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Orthodontic status and treatment need of 13 to 15 year-old children in Kwa-Zulu Natal South Africa:

An epidemiology study using the Dental Aesthetic Index (DAI)

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ABSTRACT

Introduction

The prevalence of malocclusion among school going children in KwaZulu-Natal remains poorly defined despite the known physiological and psychological impact of this dental occurrence.

Objectives

The aim and objectives of this study was to determine the prevalence of malocclusion and possible treatment need in 13-15 year-old school going children in Durban, Kwa-Zulu Natal.

Methods

This was a descriptive, cross-sectional epidemiological study conducted on 270 school-going children aged 13 to 15 years, in the Umlazi and Pinetown school districts. A two-staged clustered and systematic random sampling technique was used to draw the study sample.

Data was collected through an intraoral examination of occlusal status and the malocclusion and orthodontic treatment need was assessed through use of the Dental Aesthetic Index (DAI). Questionnaires were developed to collect information on the learners' health status and socio demographic profile.

Results

The results indicated that 144 (53.3%) of the 270 learners had DAI scores <25 (no abnormality or minor malocclusion not requiring orthodontic treatment); 26 learners (9.6%) had DAI scores of between 26-30 (definite malocclusion requiring elective orthodontic treatment); 59 learners (21.9%) had DAI scores of between 31-35 (severe malocclusion requiring orthodontic treatment); and 41 learners (15.2%) had DAI scores >36 (very severe or handicapping malocclusion requiring mandatory orthodontic treatment). There was an increase in the proportion of malocclusion in older children. The age group of 15 years old had a mean and standard deviation of 30.02+8.9 when compared to the age group 13 years old (27.76+12.17). The association between gender distribution and severity of malocclusion was found to be statistically significant (p=0.01).

Conclusion

The present study primarily indicated a significant prevalence of malocclusion in the identified children. Although 53.3% of children did not require treatment, 37.1% presented with severe and handicapping malocclusion. This suggests a definite and mandatory treatment need for this group of children. The study could provide useful baseline epidemiological data that could inform oral health planning on the prevalence of malocclusion and orthodontic treatment need for 13-15 year-old school going children in the identified geographical area.

Keywords

Malocclusion, orthodontic treatment need, Dental Aesthetic Index (DAI), epidemiology, children.

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INTRODUCTION

Malocclusion is a highly prevalent dental occurrence, with social and psychological impact that can have physical and economic implications for the individual.[1,2,3] Malocclusion can influence the quality of life, including functional ability, appearance and aesthetic self-evaluation, and inter

personal relationships,[4,5] and is also associated as an aetiological factor in sleep-related breathing disorders.[6,7,8]

The World Health Organisation (WHO) has included malocclusion under the heading of Handicapping Dentofacial Anomaly[9] which is defined as an anomaly which causes disfigurement or impedes function, and that treatment is required should the functional disability impact on the individual's well-being.[10,11] Malocclusion is listed as the third priority of oral health problems, after dental caries and periodontal disease, in children and young adults.[12,13,14]

The orthodontic status (prevalence of malocclusion) and treatment need of the population varies among different countries, as well as among the different age and gender groups within the respective populations.[15,16,17] Various orthodontic epidemiological studies have been conducted internationally[8,18] but there is a lack of published or recent data on the prevalence and severity of malocclusion and the orthodontic treatment need for children aged 13 to 15 years in KwaZulu-Natal.[19,20] Furthermore, very little has been done to quantify the proportion of the population that could benefit from orthodontic treatment[21,22] or identify measurement tools that could increase consistency and accuracy in the reporting methods.[23]

Occlusal indices are useful for research, audit, patient management and quality assurance in the treatment of malocclusion.[24,25] The epidemiological data on orthodontic treatment need is essential for the effective planning of dental education, dental public health programmes, training and deployment of dental manpower, screening for treatment priority and clinical treatment, resource planning and funding.[12,26,27,28] The increasing importance of appearance and dental aesthetics as well as functional concerns have increased the demands for orthodontic treatment at early ages[4,29,8,18] and as public interest in oral health care increases, so will the demand for orthodontic treatment.[30,31,13]

The Dental Aesthetic Index (DAI)

Different indices have been developed for various aspects of orthodontic care but these indices have not been uniformly adopted.[32,33] The Dental Aesthetic Index (DAI) was adopted as a cross-cultural index by the World Health Organisation (WHO) for assessment of orthodontic treatment needs.[34]

This index has been used by researchers for diverse communities and populations without the need to modify the index, and its clinical and aesthetic components (ACs) allows for a single score that can depict the physical and aesthetic aspects of the occlusion.[35, 36,19,37,38] The DAI index could therefore be used to identify orthodontic treatment need within different ethnic groups[24] or determine malocclusion rates and orthodontic treatment need in different countries.[26,39,40,41]

However the DAI does have some disadvantages. The reporting and scoring does not include important features such as cross-bite, midline deviation, or over-bite and may under-diagnose the need for orthodontic treatment.[42,43]

The DAI may under estimate the need for orthodontic treatment in cases where the canine is displaced and/or when the incisors are rotated or crowded. In cases of increased over-bite, the DAI may overestimate the treatment need when there is an increase in overjet, even in normally aligned teeth.[37,44]

Despite these clinically specific limitations, the DAI has been used in international collaborative studies[45] and has been used worldwide in epidemiologic studies of orthodontic treatment need in several industrialized and developing countries.[46,39] The index has been established as an essential armamentarium for the oral health care worker and epidemiologist.[47,3]

METHODS

This was a descriptive cross-sectional epidemiological study conducted in the Umlazi and Pinetown high school districts. The sample comprised of 270 school going children aged 13 to 15 year (n=270). A two-staged clustered and systematic random sampling technique was used to draw the study sample. A list of the schools was obtained from the KwaZulu-Natal Department of Education.

A traditional cluster design was used to create a group of 33 clusters with between four to eleven schools per geographical area. Eight learners per school were independently selected by a staff member in each of the identified school to reduce potential bias in participant selection. This provided a 95% confidence interval (CI). The inclusion criteria included male and female children attending the selected schools between the ages of 13 and 15.

Table 1. The components of the standard DAI regression equation and their actual and rounded regression coefficients (Weights).

DAI Component	Regression coefficient	
Weight	Actual weight	Rounded
Number of teeth missing visible teeth (incisors canines and premolars in the maxillary and mandibular arches).	5.76	6
Crowding in the incisal segments 0= no segment crowded 2=2 segment crowded.	1.16	1
Spacing in incisal segments: 0=no spaced 1=1 segment spaced 2=2 segment spaced.	1.31	1
Midline diastema in mm.	3.13	3
Largest anterior irregularity on the maxilla in mm.	1.34	1
Largest anterior irregularity on the mandible in mm.	0.75	1
Anterior maxillary overjet in mm.	1.62	2
Anterior mandibular overjet in mm.	3.65	4
Vertical anterior open bite in mm antero= posterior molar relation.	3.69	4
Largest deviation form normal either left or right: 0=normal. 1= half cusp either mesial or distal, 2=one full cusp or more. Either mesial or distal.	2.69	3
Constant.	13.6	18
Total:	DAI SCORE	

The exclusion criteria included the following: a child on orthodontic treatment or had a previous history of orthodontic treatment; a child with a known medical condition (a health questionnaire was administered to rule out any medical condition that could be exacerbated by the clinical examination); and where no parental consent or child assent was obtained.

Ethical clearance was obtained from the Biomedical Research Ethics Committee (BREC), University of Kwa-Zulu Natal. Gatekeeper permission was granted by the Kwa-Zulu Natal Department of Education. Permission was also obtained from the relevant school authorities and informed consent was obtained from parents or guardians of the participants. In addition, participant assent (child consent) were obtained prior to the study.

Data collection included a health questionnaire. A second questionnaire was used to collect socio-demographic information such as gender, age, school district (urban, peri-urban and rural), number of people in household, source of income, income level of parent, education level and access to dental treatment. All questions were closed-ended.

For calibration and pre-examination training, the researcher selected twenty study models of patients that underwent a full orthodontic examination and were representative of the age groups and types of malocclusion that were anticipated in the sample population. Three dental experts, who were familiar with the criteria for the different variables of the DAI evaluated each study model.

The independent scores obtained from this process were used as the gold standard for comparison with scores obtained in this study. The primary investigator in this study examined the twenty orthodontic study models within a five day interval and an adequate reproducibility index was obtained (k=0.91).

The research instruments was pre-tested in a pilot study among ten children attending a high school that was not on the selected school list. The questionnaires, clinical examination process and data capturing sheet were pre-tested to identify any challenges and corrective changes were made. All participants were examined by a single examiner. A full mouth clinical examination was conducted under natural light and disposable gloves, tongue blades, mouth mirror and Community Periodontal Index Probe were used.

The clinical examination was done according to the Dental Aesthetic Index (DAI), which is rank-ordered on a continuous scale to assess severity levels in order to prioritize treatment need. Each participant was examined and scored for the ten components of the DAI and this score was multiplied by its corresponding regression coefficient using the rounded weights (Table 1).

Data consisting of DAI components were recorded according to the WHO Oral Health Survey form.[34] Intra-examiner consistency was obtained by repeating the clinical examination for every 5th learner and the two scores for the same learner was compared. High levels of infection control was maintained.

The regression equation for obtaining a DAI score is:

DAI score = 6 (missing incisors, canines and premolars) + (crowding) + (Spacing) + 3 (diastema) + (largest maxillary irregularity) + (largest mandibular irregularity) + 2 (anterior maxillary overjet) + 4 (anterior mandibular overjet) + 4 (anterior open bite) + 3 (antero-posterior molar relationship) +13.[15,19,40,47]

Table 2. Malocclusion and severity levels

DAI score	Severity levels
<25	Minor or no anomaly: No treatment
26-30	Definite malocclusion: Elective treatment
31-35	Severe malocclusion: High desirable treatment
36-70	Handicapping malocclusion: Mandatory treatment

Table 3. Age and gender characteristics of the study population.

Age in years	Male		Female		Total	
	N	(%)	N	(%)	N	(%)
13	107	(39.6%)	37	(13.7%)	144	(53.3%)
14	31	(11.5%)	51	(18.91%)	82	(30.4%)
15	22	(8.1%)	22	(8.1%)	44	(16.3%)
Total:	160	(59.3%)	110	(40.7%)	270	(100.0%)

Table 4. Distribution of DAI components.

DAI	Males		Females		Total		P value
Components	N	(%)	N	(%)	N	(%)	
Missing anterior teeth							
0	122	(76.3%)	66	(60.0%)	188	(69.6%)	0.04
>1	38	(23.8%)	44	(40.0%)	82	(30.4%)	
Missing mand teeth							
0	125	(78.1%)	102	(92.7%)	227	(84.1%)	0.01
≥1	35	(21.9%)	8	(7.3%)	43	(15.9%)	
Incisal segment crowding							
0	115	(71.9%)	83	(75.5%)	198	(73.3%)	0.43
1-2	45	(28.1%)	27	(24.5%)	72	(26.7%)	
Incisal segment spacing							
0	94	(58.8%)	95	(86.4%)	189	(70.0%)	0.03
1-2	66	(41.3%)	15	(13.6%)	81	(30.0%)	
Midline diastema							
0	79	(49.4%)	93	(84.5%)	172	(63.7%)	0.04
1 to ≥3	81	(50.6%)	17	(15.5%)	98	(36.3%)	
Max. ant. Irregularity							
0	40	(25.0%)	46	(41.8%)	86	(31.9%)	0.03
>1	120	(75.0%)	64	(58.2%)	184	(68.1%)	
Mand. Ant. Irregularity							
0	40	(25.0%)	39	(35.5%)	79	(23.3%)	0.06
>1	120	(75.0%)	71	(64.5%)	191	(70.7%)	
Max. overjet							
0-2	33	(20.6%)	53	(48.2%)	86	(31.9%)	0.00
>2	127	(79.4%)	57	(51.8%)	184	(68.1%)	
Mand overjet							
0	154	(96.31%)	110	(100.0%)	264	(97.8%)	0.04
≥1	6	(3.8%)	0	(0.0%)	6	(2.2%)	
Ant. Open bite							
0	135	(84.4%)	77	(70.0%)	212	(75.5%)	0.05
≥1	25	(15.6%)	33	(30.0%)	58	(201.5%)	
Ant. Post- molar relation							
Normal	48	(30%)	30	(27.3%)	78	(28.9%)	0.22
Half cusp deviation	96	(60%)	61	(55.5%)	157	(58.1%)	
Full cusp deviation	16	(10%)	19	(17.3%)	35	(13%)	0.22

Each participant's DAI score was then placed along the dental aesthetic index continuum to determine their percentile score (Table 2). The points obtained from the regression equation were tabulated to a score for assessing the severity of malocclusion.

Two-way frequency tables for DAI groups by gender, age, location type were compiled. A log linear analysis was performed to investigate the interactions in these two-way tables. A p-value <0.05 indicated that the variables in that particular interaction term differ significantly.

If an interaction term was found to be significant, the nature of the interaction was further investigated by considering the parameter estimates and associated p-values for each interaction. The Chi-square test [X2] was used for comparison of severity of malocclusion. One way Analysis of Variance [ANOVA] test was used for comparison of mean DAI scores between the age groups and in DAI scores.

The 'Z' test was used to compare the mean DAI scores between gender groups. The DAI was dichotomized into ≤25 (no malocclusion) and, >25 (prevalence of malocclusion) to determine whether an association existed between the malocclusion and socio demographic variables. Post-hoc analysis was conducted between intragroup variables to determine significance values. The data was analysed using the Statistical Package for Social Sciences software [SPSS version 24].

RESULTS

The demographic characteristics of the study population (n=270) by age and gender is summarised in (Table 3). The results indicated that 160 (59.3%) of the study sample were boys and 110 (40.7%) were girls. Amongst 160 boys, 107 (39.6%) were in 13 years age group, 31 (11.5%) were in the 14 years age group, and 22 (8.1%) were in the 15 years age group. Similarly among the 110 girls, 37 (13.7%) were in the 13 years age group, 51 (18.9%) were in the 14 years age group and 22 (8.1%) were in the 15 years age group (Table 3).

The distribution of the DAI components by gender is presented in Table 4. Of the 270 children examined, 188 learners (69.6%) had no missing anterior maxillary teeth while 82 learners (30.4%) had one or more missing anterior teeth. Among 160 boys examined, 122 (76.3%) had no missing anterior teeth and 38 boys (23.8%) had one or more missing anterior teeth. Out of 110 girls examined 66 (60.0%) had no missing anterior teeth while 44 girls (40.0%) had one or more missing teeth. This difference between boys and girls was found to be statically significant (p= 0.04).

The results further indicate that 227 learners (84.1%) had no missing anterior mandibular teeth while 43 learners (15.9%) had one or more missing anterior teeth. Among the 160 boys examined, 125 (78.1%) had no missing anterior teeth and 35 boys (21.9%) had one or more missing anterior teeth. Out of 110 girls examined, 102 (92.7%) had no missing anterior teeth and 8 girls (7.3%) had one or more missing teeth. This difference between boys and girls was found to be statically significant (p=0.01).

A total of 198 learners (73.3%) had no incisal segment crowding and 72 learners (26.7%) had one or two segment crowding. No statistically significant differences in anterior segment crowding were observed in the study group (p=0.43) A total of 189 learners (70.0%) had no incisal segment spacing and 81 learners (30.0%) had one or two segment spacing. Incisor segment spacing when compared between the males and females was found to be statistically significant. (p=0.03).

Similarly statistically significant differences were observed in the occurrence of midline diastema. A total of 172 learners (63.7%) had no diastema and 98 learners (36.3%) had a diastema greater than 2mm (p=0.04). The anterior maxillary irregularity was significant when the prevalence was compared between males and females (p=0.03), however there was no statistically difference in the anterior mandibular irregularity (p=0.06).

When the prevalence of an anterior maxillary overjet (p= 0.00) and anterior mandibular overjet (p=0.04) was compared between the males and females, statistically significant differences were observed. Eighty-six learners (n=86, 31.9%) had no anterior maxillary overjet and 184 learners (68.1%) had an overjet of >2mm. Similarly, 264 learners (97.8%) had no anterior mandibular overjet, and 6 leaners (2.2%) had a mandibular (reverse) overjet of >2mm.

While 212 learners (78.5%) had no anterior open bite, 58 learners (21.5%) had an anterior open bite of >1mm. There was no statistical significant difference between males and females. In the antero- posterior molar relation, 78 learners (28.91%) had normal molar relationship, 157 learners (58.11%) had half–cusp deviation, and 35 learners (13.0%) had full–cusp deviation (p=0.22).

The prevalence of malocclusion and orthodontic treatment need according to the DAI for the sample population is categorised in Table 5. Of the 270 participants, 144 learners (53.3%) had DAI scores <25 (no abnormality or minimal malocclusion requiring no or slight orthodontic treatment), 26 learners (9.6%) had DAI scores of 26-30 (definite malocclusion requiring elective orthodontic treatment), 59 learners (21.9%) had DAI scores of 31-35 (severe malocclusion requiring highly desirable orthodontic treatment), and 41 learners (15.2%) had DAI scores >36 (very severe or handicapping malocclusion requiring mandatory orthodontic treatment).

Table 5. Prevalence of malocclusion and orthodontic treatment needs according to the DAI

No. of children affected N (%)	DAI score	Severity of malocclusion	Treatment need
144 (53.3%)	<25	No abnormality or minor malocclusion	No/slight need
26 (9.6%)	26-30	Definite malocclusion	Elective
59 (21.9%)	31-35	Severe malocclusion	Highly desirable
41 (15.2%)	≥36	Very severe malocclusion	Mandatory

The distribution of DAI scores and orthodontic treatment need according to age indicated that the age group of 15 year old learners had a mean and standard deviation of 30.02+8.9 when compared to age group 13 year old learners (27.76+12.17) and the 14 year old learners (26.27+11.63). The difference between age groups was not statistically significant (p=0.22) (Table 6).

The comparison of various international studies using the DAI is summarised in Table 7. The results of the current study reflect a mean DAI score of 27.67 at a 95% confidence interval (CI).

The gender distribution of the prevalence of malocclusion and orthodontic treatment need by categories of the DAI are depicted in Table 8. The mean and standard deviation were 28.93+11.6 for males and 25.85+10.744 in female learners respectively. This variation in the results were statistically significant (p=0.01).

The results of the association between and socio demographic variables and malocclusion as classified by the dichotomised DAI are depicted in Table 9. No significant differences were observed in the prevalence of malocclusion in the different school districts (urban, peri-urban, rural) (p=0.62), or in source of income (p=0.08). The prevalence of malocclusion and the learners' access to dental treatment (public or private health care) was statistically significant (p=0.02)

DISCUSSION

The Dental Aesthetics Index (DAI) establishes a list of occlusal traits in categories that are arranged in grades to allow observation of the severity of malocclusion and the orthodontic treatment need in an identified population. [37,38,48]

Table 6. Distribution of DAI scores and orthodontic treatment needs according to age.

Age in years	No. of children	DAI scores				
	No (%)	≤25n (%)	26-30n (%)	31-35n (%)	≥36 n (%)	Mean ± SD
13	144 (53.3%)	74 (51.4%)	13 (50%)	35 (59.3%)	22 (53.7%)	27.6±12.179
14	82 (30.4%)	55 (38.2%)	7 (26.9%)	8 (13.6%)	12 (29.3%)	26.27±11.633
15	44 (16.3%)	15 (10.4%)	6 (23.1%)	16 (27.1%)	7 (17.1%)	30.02±8.930

Table 7. Mean Dental Aesthetic Index score for other populations (International studies) and South Africa – Kwa Zulu Natal (Current Study).

Population (Reference)	Sample size	Age range	Mean DAI score	95% CI
Caucasians Americans[36]	1337	7-12	26.5	26.1-26.9
Native Americans[36]	485	7-12	31.8	-
Caucasians (S. Australia)[50]	5000	13	28.8	-
Australia[50]	309	10	26.6	23.3-24.9
Japanese[43]	409	15-18	30.5	29.731.3
Poles[53]	1000	12-13	24.5	-
Malaysians[39]	1512	12-15	24.6	-
South Africa[9]	5744	12	16.8	-
New Zealand[51]	150	13	26.7	-
Iranians[37]	900	12-1	23.5	23.1-23.9
Nigerian[21]	703	12-15	22.3	21.9-22.8
Indian (Himachal; Hill population)[38]	1188	9 and 12	19.9	-
Tanzania[49]	289	12-15	24.6	23.86-25.36
Brazil[48]	486	12-15	18.0	-
Indian (Maharashtra)[57]	880	12-15	20.0	-
Mongolia[58]	557	11-16	29.0	-
South Africa (Kwa-Zulu-Natal) (This study findings)	270	13-15	27.67	26.29-29.05

Table 8. Gender distribution of gender distribution of DAI scores and orthodontic treatment need.

Gender	No. of children	DAI scores			
No (%)	≤25 n (%)	26-30n (%)	31-35n (%)	≥36 n (%)	Mean ± SD
Male	160 (59.3%)	69 (47.9%)	18 (69.2%)	45 (76.3%)	28 (68.3%)
Female	110 (40.7%)	75 (52.1%)	8 (30.8%)	14 (23.7%)	13 (31.7%)
Total	270 (100.0%)	144 (100.0%)	26 (100.0%)	59 (100.0%)	41 (100.0%)

Table 9. Socio demographic variables and dichotomized DAI.

	No Malocclusion < 25		Malocclusion > 25		Total		P
	N	(%)	N	(%)	N	(%)	
1. School district							
Urban	57	(47.5%)	58	(36.8%)	155	(42.6%)	0.62
Peri Urban	60	(50.0%)	35	(23.3%)	95	(35.2%)	
Rural	3	(2.5%)	57	(38.0%)	60	(22.2%)	
2. Source of income							
Unemployed	0	(0.0%)	5	(3.3%)	5	(1.9%)	0.08
Employed	51	(42.2%)	76	(50.7%)	12	(47.0%)	
Self-Employed	68	(56.7%)	21	(23.6%)	89	(33.0%)	
Social Grant	1	(0.8%)	48	(98.0%)	49	(18.1%)	
3. Access to dental treatment							
Public Health (Clinic)	3	(2.5%)	122	(81.3%)	125	(46.3%)	0.02
Private Practice	117	(97.5%)	28	(18.7%)	145	(53.7%)	

Establishing the index's cross-cultural validation and duplicity is necessary because cultural standards regarding the position of teeth may differ from country to country, and the degree of attractiveness and treatment need also vary [26]. Rwakatema DS noted that although diastema mediale may be regarded as unaesthetic in western societies, it is considered as a sign of beauty by Tanzanians.[49] The mean DAI score of the present study was 27.67, and 53.3% of the children examined, had a dental appearance that required no orthodontic treatment (DAI score of <25). A definite malocclusion occurred in the remaining 46.7% of which a small number proportion of the study sample (n=26, 9.6%) fell in the category of elective treatment. This finding suggest that that 37% of learners examined, required definitive orthodontic treatment. The literature further suggest that children may not be aware of their orthodontic need for treatment due to poor dental knowledge, or inadequate access to treatment due to socio economic constraints or non-availability of treatment services.[44,9]

The components that primarily contributed to the variation in DAI scores in this study population were spacing in the incisal segments, diastema, largest anterior irregularities in the maxilla and mandible, maxillary overjet and anteroposterior molar relationship. These findings are similar to those reported in studies from Australia,[50] Malaysia,[39] New Zealand[51] and Nigeria.[21]

The number of children not requiring orthodontic treatment (53.3%) was consistent with a previous study conducted by van Wyk and Drummond (53%)[19] but these findings were lower when compared to 12-13 year old Malaysian children (62.5%)[39] and 12-18 year old Nigerian children (77.4%).[21] However the mean DAI score (27.67) of this study is much higher than the previously reported South African study, (16.8)[20] as well as that of the Nigerian study (22.3)[21] and Tanzanian study (24.6).[49] This difference could possibly be explained in that the previous South African survey was a national survey compared to the current study and that younger learners were included in the previous sample. It could also be suggested that there is an increasing prevalence and severity of malocclusion in the 13 to 15 year old learners. The distribution of DAI scores and orthodontic treatment need according to age indicated an increase in the proportion of malocclusion in the 15 year old children, (although there was no statistical significance between the age groups).

These results are in contrast to van Wyk and Drummond[19] who reported a high prevalence of malocclusion in the 12 year old group and a decline in the 15 year old group. A possible explanation could be the developmental differences due to the late mixed dentition stage that could aggravate the prevalence and severity of dentofacial anomalies. The current study focused on learners from age 13 and as such the malocclusions could have been possibly more established as defined by the components of the DAI.

There was a higher prevalence of females (40%) with missing anterior teeth as compared to males (23.8%). A greater number of males had spacing in the incisal segments (41.3%) and diastema (50.6%) as compared to females with 13.6% with spacing, and 15.5% with diastema respectively. The presence of a diastema in the developing dentition at age 12 is regarded as a normal phenomenon.[52] In the absence of a deep overbite, these spaces normally close spontaneously.[52] If the space between the maxillary central incisors is greater than 2mm, spontaneous closure is unlikely.[52] A diastema of 2mm and greater, occurred more in males (28.8%) than in females (9.1%). The presence of anterior irregularity in the maxilla (68.1%) and mandible (70.7%) occurred more in males than in females. The presence of increased maxillary overjet (28.9%) was higher in males than females. These results are higher than the Tanzanian study (12%)[49] and Nigerian study (14.1%)[21] but closely comparable to the South African study (29.65%).[19]

The mean DAI score of the present study (27.67) was higher than that of Caucasian Americans,[36] Australians,[50] Malaysians,[39] New Zealand,[51] Poles,[53] Iranians,[37] Tanzania[49] and Indian populations.[38] The scores were lower than that of Native Americans[36] and Caucasians Australians.[50] These differences could be due to different sample sizes and/or inclusion of younger and older age ranges. The differences could also be attributed to genetic predisposition, variation in growth and facial skeleton development, and occlusion due to population type.

The mean DAI score for males was (28.93) and females (25.85). The analysis of gender distribution of DAI scores and orthodontic treatment need revealed that males were found to have greater treatment need than females. This corresponds with other South African and Nigerian studies that found girls tend to have lower mean DAI scores than boys.[19,21,49] These gender differences in the DAI score should be interpreted with caution. The differences in dental development stage could contribute to the differences in the DAI representation for boys and girls.

No significant differences where observed in the distribution of malocclusion by school district (p=0.62). The results of the current study suggest that planning and provision of orthodontic services for urban, peri-urban and rural areas should not be prioritised differently. The prevalence of malocclusion by employment status (p=0.08) and income of parent (p=0.49) showed no statistical differences but the results suggested an association between the prevalence of malocclusion and access to dental treatment (p=0.02). These results possibly suggest that learners who had previous access to private health care to minimise caries and tooth loss had lower malocclusion scores.[54] Another possible explanation is that dental practitioners could have undertaken systematic serial extractions to alleviate crowding and thus contributed to lower incidence of malocclusion.[55]

These findings could provide reliable base-line data regarding the prevalence and severity of malocclusion as well as useful epidemiological data on the orthodontic treatment need of 13 to 15 year-old children in the identified geographical areas in Durban. As both the general dental health and socio-economic status of the population of South Africa improve together with the "globalization" and awareness of dental aesthetic needs, it is foreseeable that the number of children seeking orthodontic treatment will also increase.[56] It should be noted that 'interceptive orthodontic' programmes can reduce the

severity of the problems but rarely is so successful that later treatment becomes unnecessary.[52] Orthodontic services should therefore be comprehensive and appropriate to the specific needs of the individual.[52]

CONCLUSION

This study provided useful base-line epidemiological data on the orthodontic treatment need of 13-15 year-old South African children in the selected geographical areas in Kwa-Zulu Natal and could make a contribution to oral health planning and policy decisions in the province.

Conflict of interest

None.

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