The prevalence of malocclusion in 13- to 15-year-old children in Nairobi, Kenya

Peter M. Ng'ang'a, Florence Ohito, Bjørn Øgaard and Jakob Valderhaug
Department of Pediatric Dentistry and Orthodontics, University of Nairobi Dental School, Nairobi, Kenya, and Department of Orthodontics and Department of Prosthetic Dentistry and Stomatognathic Physiology, University of Oslo Dental Faculty, Oslo, Norway

Ng'ang'a PM, Ohito F, Øgaard B, Valderhaug J. The prevalence of malocclusion in 13- to 15-year-old children in Nairobi, Kenya. Acta Odontol Scand 1996;54:126–130. Oslo. ISSN 0001–6357.

Data on occlusal features and the need for orthodontic treatment in Kenya is scanty. This study was carried out to determine the prevalence of malocclusion in children in Nairobi, Kenya. Nine hundred and nineteen children aged 13–15 years (468 male, 451 female) were examined. The registration method used was that described by Björk et al. The prevalence of malocclusion was 72%. The predominant anteroposterior relationship of the dental arches was neutral occlusion (93%). Specific malocclusion traits were highest for crowding (19%), rotations (19%), posterior crossbite (10%), maxillary overjet (10%), and frontal open bite (8%). There was no statistically significant difference in the overall prevalence of malocclusion between males and females, but some occlusal traits were significantly higher in males. Although the findings indicate that the present population is not characterized by a substantial difference in the overall prevalence of malocclusion compared with other communities, some traits differed in prevalence from those reported elsewhere. □ *Dental occlusion; epidemiology; orthodontics; tooth crowding*

Bjørn Øgaard, University of Oslo Dental Faculty, Department of Orthodontics, P.O. Box 1109 Blindern, N-0317 Oslo, Norway

Knowledge about the prevalence of different types of malocclusion and the need for orthodontic treatment is important for planning an orthodontic service and is essential in assessing the resources required (1, 2). In Kenya, relatively few reports have been published on the occurrence of malocclusion (3–6), and the data vary from one study to another.

Kapila (3) examined 417 children of African descent aged 3–20 years in Nairobi. The prevalence of malocclusion was reported as 39%. In a sample of 251 Nairobi children aged 13–15 years, Ng'ang'a (5) found a malocclusion prevalence of 47%. The prevalence of crowding was given as 25%; anterior open bite, 10%; maxillary overjet, 23%; traumatic bite, 1%; and rotation of incisors, 4%. In a study on 505 children from Nyeri, a town approximately 150 km from Nairobi, Garner & Butt (4) found 78% of the sample with neutral, 7% with distal molar, and 16% with mesial molar occlusion. The overall value for the prevalence of malocclusion was not specified. In another investigation in Mandera, a town approximately 1000 km from Nairobi, Ng'ang'a et al. (6) examined 245 children aged 12–18 years. The prevalence of malocclusion was 58%, with 84% of the study population showing neutral occlusion, 11% distal molar occlusion, and 5% mesial molar occlusion. Anterior open bite was diagnosed in 18%, and crowding in both jaws in 16% of the sample.

In view of the wide differences in the age ranges of some of the study populations, the subjectivity of the criteria used in diagnosing the occlusal anomalies, the relatively small samples, and the few occlusal traits investigated, it is doubtful whether the occurrence of malocclusion was adequately investigated in any one of the study groups examined. Furthermore, because of these shortcomings, it is difficult to compare strictly the reported data or to relate them meaningfully to the findings of other workers elsewhere in the world. Of immediate concern, however, is that the information in the Kenyan studies seems insufficient for purposes of planning an organized orthodontic service, which at the moment is virtually non-existent in the country.

The purpose of the present study was, therefore, to investigate the prevalence of malocclusion in 13- to 15-year-old children in Nairobi.

Subjects and methods

This study was carried out in 1992. To obtain a representative sample of children in the public primary schools in Nairobi, six schools from the five different geographic/administrative divisions (that is, Eastern, Western, Southern, Northern, and Central) were randomly selected from a list of the 174 schools in the city. The Northern division contributed two schools because of the higher number of schools in the division.

To obtain a sufficient sample and to satisfy the requirement that all children examined be in dental stage DS4 M2 (that is, permanent canines, premolars, and second molars erupted), the children in grades 7 and 8 (13–15 years) were examined. Those who had undergone or were undergoing orthodontic treatment (43 children) were excluded. In total, 919 children were examined. The sample represented about 5% of 13- to

Table 1. Prevalence of malocclusion features in 919 children (468 male, 451 female) aged 13–15 years in Nairobi, Kenya (criteria in accordance with Björk et al. (1))

Malocclusion features	No. M	No. F	Total	%	*P* (chi-square)
Dentitional anomalies					
Inversion maxillary incisors (three or fewer incisors)	34	19	53	6	*
Aplasia/impacted	16	12	28	3	NS
Transposition	1	2	3	0.3	NS
Supernumerary	2	0	2	0.2	NS
Rotated (estimated >15°)	104	79	183	19	NS
Malformed	11	7	18	1.9	NS
Occlusal anomalies					
Distal molar occlusion (≥ half cusp width)	28	27	55	6	NS
Mesial molar occlusion (≥ half cusp width)	9	2	11	1	*
Maxillary overjet (≥6 mm)	63	34	97	10	†
Mandibular overjet (>0 mm)	0	0	0	0	—
Deep bite (≥5 mm)	43	27	70	7	NS
Frontal open bite (>0 mm)	35	43	78	8	NS
Lateral open bite	7	6	13		NS
Crossbite	60	36	96	10	*
Scissors bite	28	24	52	5	NS
Space anomalies					
Lack of space (maxilla ≥ 2 mm)	107	94	201	21	NS
Lack of space (mandible ≥ 2 mm)	102	68	170	18	‡
Excess of space (maxilla ≥ 2 mm)	98	63	161	17	†
Excess of space (mandible ≥ 2 mm)	61	62	123	13	NS
Other findings					
Maxillary median diastema (≥2 mm)	71	67	138	15	NS
Abnormal maxillary labial frenum	0	1	1	0.1	NS
Midline displacement (maxilla and mandible) (≥2 mm)	92	80	172	18	NS
Sagittal forced bite	9	3	12	1	NS
Transverse forced bite (≥2 mm)	0	1	1	0.1	NS

Statistical differences between males (M) and females (F): *$P < 0.05$, M > F; †$P < 0.01$, M > F; ‡$P < 0.001$, M > F; NS = not significant.

15-year-old children in public primary school in Nairobi.

The mean age of the children was 14.1 years. A few children in grade 7 were between 12.5 and 12.9 years, and these were grouped in the 13-year-old age group. Those between 15.1 and 15.5 years in grade 8 were grouped in the 15-year age group.

The clinical examination was carried out in a room with natural daylight, with the children sitting on a table/chair next to a window. Disposable dental mouth mirrors and ordinary plastic rulers were used in the examination.

The diagnosis of malocclusion followed the criteria of Björk et al. (1). Two calibrated dentists (Ng'ang'a and Ohito) carried out the examination. The need for orthodontic treatment was also assessed, and this subject is dealt with in a separate paper (7). A chi-square test was applied to test for significant differences between males and females.

Results

Forty-three children (4%) had undergone or were undergoing orthodontic treatment. These were excluded from the examination.

Of the 919 children examined 72% had some form of occlusal anomaly. There was no significant sex difference in the overall prevalence of malocclusion. However, a few occlusal traits occurred significantly more commonly in males than in females. Table 1 shows the different malocclusion features in the children and the statistical differences between the genders.

Dentitional anomalies

Rotations accounted for the largest proportion of dentitional anomalies (19%), followed by inversion of maxillary incisors (6%). Malformations accounted for 1.9%. Transposition and supernumerary teeth occurred in less than 1% of the children.

Occlusal anomalies

The frequency of crossbite and frontal open bite was 10% and 8%, respectively. Increased maxillary overjet was observed in 10% of the sample. No mandibular overjet was encountered. There were more distal molar (6%) than mesial molar (1%) occlusions.

Table 2. A comparison of the prevalence of malocclusion features in the present study with previous reports on the basis of Björk's criteria.

	Present study, Nairobi, Kenya; age, 13–15 years; n = 919 %	Al-Emram et al. (25), Riyadh, Saudi Arabia (males only); age, 14 years; n = 500 %	Affan (14), Khartoum, Sudan; age, 12 years; n = 635 %	Thilander & Myrberg (18), Umeå, Sweden; age, 13 years; n = 5459 %
Overall prevalence of maloccl.	72	62.4	—	73.8
Dentitional anomalies				
Inversion max. incisors	6	3.8	—	11.1
Transposition	0.3	0.8	0	0.2
Supernumerary	0.2	—	0.9	1.1
Malformed	1.9	—	2.1	0.7
Occlusal anomalies				
Distomolar occlusion	6	16.4	11.3	14.1
Mesial molar occlusion	1	3	3.5	4.2
Max. overjet (≥6 mm)	10	(≥5 mm) 18.4	(≥5 mm) 5.7	8
Mand. overjet (≥0 mm)	0	3.2	2.7	—
Deep bite (≥ 5 mm)	7	3.6	3.3	8.4
Anterior open bite (≥0 mm)	8	6.6	2	3.6
Lateral open bite (≥0 mm)	1	0.6	—	0.2
Crossbite	10	7.2	1.9	10.7
Scissors bite	5	3.2	0.4	2
Space anomalies				
Lack of space (≥2 mm)	19	23	8.5	26.3
Excess of space (≥2 mm)	14	17	17	8.6
Other findings				
Max. median diastema (≥2 mm)	15	3.6	8.5	5
Abnormal max. labial frenum	0.1	0.4	0.2	—
Midline displacement	18	12.6	10	—
Sagittal forced bite	1	—	1.7	—
Transverse forced bite (≥2 mm)	0.1	—	1.1	—

Space anomalies

Both lack of space and excess of space of ≥2 mm were encountered more frequently in the maxilla than in the mandible. In general, however, lack of space was the commoner finding.

Other findings

The combined value for prevalence of dental midline shift in both jaws was 18%. A median diastema was observed in 15% of the children. Other deviations found in very few cases were sagittal forced bite, transverse forced bite, and high labial frenum.

Table 2 compares the prevalence of malocclusion features in the present study with previous reports carried out using Björk's criteria (1).

Discussion

The prevalence of malocclusion varies from country to country and among races; the data reported in different studies may differ widely (8, 9). This investigation found a prevalence of 72% with no gender difference. Previously, the prevalence of malocclusion in 13- to 15-year-old children in Nairobi has been reported to be 47% (5). Strictly speaking, the findings in studies done in this city are difficult to compare, essentially because of the different criteria applied to evaluate malocclusion and the variation in sample sizes. In particular, it is noteworthy that in the present study, many relatively small anomalies were recorded.

No radiographs or study casts were used in our investigation. It is likely, therefore, that the prevalence of some of the anomalies may have been either over- or under-estimated. Helm (10) and Heikinheimo (11) have shown that records made on the basis of casts seem to give a higher prevalence of deviations than does direct recording. Nevertheless, given the size and the selection criteria in this study, the findings give a reasonably accurate indication of the occurrence of malocclusion in 13- to 15-year-old children in Nairobi.

The predominant anteroposterior relationship of the dental arches was neutral occlusion, which is the common finding elsewhere in the world. Distal molar occlusion was within the range (1%–14%) reported by other researchers in Africa (12–14) but is much lower than data from Caucasian studies (15–18), which range between 12% and 20%. One explanation for the differences in distal molar relationship could be the higher prevalence of sucking habits in the Caucasian population (19). A postnormal or unilateral postnormal relationship is frequently associated with prolonged finger-sucking habit (20). However, posterior cross-bite is also a common finding among finger-suckers. The

prevalence of posterior cross-bite was not higher in the present population than in Caucasians. This may indicate that the difference in distal molar relationship is not due to differences in sucking habits. The prevalence of mesial molar occlusion in Caucasian children ranges between 1% and 4% (15, 16, 18). The present study found a prevalence of 1%. Hence, our data were at variance with the general view in the literature that mesial molar occlusion is commoner among Africans than Caucasians (12, 21). Moreover, our study demonstrated that the prevalence of increased maxillary overjet in Nairobi was comparable to that of Swedish children (Table 2). Males had a significantly higher ($p < 0.01$) prevalence of increased overjets than females.

We found a significantly higher ($p < 0.01$) prevalence of crowding in the mandible in males than females. In general, our findings suggested a lower prevalence of crowding in Kenyan than in European children (18, 22). Spacing was found more frequently in the maxilla than in the mandible, and males had a significantly higher ($p < 0.01$) prevalence of the trait in the maxilla than females.

The prevalence of deep overbite, anterior open bite, lateral open bite, crossbite, and scissors bite was higher than those reported in Sudan (14), where Björk's criteria (1) were applied. With the exception of the prevalence of anterior open bite and scissors bite, which were higher in Kenyan children, the data for deep overbite, lateral open bite, and crossbite were similar to those of Swedish children (Table 2).

Dentitional anomalies were mainly in the form of rotations (19%) and inversion of maxillary incisors (6%). Most of the rotations were observed in the posterior segments and were probably a consequence of early loss of deciduous molars (23). Even though the prevalence of dental caries among children in Nairobi is relatively low, more decayed teeth are extracted than are currently filled (24).

Deviation in tooth anatomy is reported as between 0.3% and 2% (14, 17, 18). Our findings were within this range.

Transposition and supernumerary teeth occurred in less than 1% of the sample, whereas aplasia/impacted teeth were noted in 3% of the children. Obviously, it is likely that our findings were underestimated since no radiographs were taken. A low prevalence of transposed and supernumerary teeth have been observed in other communities (14, 18, 21). Elsewhere, the frequency of congenitally missing teeth (except third molars) is reported to be between 3.4% and 8% (18, 25, 27).

The present population had a high prevalence of midline shift (18% in both jaws) and median diastema (14%) but manifested a low prevalence of sagittal forced bite, transverse forced bite, and high labial frenum. Severe malformations such as cleft lip and palate and facial asymmetry were not observed, but they are encountered occasionally in clinical practice.

The present population was not characterized by a substantial difference in the overall prevalence of malocclusion when compared with other communities. Although the frequency of some occlusal anomalies was notably different from those reported in some other African countries and among Caucasians, it may be concluded that Björk's classification may well be applied to the east African population.

Acknowledgements.—We thank the office of the President, the Nairobi City Education Office, and the headmasters of the schools for permission to carry out the study, and the children for happily agreeing to participate. We also thank Mrs. Donna Pettersen of the University of Oslo, Faculty of Dentistry, for her assistance in data entry of the field results and transcription of the completed manuscript.

References

1. Björk A, Krebs AS, Solow B. A method for epidemiologic registration of malocclusion. Acta Odontol Scand 1964;22: 27–41.
2. Foster TD, Menezes DM. The assessment of occlusal features for public health planning purposes. Am J Orthod 1976;69:83–9.
3. Kapila S. Distribution of malocclusion in African and Asian children in some Nairobi schools. Odont Stomat Trop 1983;6: 209–14.
4. Garner LD, Butt MH. Malocclusion in black Americans and Nyeri Kenyans. An epidemiologic study. Angle Orthod 1985;55: 139–46.
5. Ng'ang'a PM. A study of occlusal anomalies and tooth loss in children aged 13–15 years in Nairobi. E Afr Med J 1991;68: 980–8.
6. Ng'ang'a PM, Karongo PK, Chindia ML, Valderhaug J. Dental caries, malocclusion and fractured incisors in children from a pastoral community in Kenya. E Afr Med J 1993;70:175–8.
7. Ng'ang'a PM, Stenvik A, Ohito F, Øgaard B. The need for orthodontic treatment in 13–15 year-olds in Nairobi, Kenya. Acta Odontol Scand 1996;54. In press.
8. Ast DB, Carlos JP, Cons NC. The prevalence and characteristics of malocclusion among senior high school students in upstate New York. Am J Orthod 1965;51:437–55.
9. Emrich RE, Brodie AG, Blayney JR. Prevalence of class I, class II and class III malocclusion (ANGLE) in and urban population. An epidemiological study. J Dent Res 1965;44:947–53.
10. Helm S. Prevalence of malocclusion in relation to development of the dentition [thesis]. Copenhagen: University of Copenhagen, 1970.
11. Heikinheimo K. Need of orthodontic treatment in 7-year-old Finnish children. Community Dent Oral Epidemiol 1978;6: 129–34.
12. Hirschowitz AS, Rahid S, Cleaton PE. Dental caries, gingival health and malocclusion in 12-year-old urban Black school children from Soweto, Johannesburg. Community Dent Oral Epidemiol 1981;9:87–90.
13. Isiekwe MC. Malocclusion in Lagos, Nigeria. Community Dent Oral Epidemiol 1983;11:59–62.
14. Affan AHA. Malocclusion and dental development in 12-year-old Sudanese children from the Khartoum area [thesis]. Bergen: University of Bergen, 1987.
15. Björk A. The face in profile. Sv Tandlakaretidskr 1947;40 Suppl 5B.
16. Goose DH, Thompson DG, Winter FC. Malocclusion in school children of the West Midlands. Br Dent J 1957;102:174–8.
17. Helm S. Malocclusion in Danish children with adolescent dentition. An epidemiologic study. Am J Orthod 1968;54:352–6.

18. Thilander B, Myrberg N. The prevalence of malocclusion in Swedish school children. Scand J Dent Res 1973;81:12–20.
19. Larsson EF, Dahlin KG. The prevalence and the etiology of the initial dummy- and finger-sucking habit. Am J Orthod 1985;87: 432–5.
20. Larsson E. The effect of finger-sucking on the occlusion: a review. Eur J Orthod 1987;9:279–82.
21. Richardson A, Ana JR. Occlusion and malocclusion in Lagos. J Dent 1973;1:134–9.
22. Foster TD, Day AJM. A survey of malocclusion and the need for orthodontic treatment in a Shropshire school population. Br J Orthod 1974;1:73–8.
23. Houston WJB. Local dental irregularities. In: A textbook of orthodontics. Bristol: Wright, 1986:121–63.
24. Ng'ang'a PM, Valderhaug J. Dental caries in primary school children in Nairobi, Kenya. Acta Odontol Scand 1992;50: 269–72.
25. Al-Emran S, Wisth PJ, Boe OE. Prevalence of malocclusion and need for orthodontic treatment in Saudi Arabia. Community Dent Oral Epidemiol 1974;18:253–5.
26. Wisth PJ, Thunold K, Boe OE. Frequency of hypodontia in relation to tooth size and dental arch width. Acta Odontol Scand 1974;32:201–6.
27. Aasheim B, Ögaard B. Hypodontia in 9-year-old Norwegians related to need of orthodontic treatment. Scand J Dent Res 1993;101:257–60.

Received for publication 20 June 1995
Accepted 29 August 1995