The epidemiology of malocclusion in Zambian urban school children

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SUMMARY

This survey was undertaken to determine the occlusal status of a selected group of urban Zambian Black 9-12 year old children at 5 different schools in the same geographical area in order to determine their need for orthodontic treatment. The examination criteria of the Occlusal Index of Summers (1966) were used. Six hundred and one children who had not previously received orthodontic treatment were examined. The data were analysed statistically by using the calculated Summers Index. The results showed that 83 per cent of the subjects required no orthodontic treatment. Of the 17 per cent who did require orthodontic treatment, 5.2 per cent needed specialized treatment. The malocclusion status of Black Zambian children is very similar to that recorded in epidemiological studies on South African and Swazi Black children. This study indicates that only a small need exists for orthodontic treatment amongst Black Zambian children.

OPSOMMING

Hierdie opname is onderneem om die okklusale status van 'n gekose groep stedelike Zambiese Swart kinders van 9-12 jaar ouderdom, vanuit 5 skole in dieselfde geografiese area, te bepaal sodat hulle behoefte vir ortodontiese behandeling bepaal kan word. Die ondersoek kriteria van die Occlusal Index of Summers (1966) is gebruik. Ses honderd en een kinders wat nie voorheen ortodontiese behandeling ontvang het nie, het aan die ondersoek deelgeneem. Die data is statisties deur gebruik van die Summers Index ontleed. Die resultate toon dat 83 per sent van die kinders geen ortodontiese behandeling benodig nie. Van die 17 per sent wat wel ortodontiese behandeling nodig het, het 5.2 per sent gespesialiseerde behandeling nodig. Die wansluiting status van Swart Zambiese kinders is soortgelyk aan die bevindings in epidemiologiese studies op Suid-Afrikaanse en Swazi Swart kinders. Hierdie studie toon dat daar slegs 'n geringe behoefte vir ortodontiese behandeling onder Swart Zambiese Kinder is.

INTRODUCTION

A public health service is one of the initiatives organized by society to protect, promote and restore the health of the people (Last, 1988). In Public Dental Services for children, the need for orthodontic treatment is determined by the early recognition and diagnosis of occlusal anomalies during the development of the individual child, and a decision is made regarding provision of treatment (Helm, 1977). Hence, objective criteria are required to assess each case and grade its severity.

Developing communities such as the South African blacks (Jacobson, 1967; De Mûelenaere and Viljoen, 1987; De Mûuelenaere, Wiltshire and Viljoen, 1992, Volschenk et al, 1993) the Chippewa Indians (Grewe et al, 1968), the Melanesians (Lombardi and Baillit, 1972) and the Polynesians (Baume, 1974) exhibit a low prevalence of malocclusion. The majority of children in developed communities, however, demonstrate dental irregularity of varying degrees. Over the years a number of surveys have been undertaken to establish the prevalence of malocclusion in different developed or first world population groups. The reported prevalence has varied between 59 per cent and 99 per cent, emphasizing the importance of undertaking epidemiological surveys in different communities in order to develop a strategy for the provision of treatment for each specific community. Although several studies investigated the prevalence of malocclusion in various ethnic groups in different parts of Africa (Table I), to date no data are available for Zambia.

Quantitative assessment of the severity of malocclusion is a problem in orthodontics, particularly in epidemiological surveys. The committee responsible for the coordination of oral health studies in the Republic of South Africa (Working group for the Co-ordination of Oral Health Studies, 1985), recommended that the Occlusal Index of Summers (1966) be used for scoring

occlusal abnormalities in epidemiological surveys. The Occlusal Index (O.I.) system comprises 3 divisions and 7 syndromes. Divisions I,II and III, coincide with the classes of malocclusion described by Angle (1907). These are normal molar occlusion (Division I), distal molar occlusion (Division II) and mesial molar occlusion (Division III). Summers (1966) subdivided the three Divisions into seven descriptive Syndromes (Table II), and introduced, the Occlusal Index scoring device to quantify the severity of malocclusion (Table III). Furthermore, Summers (1966) used these O.I. scores to derive five classes, thus ranking malocclusion in severity and treatment need. Scores range from 0,0 (ideal occlusion) to 16.0 (worst occlusion), (Table III).The personnel at of the South African Medical Research Council, Pretoria, conducted the statistical analyses. The Statistical Analysis System (SAS) of the University of North Carolina (1985) was used for analyzing the data and for obtaining frequency distributions and percentages.

The purpose of this study was to determine the occlusal status and the orthodontic treatment needs of an urban community in Zambia and to compare the data obtained with those of similar studies elsewhere in Africa.

MATERIALS AND METHODS
Permission to undertake the survey was obtained from the Departments of Health and of Education in Zambia. Written consent was obtained from parents or guardians prior to examination of the children.

Table II: *Divisions and Syndromes incorporated in the Occlusal Index system of Summers (1966)*

Division I (Normal molar relation) and Division II (distal molar relation):

Syndrome A	Overjet and openbite
Syndrome B	Distal molar relation, overjet, overbite, posterior crossbite, midline diastema and midline deviation
Syndrome C	Congenitally missing incisors
Syndrome D	Potential tooth displacement
Syndrome E	Posterior openbite

Division III (Mesial molar relation)

Syndrome F	Mesial molar relation, overjet, overbite, posterior crossbite, midline diastema and midline deviation
Syndrome G	Mixed dentition analysis and tooth displacement

Table III: *The five classes of Summers Occlusal Index describing the severity of malocclusion (O.I. score)*

Class	O.I. score	Occlusal status
I	0,00–2,5	Good occlusion
II	2, 6–4,5	Slight malocclusion (No treatment needed)
III	4, 6–7, 0	Minor treatment needed (Removable appliances)
IV	7, 1–11, 0	Comprehensive treatment needed (Fixed appliances)
V	11, 1-16, 0	Worst malocclusion (Fixed appliances)

Table I: *The prevalence of malocclusion in some African countries*

Researchers	Country	Sample Size (n)	Percentage Age (yr.)	Normal	C1 I	C1 II	C1 III
Jacobson (1967)	South Africa	460	Adult		*F 97.4 **M 96.4+	F 2.6 M 2.7	– M 0.7
Hirschowitz, Rashid & Cleaton Jones (1981)	South Africa	402	12	89	8.7	1.2	1.1
Richardson & Ana (1973)	Nigeria	300	6_22		82+	10	8.5
Isiekwe (1993)	Nigeria	617	10–19		76.8+	14.7	8.4
Lundstrom & Lundstrom (1969)	Egypt	318	6–18	29	60	7	4
El-Hadary & Aboul-Azm (1977)	Egypt	600	Adult	36.2	52	8.17	3.67
Gardiner (1982)	Libya	479	10–12		77+	18	5
Kerosuo, et al (1988)	Tanzania	642	11-18		96+	3	1
Garner & Butt	Kenya	505	10–12		68.5+	7	16.8
Abu-Affan, Wisth & Boe (1990)	Sudan	635	12		77.6+	11	3.1

*Female
**Male
+Class I Occlusion was taken to include both "normal" and Angle Class I malocclusion

Six hundred and one Black Zambian school children in the age group of 9-12 years were examined. Five schools situated in the urban areas of Choma, Zambia were visited. They are the only schools in the district. Choma is the largest district in the Zambian southern province, with a population of over 100 000, and is an urban area with an embattled economy due to the depression in the copper trade industry which affects the socio-economic profile of all Zambians. It was chosen for geographical and logistical reasons. The sample of children may have been living in the urban area of Choma all their lives or, may have come from the surrounding rural area. A large shift in the population towards urbanized areas has taken place. The examinations were done by two senior postgraduate orthodontic students, using a mouth mirror, probe, Vernier gauge caliper and a gauge for measuring angles of rotated teeth according to the method described by Summers (1966). The observations made and the information obtained were recorded by a Zambian dental assistant who did not take part in the examination.

In order to assess inter- and intra-observer variability, repeat examinations were performed on sixty randomly selected subjects (10 per cent of the total sample). Both examiners achieved the desired 80 per cent degree of reliability during the survey. Prior to the field survey, the examiners were correlated for the examination on two separate occasions using fifty sets of models.

RESULTS
The chronological age of the subjects in the sample examined varied from 9 to 12 years. Fifty eight per cent of the subjects were in the mixed dentition stage of development and were of the dental age IV (which begins when all permanent central and lateral incisors and first molars are in occlusion and ends with the eruption of any permanent canine or premolar) or V (which begins with the eruption of any permanent canine or premolar and ends when all the of them are in occlusion). Forty two per cent of the children were of dental age VI (which begins when all permanent canines and bicuspids are in occlusion). Sex distribution amongst the subjects was 53.2 per cent females and 46.8 per cent males.

Table IV: *Distribution of O.I. scores in relation to dental age*

Dental age	Frequency	Mean OI Score	Std Deviation
Mixed IV	70	1.66	1.71
Late Mixed V	255	1.85	2.30
Permanent VI	276	2.53	2.62

The distribution of the O.I. scores of the sample related to dental age is shown in Table IV. The percentage distribution of the five Classes of Summers Index (Fig 1) indicates that 83.2 per cent of the children examined (65.9 per cent and 17.3 per cent) fell into the first two Classes that required no orthodontic treatment. The remaining 16.8 per cent (11.6 per cent plus 5.2 per cent) did require treatment and of these, 5.2 per cent required treatment of a specialized nature with fixed appliances.
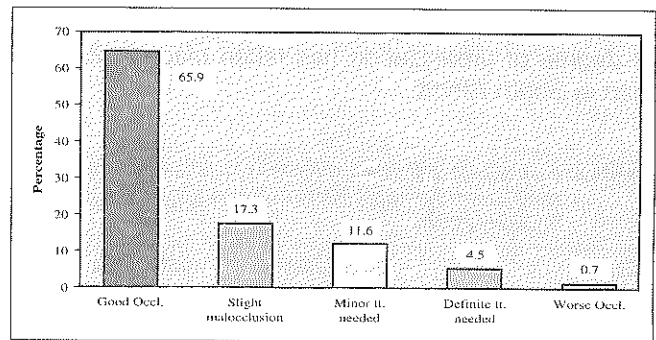

Fig 1: **Distribution of O.I. Classes in the sample of Zambian schoolchildren**

Syndrome B (distal molar relation, overjet, overbite, posterior crossbite, midline diastema and midline deviation) showed the highest incidence (67 per cent of the total sample) followed by Syndrome D (tooth displacement due to space shortage) with 19 per cent of the total sample (Fig 2). Syndromes A,C,E,F and G (see Table II for description of the syndromes) were present in 14 per cent of the total sample.
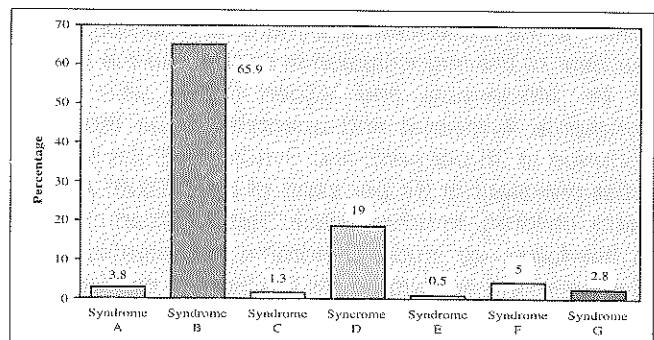

Fig 2: **Distribution of O.I. Syndromes in the sample of Zambian schoolchildren**

DISCUSSION
The malocclusion status of Black Zambian children is very similar to that recorded in epidemiological studies on South African and Swazi Blacks (Table V). De Mûelenaere and Viljoen (1987) found that 83 per cent of the children in a Black rural community required no orthodontic treatment. This finding is similar to that for urban Zambian children in our study and to Volschenk et al's (1993) investigation of Swazi children where it

was found that 82 per cent of children required no orthodontic treatment. These findings differ slightly from those of Briedenhann et al (1994) who reported that 75 per cent of the South African Black children they examined needed no orthodontic treatment. The study of De Mûelenaere, Wiltshire and Viljoen (1992), found that a slightly lower proportion, 72 per cent, of Black urban children required no orthodontic treatment. This suggests that urban Black Zambian children share similar occlusal characteristics with rural South African Black children possibly because a lesser degree of urbanization has taken place in Zambia than in South Africa.

Table V: *A percentage distribution of the need for orthodontic treatment recorded amongst Blacks in Africa using the O.I. of Summers (1966)*

Study	No orthodontic treatment needed	Orthodontic treatment needed
De Mûelenaere & Viljoen 1987	83%	17%
De Mûelenaere, Wiltshire & Viljoen 1992	72%	28%
Volschenk et al 1993	82%	18%
Briedenhahn et al 1994	75%	25%
Ghabrial, Wiltshire & Viljoen (present study)	83%	17%

There are distinct differences in the characteristics of malocclusion reported between different studies in Africa. In the present study, Syndrome B comprised 67 per cent of the malocclusion in contrast to the finding of De Mûelenaere and Viljoen (1987) who found Syndrome A (overjet and openbite) to be the most common at 38 per cent, and Syndrome B the second most prevalent at 34 per cent, of rural South African Black children. In urban Black South African children in the follow-up study, Syndrome D (potential tooth displacement) accounted for the highest incidence of 53 per cent of the malocclusions (De Mûelenaere, Wiltshire and Viljoen 1992). Swazi Black children are closer to their Zambian counterparts in both the O.I. distribution and in the Syndrome distribution, with Syndrome B being the most common at 41 per cent (Volschenk et al, 1993).

The Occlusal Index used in the present study to assess the severity of malocclusion relies predominantly upon dental morphological relationships. Little or no attention is paid to the effect of other facial features on the perception of malocclusion by an individual. The scoring of facial features objectively, together with a concept of beauty and aesthetics amongst Black subjects, will be a valuable adjunct to the determination of treatment need.

CONCLUSIONS

This study has shown that only a small need exists for orthodontic treatment in urbanized Black Zambian children. Further studies should be undertaken to include other ethnic groups in both urban and rural Zambia.

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