

Original Article

Assessment of early orthodontic treatment need and its relationship with sociodemographic characteristics among Tanzanian children using index for preventive and interceptive orthodontic treatment need

ABSTRACT

Background: Early orthodontic treatment (EOT) aims at identifying and intervening occlusal conditions in primary and early-mixed dentition.

Aim: This study aimed at assessing EOT need and its relationship with sociodemographic characteristics using the index for preventive and interceptive orthodontic treatment needs (IPION) among schoolchildren in Dar es Salaam, Tanzania.

Study Setting and Design: An analytical cross-sectional study was conducted among schoolchildren aged 6 and 9 years.

Materials and Methods: Schoolchildren were selected by multistage cluster sampling technique. Questionnaires were used to obtain sociodemographic information; clinical examinations were done to record schoolchildren's IPION scores.

Statistical Analysis Used: Data were analyzed using a computer software, SPSS version 20.0. Chi-square test was used for assessing statistical differences between variables; *P* value was set at $P < 0.05$.

Results: A total of 667 schoolchildren were involved (59.5% girls; 52.5% 9-year-olds). In 6-year-olds, 77.9% had caries, and in 9-year-olds, 60% had caries. Lower-second primary molars were the most common prematurely lost teeth. Increased overjet was the most frequently recorded occlusal anomaly. Many 9-year-old boys than girls had caries (67.4% vs. 55.5%, $P = 0.032$). Six-year-olds with mothers who were homemakers compared to those with employed mothers experienced caries (81.7% vs. 71.0%, $P = 0.034$). Overall, 67.2% and 41.7% of the participants had EOT need and definite EOT need, respectively.

Conclusion: EOT need for malocclusions was high in the involved school children, these will thus benefit from preventive and interceptive orthodontic treatment programs.

Keywords: Early loss, early treatment, dental caries, lip competency, occlusion, orthodontic treatment need

INTRODUCTION

Malocclusion is a condition that reflects an expression of variability in the way the maxillary and the mandibular teeth occlude.^[1] Untreated malocclusions usually have physical, psychological, and social effects to individuals where one Tanzanian study found that 23% of children they studied were dissatisfied because of having malocclusions.^[2] Early orthodontic treatment (EOT) thus aims at identifying and treating malocclusions and malocclusion-related conditions occurring in children with primary and early-mixed dentition.^[3]

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The treatment hence tends to eliminate the primary etiological factors for malocclusions and prevent the progression of inharmonious skeletal, dental, and functional occlusal conditions.^[4] Strategies for EOT need may include preventive and interceptive orthodontic programs. Principally, there is a slight difference between interceptive orthodontics and preventive orthodontic treatment. Interceptive orthodontics refers to the procedures that eliminate or reduce the severity of a developing malocclusion, while preventive orthodontics is any action taken to preserve the integrity of a normal occlusion.^[5] Furthermore, preventive treatment in orthodontics aims at promoting a physiological development of a good occlusion and avoiding the progression of a malocclusion.^[6] Hence, early diagnosis of conditions affecting the normal development of dental occlusion can contribute to an overall reduction in the incidence of malocclusions.^[4]

As far as the treatment cost is concerned, successful EOT with simple appliances provide a potential cost–benefit as compared to complex treatment with fixed appliance treatment.^[7] Before initiation of EOT in children, it is important to consider that different factors such as sociodemographic and behavioral factors have an influence on the development of malocclusions in children at different ages, i.e., 6- and 9-year-olds. Consequently, different indices exist for particular ages.^[8] Index for preventive and interceptive orthodontic treatment need (IPION) was chosen for the present study and the reason for choosing the IPION index is that it specifically focuses on children aged 6 and 9 years. In most 6-year-olds, there is initiation of mixed dentition, and in 9-year-olds, there is the beginning of eruption of canine-premolar group of teeth.^[8-10] Generally, these children have characteristic mixed-dentition stage, which is prone to present with various occlusal deviations.^[11] In addition, an IPION index was developed to rank malocclusions in a population of 6- and 9-year-olds by their respective significance for preventive and/or interceptive treatment. Using the index, the traits [Table 1] are scored and categorized into “no treatment need,” “moderate treatment need,” and “definite treatment need.^[9] Hence, this largely gives an indication for preventive or interceptive orthodontic treatment need for the examined children. Overall, the IPION index allows early detection of developing malocclusions, facilitates the provision of interceptive treatment, and minimizes or even eliminates the need for complex treatment in the future.^[7,9] It may also minimize or eliminate future costly complex orthodontic treatment which is relevant in a resource limited country like Tanzania.^[12] This study, therefore, aimed at gathering information on EOT need and its associated sociodemographic characteristics, using the IPION index among 6- and 9-year-old Tanzanian children from Kinondoni municipality of Dar es Salaam region in Tanzania.

Table 1: Occlusal traits and criteria measured by the index for preventive and interceptive orthodontic need

6-year-olds	9-year-olds
Caries	Caries
Early loss	Early loss
Molar relationship	Molar relationship
Rotation/tipping of molars	Rotation/tipping of molars
Overjet	Overjet
Overbite	Overbite
Anterior crossbite	Anterior crossbite
Posterior crossbite	Posterior crossbite
Open bite	Open bite
Lip incompetency	Lip incompetency
	Submerged teeth
	Active frenum
	Absent teeth

Source^[8]

MATERIALS AND METHODS

This was an analytical cross-sectional study, where primary schoolchildren aged 6 and 9 years from public primary schools in Kinondoni municipality, in Dar es Salaam, were involved. A stratified multistage proportionate cluster sampling method was utilized, where, in the first stage, five districts were listed and Kinondoni district was selected randomly from the list of all five Dar es Salaam districts. In the second stage, systematic random sampling method was employed to sample primary schools, and 18 out of 77 primary schools from 20 wards were chosen. Class attendance registers were used, where children’s names were picked randomly until the required number of 40 children per school was reached. Since there were 18 schools, 720 children were set as the required sample size.

Ethical clearance and ethical considerations

Ethical clearance for the study was obtained from the Research and Publication Committee of the Muhimbili University of Health and Allied Sciences. Furthermore, permission for the study was obtained from all relevant persons and authorities. Permission to work with schoolchildren was obtained from Kinondoni Municipal, their respective educational authorities, schools administrations, parents, and children. Written informed consent was requested from all parents of the children. Only consenting children were included in the study.

Examiner calibration

Examiner training and calibration were performed using a sample of schoolchildren, and inter-examiner agreement was assessed based on the scoring of the IPION index components.

Data collection

One trained and calibrated dentist (principal investigator) conducted all clinical examinations in a classroom setting with natural daylight as the source of illumination, and a research assistant was recording the findings in the clinical record form.

Dental caries

It refers to a localized posteruptive, pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity. Dental caries was coded as 0 – no visible caries or restorations on canine, primary first molar, primary second molar, and first permanent molar; 1 – one interproximal surface with caries or restorations or occlusal restoration only; and 2 – two interproximal surfaces with caries or restorations. It was recoded into 0 = absent and 1 = present (including the 1 and 2 categories).^[9]

Early teeth loss

It refers to the loss of a deciduous tooth before the time of their natural exfoliation. The number of prematurely lost lower and upper primary canine, primary first molar, and primary second molar were counted. It was recoded into 0 = absent and 1 = present.^[9]

Molar relationship

The basic Angle's classification was used. The intermaxillary relationship of the first permanent molars was registered as Class I (normal/neutral) when the mesiobuccal cusp of the maxillary first permanent molar occluded with the mesiobuccal groove of the mandibular first permanent molar. A Class II (distal) or Class III (mesial) molar occlusion was recorded when there was a deviation of at least one-half cusp width distally or mesially to Class I, respectively. It was coded as Class I (CL I = 1), II (CL II = 2), and III (CL III = 3) and dichotomized into 0 (CL I), 1 (CL II), and 1 (CL III) for use in cross-tabulation analysis. In the absence of the first permanent molar, the second deciduous molar was used.^[9]

Overjet

Overjet is the distance from the most labial point of the incisal edge of maxillary right central incisor to the most labial surface of the corresponding mandibular incisor measured to the nearest ½ mm, using a metal ruler parallel to the occlusal plane. A positive value (maxillary overjet) was recorded if the upper incisor was ahead of the lower incisor. Maxillary overjet was categorized as 0 – 0–3 mm (normal); 1 – 3.1–5 mm; 2 – 5.1–7 mm; 3 – 7.1–9 mm; and 4 – ≥9 mm. It was considered increased when the value exceeded 3 mm and dichotomized into 0 ≤ 3 mm and 1 > 3 mm (including 1, 2, 3, and 4 categories) for use in cross-tabulation analyses.^[9]

Overbite

Overbite is the vertical overlap of incisors, measured to the nearest ½ mm vertically from the incisal edge of the maxillary right central incisor to the incisal edge of the corresponding mandibular right incisor. If the right central incisor was missing or fractured, it was substituted by the left central incisor. It was coded as 0 – ≤2/3 coverage of lower incisors; 1 – >2/3 coverage of the lower incisor, but less than full coverage; and 2 – greater than or equal to full coverage of the lower incisor. It was then recoded into 0 = absent and 1 = present (including 1 and 2 categories).^[9]

Open bite

An anterior open bite was recorded when there was no vertical overlap of the incisors, measured to the nearest ½ mm. An open bite was coded as 0 – no open bite; 1 – ≤1 mm open bite; 2 – 1.1–2 mm; 3 – 2.1–3 mm and 4 – ≥3.1 mm open bite and recoded into 0 = absent and 1 = present (including 1, 2, 3, and 4 categories).^[9]

Anterior crossbite

An anterior crossbite was registered when lingual positioning of the maxillary anterior teeth in relationship to the mandibular anterior teeth. It was coded as 0 – no crossbite; 1 – one or more teeth edge-to-edge; 2 – one or two teeth in crossbite; and 3 – more than two teeth in crossbite, and it was then dichotomized into 0 = absent (1) and 1 = present (including the 1, 2 and 3 categories).^[9]

Lip competences

Lip position at rest was noted by measuring with a plastic ruler and scored as follows: 0 – lips sealed at rest; 1 – ≤4 mm space between lips at rest; and 2 – >4 mm space between lips at rest. It was then recoded into 0 = lips sealed at rest and 1 = space between lips at rest (including 1 and 2 categories).^[9]

Reliability of data

Re-interview and a test–retest clinical examination were carried out about a month after initial examination. Cohen's Kappa values were calculated accordingly and they ranged from 0.462 to 1.000, which indicated a moderate, substantial, and perfect agreement.^[13] This was done based on double measurements of 80 children.

Statistical analysis

Frequency distributions of different variables were generated in a univariate analysis. Dental caries and early loss of teeth were tested for their statistically significant differences by sociodemographic characteristics, namely sex of the child, parent's education, and parents' occupation using a Chi-square test. The treatment need (cut-off point) was set

at 0–5 no treatment need, 6–14 moderate treatment need, and 15+ definite treatment need. Statistical significant level was set at 5%.

RESULTS

A total of 667 children participated in the study, majority of the participants were (59.5% girls); aged 9 years (52.5%), grade I and nursery school (53.7%), with low educated parents (fathers 59.8% and mothers 75.1%) and with fathers who were informally employed (72.4%) and mothers who were not homemakers (58.6%) [Table 2].

Caries

In the 6-year-olds group, 35.1% of the children had caries affecting up to four teeth; in the 9-year-olds group, 20.2% had caries affecting up to four teeth [Table 3]. For the 6-year-olds, caries mostly affected the primary lower first molars (47.3%), and this was followed by the primary lower second molars (43.9%). In the 9-year-olds, primary lower first molars were mostly affected (33.5%), followed by the lower primary canines (32.3%) [Table 4].

Premature loss of teeth

The 6- and 9-year-olds who had at least one primary tooth prematurely lost comprised 10.7% and 4.9%, respectively, of all the participants [Table 3]. The most common prematurely lost teeth were the lower primary second molars (6%) followed by the lower primary canines (4.4%), for the 6-year-olds. For the 9-year-olds, lower primary second molars (4.9%) were the most common prematurely lost teeth [Table 4].

Occlusal characteristics

Among the 6-year-olds, 89% presented with a Class I molar relationship, according to Angle's classification. In the 9-year-olds, 64% presented with a Class I molar relationship. An overjet of >3 mm was recorded in 20.5% of children aged 6 years. The 9-year-olds with an overjet of >3 mm comprised 36% of all children [Table 5]. A deep bite was recorded in 7.6% of the 6-year-olds and 12.3% of the 9-year-olds [Table 5]. For the younger age group (6-year-olds), an open bite was found in 7.9%, and for the older ones (9-year-olds), it was found in 9.7% [Table 5]. Anterior crossbite was found in 3.5% of the 6-year-olds and 2.6% of the 9-year-olds [Table 5].

Lip incompetencies

Lips were incompetent in 5.7% and 13.7% of the 6-year-olds and 9-year-olds, respectively. These had ≤4 mm space between their lips at rest. In 1.6% and 2% of the 6-year-olds and 9-year-olds, respectively, >4 mm space between their lips at rest was recorded [Table 5].

Table 2: Distribution of participants by sociodemographic characteristics

Variable	Category	n (%)
Age	6	317 (47.5)
	9	350 (52.5)
Sex	Male	270 (40.5)
	Female	397 (59.5)
Grade of the child	Grade II and III	309 (46.3)
	Grade 1 and nursery	358 (53.7)
Father's education	Primary education and below	399 (59.8)
	Secondary education and above	268 (40.2)
Mother's education	Primary education and below	501 (75.1)
	Secondary education and above	166 (24.9)
Father's occupation	Formal employment	184 (27.6)
	Informal employment	483 (72.4)
Mather's occupation	Homemaker	276 (41.4)
	Formal and informal employment	391 (58.6)

Table 3: Percentage distribution of participants by numbers of teeth affected with caries and prematurely lost

Number of teeth	Age 6 years, n (%)		Age 9 years, n (%)	
	Caries	Early loss	Caries	Early loss
0	61 (22.1)	270 (85.2)	140 (40)	332 (94.8)
1	36 (13)	34 (10.7)	52 (14.9)	17 (4.9)
2	52 (18.8)	7 (2.2)	59 (16.9)	1 (0.3)
3	30 (10.9)	6 (1.9)	28 (8)	0 (0.0)
4	97 (35.1)	-	71 (20.2)	-
X	41 (0.1)	-	-	-

X: The number of 6-year-olds whose first permanent molars were not yet erupted

Table 4: Percentage distribution of participants by numbers and type of teeth most commonly affected by caries and early lost

Number of teeth	Age 6 years, n (%)		Age 9 years, n (%)	
	Caries	Early loss	Caries	Early loss
Upper primary canine	128 (40.4)	7 (2.2)	70 (20)	-
Lower primary canine	137 (43.2)	14 (4.4)	78 (32.3)	-
Upper 1 st primary molar	97 (30.6)	8 (2.5)	80 (22.9)	-
Lower 1 st primary molar	150 (47.3)	9 (2.8)	117 (33.5)	-
Upper 2 nd primary molar	111 (35)	9 (2.8)	104 (29.7)	2 (0.6)
Lower 2 nd primary molar	139 (43.9)	19 (6.0)	109 (31.1)	17 (4.9)
Upper 1 st permanent molar	7 (2.2)	-	11 (3.1)	-
Lower 1 st permanent molar	22 (6.9)	-	23 (6.6)	-

Relationship between dental caries, early loss of primary teeth, and sociodemographic characteristics

Regarding the relationship between sociodemographic characteristics and caries as per the IPION index, significantly, many 9-year-old boys than girls had caries (67.4% vs. 55.5%, respectively; $P = 0.032$). Furthermore, many 9-year-olds with more educated parents compared to those with less educated parents had caries (66.4% vs. 55.4% of more than less educated fathers, respectively, $P = 0.046$; and 72.5% vs. 55.6% of more than less educated mothers, respectively, $P = 0.006$).

In addition, many of the 6-year-olds whose mothers were homemakers experienced caries compared to those with mothers who were employed (81.7% vs. 71.0%, respectively; $P = 0.034$) [Table 6]. None of the children (9 years) whose mothers were more educated experienced an early lost tooth, compared to 6.9% of children aged 9 years whose mothers were less educated and had an early lost tooth ($P = 0.005$) [Table 7].

Table 5: Percentage distribution of children with different occlusal characteristics and lips competency

Occlusal characteristics	Age 6 years, n (%)	Age 9 years, n (%)
Angle's classification		
Angle's class I	282 (89)	224 (64)
Angle's class II	35 (11)	126 (36)
Overjet (mm)		
0-3	252 (79.5)	224 (64)
3.1-5	32 (10.1)	67 (19.1)
5.1-7	21 (6.6)	40 (11.4)
7.1-9	7 (2.2)	15 (4.3)
Not measurable	5 (1.6)	4 (1.2)
Overbite		
≤2/3 coverage	293 (92.4)	307 (87.7)
>2/3 but full coverage	17 (5.4)	32 (9.2)
≥full coverage	7 (2.2)	11 (3.1)
Open bite (mm)		
No open bite	292 (92.1)	316 (90.3)
≤1	3 (0.9)	8 (2.3)
1.1-2	10 (3.2)	19 (5.4)
2.1-3	7 (2.2)	2 (0.6)
≥3	5 (1.6)	5 (1.4)
Anterior crossbite		
No crossbite	290 (91.5)	325 (92.8)
1 or more teeth edge-to-edge	16 (5.1)	16 (4.6)
1 or 2 teeth in crossbite	9 (2.8)	9 (2.6)
>2 teeth in crossbite	6 (0.6)	0
Lip competences		
Lips sealed at rest	294 (92.7)	295 (84.3)
≤4 mm space btm lips at rest	18 (5.7)	48 (13.7)
>4 mm space between lips at rest	5 (1.6)	7 (2)

Index for preventive and interceptive orthodontic treatment need scores

IPION scores for both groups are indicated in Figure 1. The scores were grouped into no treatment need, moderate treatment need, and definite treatment need. Moderate need for EOT was obtained in 25.2% and 25.7% of the 6-year-olds and 9-year-olds, respectively. Definite need for EOT was obtained in 46.4% and 37.4% of the 6-year-olds and 9-year-olds, respectively. The overall EOT need revealed that only 32.8% of the participants had no treatment need while 25.5% and 41.7% of all the participants had moderate and definite treatment need, respectively [Figure 1].

DISCUSSION

This study has considered EOT need for malocclusions and its associated sociodemographic characteristics in Tanzanian children using the IPION index. It is the first population-based study to describe the need for EOT utilizing the index. The participants were sampled to represent a population of

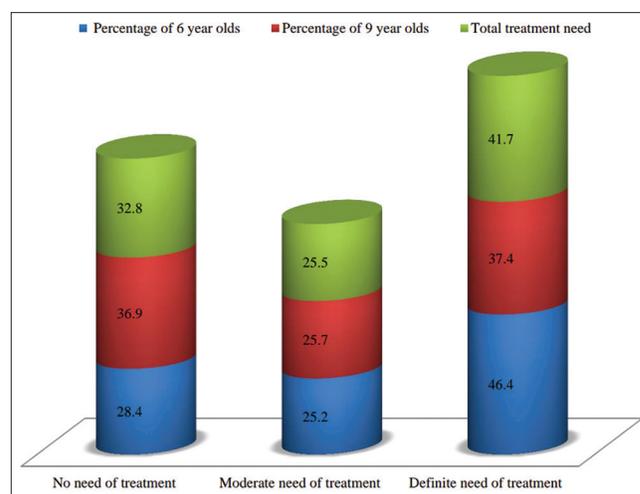


Figure 1: Early orthodontic treatment need in the study participants. Blue color: Percentage of 6-year-old, Red color: Percentage of 9-years-old, Green color: Percentage of total treatment need

Table 6: Percentage distribution of participants by sociodemographic characteristics and caries

Sociodemographic characteristics	Category	6 years			9 years		
		No, n (%)	Yes, n (%)	P	No, n (%)	Yes, n (%)	P
Sex	Boys	27 (19.6)	111 (80.4)	0.087	43 (32.9)	89 (67.4)	0.032*
	Girls	51 (28.5)	128 (71.5)		97 (44.5)	121 (55.5)	
Education	Father (secondary and above)	29 (23.8)	93 (76.2)	0.893	49 (33.6)	97 (66.4)	0.046*
	Father (primary and below)	49 (25.1)	146 (74.9)		91 (44.6)	113 (55.4)	
	Mother (secondary and above)	20 (26.7)	55 (73.3)		25 (27.5)	66 (72.5)	
	Mother (primary and below)	58 (24.0)	184 (76.0)		115 (44.4)	144 (55.6)	
Occupation	Father (formal employment)	15 (17.4)	71 (82.6)	0.079	35 (35.7)	63 (64.3)	0.333
	Father (informal employment)	63 (27.3)	168 (72.7)		105 (41.7)	147 (58.3)	
	Mother (homemaker)	24 (18.3)	107 (81.7)		65 (44.8)	80 (55.2)	
	Mother (employed)	54 (29.0)	132 (71.0)		75 (36.6)	130 (63.4)	

* $P < 0.05$: Statistically significant with 95% confidence interval

Table 7: Percentage distribution of participants by sociodemographic characteristics and early loss of teeth

Sociodemographic characteristics	Category	6 years			9 years				
		No, n (%)	Yes, n (%)	P	No, n (%)	Yes, n (%)	P		
Sex	Boys	115 (83.3)	23 (16.7)	0.430	123 (93.2)	9 (6.8)	0.320		
	Girls	155 (86.6)	24 (13.4)		209 (95.9)	9 (4.1)			
Education	Father (secondary and above)	103 (84.4)	19 (15.6)	0.871	139 (95.2)	7 (4.8)	1.000		
	Father (primary and below)	167 (85.6)	28 (14.4)		193 (94.6)	11 (5.4)			
	Mother (secondary and above)	64 (85.3)	11 (14.7)		91 (100)	0 (0.0)		0.005*	
	Mother (primary and below)	206 (85.1)	36 (14.9)		241 (93.1)	18 (6.9)			
Occupation	Father (formal employment)	73 (84.9)	13 (15.1)	1.000	93 (94.9)	5 (5.1)	1.000		
	Father (informal employment)	197 (85.3)	34 (14.7)		239 (94.8)	13 (5.2)			
	Mother (homemaker)	113 (86.3)	18 (13.7)		0.749	135 (93.1)		10 (6.9)	0.228
	Mother (employed)	157 (84.4)	29 (15.6)			197 (96.1)		8 (3.9)	

* $P < 0.05$

children aged 6 and 9 years in Kinondoni municipality of Dar es Salaam region. Moreover, no one among the participants had received interceptive or corrective orthodontic treatment. In studies describing occurrence of malocclusions in a particular population, it is recommended that participants should be taken from a population of nonorthodontically treated individuals.^[14] Therefore, the current study conforms to the standard methodology. Due to cost implications, no X-rays were taken and clinical findings were based only on the clinical examination. This might over- or under-estimate the findings obtained. However, examination was in line with the IPION index requirements.^[9] Hence, the findings give a reasonably indication of EOT in children of Kinondoni municipality of Dar es Salaam region in Tanzania.

The sociodemographic profile of parents of the present participants showed that most parents/guardians of the children who were involved had primary education level and below. This profile conforms well to the profile of parents of most children attending public schools in Tanzania.^[15]

In this study, various occlusal traits and other conditions related to malocclusions were investigated in children who participated. Considering all the clinical parameters examined for the purpose of determining the EOT need for malocclusions, dental caries was the most common condition associated with the IPION scores. This may be due to schoolchildren's snacking behaviors since children are able to access sugary snacks and drinks available around their schools premises. Another factor that could have contributed on top of children's snacking behavior is the children's low fluoride exposures. The finding obtained is also in line with those reported in other studies elsewhere.^[10,16,17] Moreover, 77.9% of the 6-year-olds and 60% of the 9-year-olds had at least one tooth affected by caries, and many of their lower primary teeth were affected by caries. This result supports what was documented in the World Health Organization report, which highlighted that 60%–90% of the schoolchildren

population is affected by caries.^[18] In addition, the high prevalence of caries in 6-year-olds could be explained by inadequate toothbrushing supervision by their parents, inadequate toothbrushing skills, and poor manual dexterity during their toothbrushing process.^[19]

Premature loss of primary teeth was as well recorded in the present study. This is an environmental etiological factor for malocclusions, and it is an important component of the IPION index.^[9] In the current study, early loss of primary teeth was seen in 14.8% of the 6-year-olds and in 5.1% of the 9-year-olds. Nonetheless, the children who were found currently with premature primary teeth loss are fewer than those reported in other studies.^[10,20] The main reason behind losing teeth prematurely among the participants in this study could be early teeth extractions due to caries. In Tanzania, extractions is the treatment modality offered to many of those who demand dental care to relieve dental pain, due to dental caries.^[21] Usually, when premature extractions are done, the placement of space maintainers to preserve spaces for the coming permanent teeth is often recommended to prevent migration of adjacent teeth.^[11] Thus, without space maintainers, spaces for permanent teeth may be lost with likelihood of the child to develop crowding in future. The other consequences of losing spaces for permanent teeth can be impaction of the permanent canines and inter incisive line diversion.^[22]

As regards the commonly missing teeth currently, the second lower primary molars were mostly affected. This finding is in contrast to those obtained by researchers in other parts of the world.^[10,17,20] In those studies, lower first primary molars were found to be the most frequently extracted teeth. The pattern of losing lower molars was explained as being the effect of chronological age, exposure of those teeth to the oral environment, food becoming packed in these teeth, accumulation of dental plaque, and bacterial metabolism.^[23] It should be noted that all those factors can be aggregated as the child ages. It should further be understood that the

outcome of losing early a second primary molar can be an altered molar relationship in the future.^[20]

As regards occlusal characteristics, majority of the current participants were found with a Class I molar relationship according to classification by Angle. This was found in 89% of children aged 6 years and 64% of 9-year-olds. The finding is in line with the prevalence obtained from previous Tanzanian studies which found Class I molar relationship as being a dominant molar relationship in their participants.^[24,25]

The other occlusal characteristics assessed included the overjet, overbite, open bite, and crossbites. The prevalence of an altered overjet in the 6 and 9-year-olds was 18.9% and 34.9%, respectively. This result is comparable to those obtained in previous Tanzanian studies and elsewhere.^[24,25]

Currently, an overjet of more than 5 mm was found in 8.8% of the 6-year-olds and 15.7% of the 9-year-olds. These findings support those obtained in other studies.^[10,17,24]

In this study, the prevalence of deep bite among 6- and 9-year-old children was found to be 7.6% and 12.2%, respectively. This finding is contrary to that reported in Canadian children^[8] but analogous to that obtained in Romania.^[10] At present, few 6- and 9-year-olds had greater than or equal to full coverage of the lower incisors, when their teeth were assessed for overbite status. This finding is in contrast to that reported among Tanzanian children.^[24] It should be recognized that deep bite is a condition with detrimental effects, such as temporomandibular joint (TMJ) problems, attrition of the anterior teeth, direct trauma of the palatal gingiva, periodontal problems, and restriction of the development of the mandibular anterior dentoalveolar process. In addition, deep bite is a condition which is difficult to treat.^[26] Thus, early recognition of its presence and its subsequent early intervention is crucial.

In this study, anterior open bite prevalence was lower than that reported in earlier Tanzanian studies.^[24,25] However, other studies reported a higher prevalence of anterior open bite among the children of Canada and Romania, respectively.^[8,10] Open bite is a malocclusion that can be associated with multiple functional disorders, namely; atypical swallowing of protrusion type, oral breathing problems, and phonetic disorders.^[27] Hence, indication of its early interception is worthy of consideration.

Regarding the presence of anterior crossbite in the current participants, findings obtained were comparable with a study done among 6- and 9-year-old Canadian children.^[8] It is recommended that all forms of crossbites should be treated

as early as possible upon detection, and untreated crossbites may lead to unfavorable growth changes in the TMJ and altered skeletal and dental patterns.^[28] An anterior crossbite should also be treated timely to prevent upper incisors to traumatically occlude with the lower incisors. Such traumatic occlusion may potentially have adverse outcomes, including periodontal problems, subsequent mobility of teeth, and even fractures.^[8]

Each child in this study was examined extraorally for competency of the lips; the 6-year-olds and 9-year-olds who had less or more than 4 mm space between lips at rest presently were more than those reported elsewhere.^[27]

Measurements of caries, early tooth loss, lip competency, and occlusal characteristics were used to calculate the IPION scores. In this study the IPION scores indicated that 32.8% of the participants had no treatment need. However, 25.5% and 41.7% of all the participants had moderate and definite EOT need, respectively. Thus, the needs for EOT in these children were generally high. This finding is somewhat similar to that reported in Syria.^[16] The current 6-year-olds and 9-year-olds who were categorized into the moderate-to-definite treatment need group comprised, respectively, 71.6% and 63.1% of all children. It is imperative to say that these children would benefit from EOT, regardless their skeletal patterns. The present IPION scores are higher compared to those obtained in other studies.^[10] Nevertheless, these results are in line with those reported in the United States of America, where their 6-year-olds and 9-year-olds had EOT need of 75% and 87%, respectively.^[17] The obtained higher IPION scores in this study are possibly due to inadequate access to dental services and lack of commitment among busy parents. All these factors are important when it comes to accessing oral health care and maintaining good oral health status of children. Furthermore, comparison between boys and girls currently in bivariate analysis revealed that, many boys than girls had more dental caries, and this might have contributed to the high IPION scores. Boys compared to girls are likely to have oral health detrimental behaviors.^[29] Thus, there is a need to set specific preventive and interceptive orthodontics interventions, focusing on these particular children.

CONCLUSION AND RECOMMENDATION

The occurrence of the need for EOT for malocclusions was high in schoolchildren of Kinondoni municipality, Dar es Salaam, Tanzania. The study revealed that about half of the participants had definite EOT need according to the IPION scores. The sociodemographic characteristics associated with the overall IPION score were mainly sex of the child, parent's education, and parents' occupation. The children

would therefore benefit from preventive and interceptive orthodontic treatment programs. The programs should target nursery schoolchildren as well as primary schoolchildren, together with their parents. They can be in terms of efforts such as providing school oral health interventions, oral health education sessions, and provision of continuous oral health information.

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Conflicts of interest

There are no conflicts of interest.

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