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#### ORTHODONTIC TREATMENT NEEDS AMONG 12-15 YEAR-OLDS IN MOSHI, TANZANIA

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D.S. RWAKATEMA, P.M. NG'ANG'A and A.M. KEMOLI

### ABSTRACT

**Objective:** To assess malocclusion and orthodontic treatment needs among 12-15-year-olds in Moshi municipality, Tanzania.

**Design:** A cross-sectional study.

**Setting:** Moshi municipality, Tanzania.

**Subjects:** Two hundred and eighty nine randomly selected primary school children in Moshi municipality in the year 2003.

**Results:** Maxillary median diastema occurred in 20.1% of the children. Crowding and spacing in the incisor segments occurred in 41.2% and 28.4% respectively with significantly more crowding in males than in females ( $p = 0.009$ ). Anterior irregularities occurred in 46% of the sample in the maxilla and 51.6% in the mandible. These irregularities were significantly more common in the females than in males in the maxilla and mandible ( $p=0.014$ ,  $p=0.037$  respectively). Reverse overjet was extremely rare (0.3%). Anterior openbite and antero-posterior molar relation discrepancies occurred in 6.2% and 32.5% of the sample, respectively. Crowding, irregularities in the incisor segments and antero-posterior molar relation discrepancies were dominant malocclusion traits in this population. The sample mean DAI score was 24.6 points (CI 95% 23.86–25.36). There was no statistically significant gender difference of DAI scores ( $p = 0.473$ ). About 65% of the subjects had either no need or had slight need for treatment whereas 35.3% were found with orthodontic treatment needs ranging from elective (21.5%), highly desirable (6.9%) to mandatory (6.9%). There was no significant gender difference in the categories of treatment need ( $p = 0.942$ ). Unmet orthodontic treatment needs were present in this population with a very small proportion of subjects exhibiting handicapping malocclusion.

**Conclusion:** The information from this study forms part of the basis not only for further research, but also for planning orthodontic care in this community where unmet orthodontic treatment needs are present.

### INTRODUCTION

Oral health services in Tanzania are currently run by a few dentists who are mostly located in the major urban areas. They are assisted by other cadres who are located in different parts of the country(2). Goals for the National Oral Health Programme of Tanzania

are not clear on malocclusion affecting the children of this country. Moreover orthodontic specialists are not yet available in the country.

A few recent studies on malocclusion and orthodontic treatment need among Tanzanian children have been carried out in the capital city, Dar-es-Salaam (3). Little is known regarding

the prevalence of malocclusion and orthodontic treatment need among children from the other parts of Tanzania (4). Indeed, a search for data on malocclusion in East Africa reveals very little information on orthodontic treatment needs among children in these countries (5-7). Effective planning of orthodontic services requires knowledge of the potential orthodontic treatment load. This planning has been defined as the number of subjects assessed to need treatment, minus those whose general condition is inadequate for treatment and those who do not wish to receive treatment (8). According to previous observations (9), orthodontic treatment need may be perceived or felt by the patient or detected by the dental professional. A previous study (6) indicated that 3-12% of Tanzanian children in Dar-es-Salaam had "absolute need" for orthodontic treatment. Objective orthodontic treatment need was found in 29% of the 13-15 year-olds in the neighbouring Republic of Kenya (5). Since studies are few and inconclusive, there is need for additional scientific data on malocclusion and orthodontic treatment needs which can be used for planning appropriate services.

The Dental Aesthetic Index (DAI) has been frequently used for epidemiological data collection and assessment of orthodontic treatment need in most parts of the world outside Africa (10-18). It was possible to use the DAI criteria in many of these studies without modification according to the cultural diversity. However; the DAI criteria have never been used in East Africa before although they have extensively been used in other parts of Africa (19-25). The aim of this study was, therefore, to assess the frequency and distribution of malocclusion and orthodontic treatment needs in 12-15 year-olds in Moshi Municipality, Tanzania, using the DAI criteria.

## MATERIALS AND METHODS

Study participants were randomly selected from all the 26 public primary schools in Moshi Municipality. In the first step, a random sample of two primary schools from each division was selected. In the second stage, each pupil aged 12-15 years in the selected schools was identified through a register and assigned a number for random selection. Based on the previous report of the prevalence of malocclusion in East Africa (26), a total number of 289 children

constituted a representative sample. This sample constituted about 4% of all the public primary school children (8136 children) aged 12-15-years in the municipality. All the subjects were Tanzanians of African origin. Ethical clearance for this study was sought and obtained from Tumaini University, Kilimanjaro Christian Medical College Ethics Committee in Moshi, Tanzania. Informed consent was obtained from all the children's parents.

Data were collected in two parts; first, by self-administered questionnaire and secondly by clinical examination according to the Bjork *et al.* (27) criteria and the DAI criteria (28). A special clinical examination form was designed by the authors for easy recording of malocclusion traits according to both criteria where it was required. The clinical examination was carried out in a classroom under natural daylight. This was achieved by having the child sit on a chair next to a window. One investigator (DSR) carried out all the clinical examination of the subjects. A total of 24 subjects were re-examined to test the intra-examiner reliability.

Final individual DAI score points were calculated using the recommended regression equation (28). An individual final DAI score which indicated severity of malocclusion also determined the subject's orthodontic treatment need according to the cut-off points of treatment categories. Treatment categories were DAI scores of  $\leq 25$  which indicated "no or minor orthodontic treatment need" and 26 - 30 DAI scores which indicated "elective" orthodontic treatment need. DAI scores of 31 - 35 and  $\geq 36$  indicated "highly desirable and mandatory" orthodontic treatment need respectively. The Kappa test (29) was used to determine intra-examiner reliability of the qualitative variables of the DAI components and related t-test for continuous variables of the DAI components. The Chi-square test was used to evaluate for any significant differences between males and females on the prevalence of malocclusion according to the DAI. Unrelated t-test was used to test the gender difference on the DAI scores. A p-value of less than 0.05 was considered significant.

## RESULTS

The results for awareness and concern about malocclusion in this population were found to have been moderate (30). Overall prevalence of malocclusion according to Bjork's *et al.* criteria in

this population was found to have been 97.6% (31). A kappa value of 0.95 for intra-examiner reliability of qualitative variables of DAI components was achieved. This indicated high reliability of the examined qualitative variables. There was no significant difference for continuous variables of the DAI components for the 24 re-examined subjects ( $p > 0.05$ ).

The frequency distribution of unweighted DAI components is shown in Table 1. Maxillary median diastema occurred in 20.1% of the children. Crowding and spacing in the incisor segments occurred in 41.2% and 28.4% respectively with significantly more crowding in males than in females ( $p = 0.009$ ). Anterior irregularities were frequent in both the maxilla (46%) and mandible (51.6%) with significantly more females showing irregularities than males in the maxilla and mandible ( $p = 0.014$  and  $p = 0.037$  respectively). Majority of the children had maxillary overjet with varying degree of expressivity. Among these 11% had

edge to edge bite and 12.1% had increased overjet ( $\geq 4$  mm). Mandibular overjet was extremely rare (0.3%). Anterior open-bite was registered in 6.2% of the sample. Antero-posterior molar relation discrepancies occurred in 32.5% of the sample.

The cumulative percentage of the sample population DAI scores is illustrated in Figure 1. The sample mean DAI score was 24.6 points (95% CI 23.86-25.36). The mean DAI score covered the 64 percentile of the sample DAI scores. Table 2 presents comparisons of the DAI scores according to gender. There was no significant gender difference according to the DAI scores ( $p = 0.473$ ). Table 3 presents results of orthodontic treatment need according to the DAI cut-off point of treatment categories. About 65% of the subjects had either no need or had slight need for treatment whereas 35.3% were found with orthodontic treatment needs ranging from elective (21.5%), highly desirable (6.9%) to mandatory (6.9%). There was no significant gender difference according to categories of treatment need ( $p = 0.942$ ).

**Table 1**

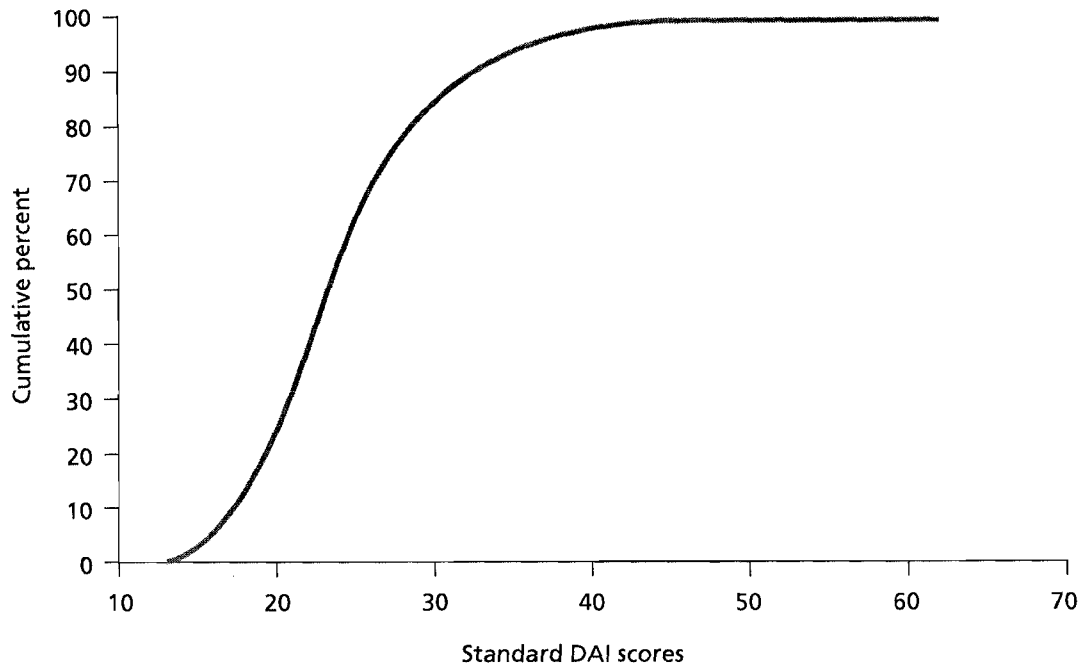
*Distribution of unweighted DAI components (n=289) and statistical gender differences (153 males, 136 females) among children in Moshi, Tanzania*

Unweighted DAI component	Gender				Total	P-value (chi-square)	
	Male		Female				
	No.	(%)	No.	(%)	No.	(%)	
Missing visible teeth ( $\geq 1$ tooth)	10	(3.5)	10	(3.5)	20	(6.9)	0.79▼
Crowding incisors (mm) 1-2 segments	74	(25.6)	45	(15.6)	119	(41.2)	0.01■
Spacing incisors (mm) 1-2 segments	50	(17.3)	32	(11.6)	82	(28.4)	0.09▼
Maxillary median diastema ( $\geq 1$ mm)	33	(11.4)	25	(8.7)	58	(20.1)	0.50▼
Largest anterior maxillary irregularity ( $\geq 1$ mm)	60	(20.8)	73	(25.3)	133	(46.0)	0.01•
Largest anterior mandibular irregularity ( $\geq 1$ mm)	70	(24.2)	79	(27.3)	149	(51.6)	0.02•
Increased maxillary overjet ( $\geq 4$ )	16	(10.5)	19	(13.1)	35	(12.1)	0.36▼
Mandibular overjet ( $> 0$ mm)	0	(0.0)	1	(0.3)	1	(0.3)	0.47▼
Anterior vertical open bite ( $> 0$ mm)	8	(2.8)	10	(3.5)	18	(6.2)	0.56▼
Antero-posterior molar relation ( $\geq 1/2$ cusp width)	43	(14.9)	51	(17.6)	94	(32.5)	0.09▼

■ =  $p < 0.05$  (males more than females); • =  $p < 0.05$  (females more than males); ▼ =  $p > 0.05$  (no significant gender difference  $p > 0.05$ ).

**Figure 1**

*Distribution of DAI scores and their cumulative percentages among children in Moshi, Tanzania*



Sample mean DAI score (24.6 points (CI 95% 23.86 – 25.36)) covered 64 percentile of the sample DAI scores and handicapping malocclusion (DAI score of  $\geq 36$ ) is at the 95th percentile

**Table 2**

*Comparisons of DAI scores according to gender among children in Moshi, Tanzania*

Variable	No.	(%)	DAI Score		
			Mean	95% CI	P-value
Gender					
Male	153	52.9	24.5	23.52; 25.48	0.473
Female	136	47.1	24.9	23.75; 26.05	

There was no significant gender difference; statistics: t-test

**Table 3**

*Orthodontic treatment needs among children in Moshi, Tanzania based on the category of treatment indications according to DAI*

Variable	Treatment needs									
			No or slight need ( $\geq 25$ DAI Scores)		Elective (26-30- DAI Scores)		Highly desirable (31-35 DAI Scores)		Mandatory ( $\geq 36$ DAI Scores)	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Gender										
Male	153	(52.1)	103	(67.3)	29	(19.0)	11	(7.2)	10	(6.5)
Female	136	(47.9)	84	(61.8)	33	(24.3)	9	(6.6)	10	(7.3)
Total	289	(100)	187	(64.7)	62	(21.5)	20	(6.9)	20	(6.9)

There was no significant gender difference in the categories of treatment needs ( $p = 0.942$ ); statistics: Chi-square test

## DISCUSSION

Comparison between different studies of malocclusion has usually been difficult due to lack of suitable universally accepted indices. In this regard, the World Health Organisation (WHO) has recommended the DAI as a simple and acceptable index for use in epidemiological surveys to assess the unmet orthodontic treatment need and as a tool for screening and determining priority for orthodontic care in public-financed programmes (32). The DAI was, therefore, adapted for use in the present study. It is worthy to mention that ten DAI components on their own may have not exhausted malocclusion traits that may have been present in this sample for assessment of orthodontic treatment need. For instance, the DAI criteria takes no account of malocclusion such as buccal crossbites, central line discrepancy and increased overbite that can impinge on the palatal gingivae any of which may form a strong indication for treatment need. This is one of the reasons why the Bjork *et al.* (27) criteria, were also used (31) for recording such types of malocclusion traits. Although the prevalence of some malocclusion traits has been reported in the East African literature (3,4,26) to the knowledge of the authors, no studies have previously employed the DAI.

Children with aplasia/impacted teeth in this study (6.9%) were more compared to a previous report in Nigerian adolescents (3.7%) (19) in whom the DAI criteria were used but lower than those reported in South African children (24). However; since no radiographs were used, further research is recommended to confirm this. Crowding (42.2%) and spacing (28.4%) in the incisor segments occurred frequently in both jaws. Similar results have previously been reported in Tanzanian (4), Kenyan (26) and South African children (24) as well as in the multiracial American population (33) of a similar age group. Diastema was commonly found (20.1%) in this study. Although it is generally regarded as unaesthetic in the Western societies (34), general observation shows that diastema mediale is considered as a sign of beauty by many Tanzanians. A previous study (19) has reported similar findings (24.9%) of diastemata amongst Nigerians using the DAI. However, a previous report in South African black children (24) indicated a low (17.66%) prevalence of this trait than in our study. Anterior irregularities in the maxilla (46%) and mandible (51.6%) were common in this

sample and were shown to have been significantly more in females than in males. Irregularities may increase with eruption stages which have been shown to occur earlier in Tanzanian females than in males (3). Concern with regard to crowding and irregularities in this population was reported by 29.1% of the respondents (30). A previous study among Tanzanian children showed severe deviations including crowding having been rated the most unaesthetic (35). About 12% of the children in the present study had increased maxillary overjet. This was much less than that reported in South African black children (29.65%)(24) but comparable to that of a previous report in Nigerian children 14.1%)(19). One subject was found to have had mandibular overjet (0.3%) which agrees with a previous report regarding the rarity of this malocclusion trait in East African children (26).

Few studies on orthodontic treatment needs have been reported in Tanzania (6) and Kenya (5), using indices other than the DAI. This makes direct comparison of the present findings with the earlier observations difficult. Based on the cut-off point of  $\geq 26$  DAI score, orthodontic treatment need was found in 35.3% of the examined subjects. This was high in relation to a previous report based on Nigerian children (22.6%) (19) but lower than that of black South African children (49.13%)(24) and those of previous reports outside Africa (13,15,16,36). This demonstrates that orthodontic treatment needs in Moshi are generally low compared to many studies in other populations. A previous study (37) reported a mean DAI score of 30.1 points for Japanese and 26.5 points for white Americans which are relatively higher compared to findings in the present study and those in Nigerian children (22.3 points) (19). This may be due to racial differences. Handicapping malocclusion (DAI score of  $\geq 36$ ) in the present study was at the 95<sup>th</sup> percentile compared to the earlier minimum 86<sup>th</sup> percentile set for the DAI as a predictor of handicapping malocclusion (38). This demonstrated that relatively few children in the present study had handicapping malocclusion needing mandatory treatment. Although DAI was chosen for use to assess objective orthodontic treatment needs in the present population, it would be worthwhile to determine norms for dentofacial appearance in Tanzania in order to ascertain the appropriateness of the index in the evaluation of orthodontic treatment need.

In conclusion, crowding, irregularities in the incisor segments and antero-posterior molar relation discrepancies were the dominant malocclusion traits in this population. Unmet orthodontic treatment needs were present with a very small proportion of subjects exhibiting handicapping malocclusion. The information from this study forms part of the basis not only for further research, but also for planning orthodontic care in this community where unmet orthodontic treatment needs are present.

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