliances at the time of the study, 19 (12%) had discontinued the treatment, 29 (18%) were in the retention stage and the remaining 64% had completed treatment. To evaluate the influence of orthodontic treatment in the Finnish sample, a pretreatment group of the same sample was created by replacing the clinical examination with an occlusal analysis of the pretreatment study casts of the treated subjects. The age for the treated subjects in the pretreatment group was recorded according to the subject's age when the casts had been made. Therefore the age

range in this group was 5 to 18 years. Pretreatment casts were not available for 14 of the subjects. In 9 of these cases information about the existence and treatment of the occlusal or space anomaly (cross-elastics, extraction of a single tooth without appliance treatment) was obtained from the annual dental recordings. These subjects were included in the pretreatment data only to the extent of the anomaly in question; the rest of the pretreatment occlusal characteristics were recorded as missing information. The remaining five subjects — those with no pretreatment diagnostic information — were excluded from the study.

In some cases, complete assessments were not possible from the study casts. Sagittal molar relationship was unclear in two cases, overjet in three cases, and overbite in 11 cases, primarily due to the eruptional stage of the reference teeth. Table 1 shows distribution of the subjects by age, sex and ethnic group, and presents the Finnish group both before treatment and at the time of the clinical examination. Those with a history of orthodontic treatment are also identified.

All clinical examinations, both in Tanzania and in Finland, were made by the same examiner (H.K.) using a mouth mirror and a periodontal probe with a mm-scale or ruler for measurements. In Tanzania the subjects were examined in natural daylight at schools while in Finland a dental unit was used for the examinations.

Because a detailed description of the criteria for recording individual occlusal traits and anomalies has been presented previously,¹³ the registration categories are outlined here only briefly: Sagittal (anteroposterior) molar relationship was registered from the first molars and graded into Class I, II and III.

Overjet (mm): 1 = reverse (negative) overjet; 2 = 0-4 mm; 3 = 5-8 mm; and 4 = >8 mm.

Overbite, recorded as overlap of the central incisors: 1 = no overlap = anterior openbite; 2 = overlap of half of the crown height of the antagonistic mandibular incisor or less; 3 = overlap of more than half but less than the total crown height of the mandibular incisor; 4 = total overlap of the incisors or mandibular incisors in contact with the palatal mucosa = deepbite.

Anterior crossbite: 0 = no; 1 = one or more of the maxillary incisors in crossbite with the antagonistic mandibular tooth.

Lateral crossbite: 0 = no; 1 = one lateral tooth from canine to second molar was in crossbite with the antagonist; 2 = two or more teeth in crossbite with the antagonists.

Scissors bite (complete buccoversion of maxillary posterior teeth): 0 = no; 1 = one or more premolars or molars in scissors bite with the antagonist.

Crowding was estimated separately for the anterior and posterior segments of the maxillary and mandibular arches. 0 = no crowding; 1 = mild (lack of space for less than half of the mesiodistal width of a tooth in a segment; 2 = moderate (lack of space for half or more of the width of one tooth, but less than one tooth); 3 = severe (lack of space for one tooth or more). Crowding was registered as being present if it was ≥ 1 mm and if it was recorded in at least one segment. The severity of crowding was determined according to the segment with the highest score.

Medial diastema: 0 = < 2 mm; 1 = 2-5 mm; 2 = > 5 mm.

Five percent of the Finnish and 7% of the Tanzanian subjects were still in late mixed dentition.

In the statistical analysis the z-test and chi-square test were used to examine differences in the prevalences of different occlusal anomalies between the sexes, ethnic groups and between the same Finnish children before orthodontic treatment and at the time of the clinical examination. The logistic regression model was used to analyze the effect of ethnic group on the probability of having a certain malocclusion, when age and sex were controlled. For each model, the study population was divided into two dichotomous groups (absent = 0, present = 1) according to each malocclusion trait studied. The category Ethnic Group was dichotomized as Finnish = 0 and Tanzanian = 1. Age was included as a continuous variable in the model. In the regression model, which included the pretreatment group, age was not reconstructed from the casts.

Results

Finnish pretreatment — Tanzanian

Tanzanian children had occlusion with no occlusal or space anomalies considerably more often than Finnish children did, 55% and 12%, respectively.

Distal molar occlusion (Table 2) was significantly ($p < 0.001$) more prevalent among Finnish than among Tanzanian children, who had more Class I sagittal molar relationships than Finnish children did ($p < 0.001$). Mesial molar relationship was rare in both groups.

Overall, there was little difference in the degree of overjet between these two ethnic groups (Table 3). Finnish boys had, however, an overjet

Table 2
Distribution of sagittal molar relationship in Tanzanian and Finnish children and adolescents.

Molar relationship	Tanzanian		Finnish pt*		Finnish	
	boys n=340	girls n=302	boys n=205	girls n=242	boys n=208	girls n=250
Class I	96	95	77	84	79	89
Class II	2	4	22	15	19	9
Class III	2	1	1	1	2	2

*Finnish pt (pretreatment) = the Finnish group before treatment.

Table 3
Distribution of overjet among Tanzanian and Finnish children and adolescents.

Overjet/mm	Tanzanian		Finnish pt*		Finnish	
	boys n=340	girls n=302	boys n=204	girls n=242	boys n=208	girls n=250
< 0	1	1	2	2	1	0
0-4	86	86	75	83	85	92
5-8	12	11	20	13	14	8
8	1	2	2	2	0	0

*Finnish pt (pretreatment) = the Finnish group before treatment.

of at least 5 mm ($p < 0.01$) more often than did Tanzanian boys or girls.

Concerning vertical relations (Table 4), Finnish children had a higher prevalence of deepbite, 11% and 2%, respectively ($p < 0.001$), and a lower prevalence of anterior openbite, 1% and 8%, respectively ($p < 0.001$), than did Tanzanian children. In the Finnish group, deepbite was observed significantly ($p < 0.05$) more often in boys than in girls.

Table 5 shows the prevalence of different

Table 4
Distribution of overbite in Tanzanian and Finnish children and adolescents.

Overbite**	Tanzanian		Finnish pt*		Finnish	
	boys n=340	girls n=302	boys n=200	girls n=238	boys n=208	girls n=250
	%	%	%	%	%	%
no overlap	9	8	2	2	1	0
≤half crown	78	81	44	59	51	65
>half crown	12	9	40	31	41	32
deep bite	1	2	14	8	7	3

*Finnish pt (pretreatment) = the Finnish group before treatment.

**Overbite measured as overlap of the central incisors.

Table 5
Frequencies of different occlusal and space anomalies among Tanzanian and Finnish children and adolescents.

Anomaly	Tanzanian n=642	Finnish pt*		Finnish n=458
	%	%	n	%
Anterior crossbite	4	8	447	3
Anterior openbite	8	1	446	1
Lateral crossbite				
one tooth in crossbite	2	6	453	4
more than one tooth	2	6	453	0
Scissors bite	2	3	449	4
Crowding				
mild	9	40	454	45
moderate-severe	6	23	454	10
Medial diastema				
2-5 mm	5	6	447	3
>5 mm	1	0	447	0

*Finnish pt (pretreatment) = the Finnish group before treatment.

occlusal and space anomalies. The occurrence of both anterior and lateral crossbites was significantly higher among Finnish than among Tanzanian children, $p<0.01$ and $p<0.001$, respectively.

Crowding was found to be the most common anomaly in both the Finnish and the Tanzanian groups (Table 5). However, there was a marked difference in the prevalence of crowding between these groups, 63% and 15%, respectively. About two-thirds of the crowding in both ethnic groups was mild. Mild crowding was more prevalent in the older age groups in the Finnish sample (Table 6); moderate-to-severe crowding was more prevalent among the younger age groups in the Tanzanian sample.

Children in the Finnish group (Table 7) were more likely to have distal occlusion, anterior crossbite, lateral crossbite and crowding, and were less likely to have anterior openbite than children in the Tanzanian group, when age and sex were controlled.

Finnish (including orthodontic treatment) — Tanzanians

The differences between Tanzanian and Finnish children and adolescents were significant for distal occlusion ($p<0.001$), deep overbite ($p<0.01$), anterior openbite ($p<0.001$) and crowding ($p<0.001$) (Tables 2, 4 and 5). The prevalence of anterior and lateral crossbite and overjet of ≥ 5 mm, did not differ between ethnic groups. In the Finnish group, distal bite and crowding were more common, while anterior openbite was less common than in the Tanzanian group, when age and sex were controlled (Table 7).

Finnish pretreatment — Finnish (including orthodontic treatment)

Distal bite (Table 2), overjet of ≥ 5 mm (Table 3), deep overbite (Table 4), anterior and lateral crossbite, and moderate-to-severe crowding (Table 5) all occurred more often in the Finnish children before treatment than after orthodontic treatment. With regard to mesial occlusion, anterior openbite and scissors bite, no difference was found between the pretreatment group and the group including orthodontic treatment. With treatment, the proportion of children with occlusal or space anomalies decreased from 88% to 78%.

Discussion

The Finnish children in the present sample had been entitled to organized orthodontic care, while none of the Tanzanian children received any kind of orthodontic treatment. Therefore, it was necessary to take previous orthodontic treatment into account when comparing the prevalence of different occlusal characteristics.

In previous studies^{2,7,16} various procedures have been used to adjust the material to correspond to the natural state of occlusion. In most of these studies, however, orthodontic treatment has been carried out only occasionally. For Finnish children in this study, orthodontic treatment has been a part of public dental health care, which makes the proportion of treated subjects considerably larger, i.e. one-third of the subjects. In subjects with orthodontic treatment, determining the pretreatment occlusion from casts and using that information in the analyses instead of using the present occlusal situation provides reliable information about malocclusion prevalences. However, this practice biases the age structure in the material by over-representing the treated subjects in the lowest age group: anomalies exist only until the time diagnosis and treatment are started. Therefore, prevalences in different age groups are comparable and real only with regard to anomalies which, like mild crowding, have not belonged in the scope of orthodontic treatment.

Most of the Tanzanian children in this study had a neutral sagittal relationship of the dental arches. The higher prevalence of distal occlusion in Finnish children compared to Tanzanian children confirms the difference found by comparing various African and European studies.^{2-7,9-12} The reported prevalences of distal occlusion in different European studies, including this study, are mainly in agreement with each other,^{2-5,7,16} while in previous African studies^{6,9,11-12} larger variations were found in the prevalence of distal occlusion. In this study the prevalence of mesial occlusion was low in both ethnic groups. This finding contradicts many previous reports in which mesial occlusion has been reported to be higher in Africans than in Caucasians.^{3-6,9-11} A low prevalence of mesial occlusion in Africa has also been reported by Aggarwal & Odysanya for Nigerian children.¹² The diagnostic criteria vary considerably between Scandinavian and African studies, and also between different African studies, which often include only a rough description of the criteria used. Therefore, this type of approach does not provide a proper basis of comparison, even if general trends seem evident. The present study design with the same criteria and similar conduct of the study in both countries allows better premises for finding real occlusal differences between the groups. However, the method of evaluating sagittal molar relationship in this study might slightly under-evaluate the prevalence of Class II and Class III cases in comparison with other studies. The higher occurrence

Table 6
Distribution of crowding according to age
among Tanzanian and Finnish children and adolescents.

Crowding	Age								
	11-13 years			14-15 years			16-18 years		
	TZ %	F pt %	F %	TZ %	F pt %	F %	TZ %	F pt %	F %
no	82	31	54	84	50	54	91	33	34
mild	7	34	35	11	39	38	7	56	55
moderate	8	19	8	3	9	7	2	11	11
severe	1	16	4	1	2	1	0	1	1

TZ = Tanzanian, F pt = Finnish pretreatment, F = Finnish

of distal occlusion found in Caucasians compared with Africans seems, in any case, to point to structural differences in the sagittal jaw relationships between these ethnic groups.¹⁷

Overbite patterns were distributed differently in the Tanzanian and Finnish children. Eighty to ninety percent of the Tanzanian children had small overbites while the Finnish children tended to have deepbites. These findings are supported by previous reports from Nigeria showing that Africans tend to have smaller overbites than Caucasians.^{2,6-7,9} This seems to reflect the differences found in certain craniofacial and dento-alveolar structures, including greater lower facial height and mandibular plane inclination among Africans.¹⁸⁻¹⁹

In this study the prevalence of lateral crossbite in Finnish children agreed with recent Finnish^{16,20-21} and other Scandinavian reports.^{2,5,7} The difference in the prevalence of that anomaly between the two ethnic groups studied here also agrees with previous African and Scandinavian reports,^{2,5-7,12} indicating a relatively uniform interpretation of the diagnosis of lateral crossbite.

The total prevalence of crowding among Finnish children in this study was distinctly higher than that previously reported in Scandinavian countries.^{2,4-5,7,20} This difference can, to some extent, be explained by the strict definition of crowding used in this study, in which mild (even 1 mm) cases were counted. However, great differences in the frequency of both mild and moderate-to-severe crowding between the two

Table 7
Odds ratios (OD) and 95% confidence intervals (CI) for Finnish children and adolescents (compared to Tanzanians) for different occlusal and space anomalies.
In all tests age and sex were controlled.

Anomaly	Finnish pt*				Finnish			
	OD	CI		prob.	OD	CI		prob.
Distal bite	7.6	4.5	12.9	***	5.4	3.1	9.3	***
Anterior crossbite	2.0	1.2	3.4	**	0.8	0.4	1.5	n.s.
Lateral crossbite	3.1	1.9	5.1	***	1.0	0.5	1.8	n.s.
Scissors bite	1.5	0.7	3.2	n.s.	1.8	0.8	3.7	n.s.
Deep bite	1.5	1.0	2.3	n.s.	0.6	0.3	1.0	n.s.
Anterior openbite	0.2	0.1	0.4	***	0.1	0.0	0.2	***
Crowding	10.1	3.2	13.7	***	6.8	5.2	9.2	***

*Finnish pt (pretreatment) = Finnish group before orthodontic treatment.

ethnic groups are well demonstrated in this study. Different trends in the manifestation of mild crowding with age can also be seen. However, the analysis by age of the Finnish group is severely biased, because orthodontic treatment decreases prevalence of moderate-to-severe crowding in the oldest age groups.

The small proportion of Finnish children with no occlusal or space anomalies, in spite of orthodontic treatment, seems somewhat surprising, especially when compared to the pretreatment group. The Finnish group, however, also in-

cluded subjects who were undergoing treatment at the time of the study and subjects who had either refused or discontinued treatment. The small number of Finnish children with no occlusal or space anomalies can probably be explained in terms of mild crowding, which was included as an anomaly in the assessments. This disorder alone, which is too mild for treatment, markedly increases the total prevalence of anomalies in both Finnish groups.

The present results indicate that Finnish children, even when entitled to organized ortho-

dontic treatment, have distinctly more occlusal and space anomalies than their Tanzanian counterparts of the same age. In addition, the distinct differences in the prevalence of distal bite and crowding as well as the variation of vertical incisal occlusion seem to reflect some hereditary or environmental factors which are expressed as skeletal or dentoalveolar differences between the two ethnic groups.

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