ORIGINAL ARTICLE

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Oral hygiene measures and the periodontal status of school children

Abstract: Background: Tooth brushing and other mechanical cleaning procedures are considered the most reliable methods of effective plaque removal, which is essential for prevention of periodontal diseases. Objective: To investigate the relationship between oral hygiene practices, socioeconomic status and gingival health in a group of Nigerian children. Methods: Our study population consisted of 242 randomly selected school children in Ile-Ife, Nigeria. Participants completed a questionnaire on oral hygiene measures, their gingival health was assessed using oral hygiene index (OHI), plaque index (PI) and index of gingival inflammation (GI). Results: Toothbrushing once daily was the most common practice (52.1%). Toothbrush with a fluoride-containing toothpaste was the most common tooth cleaning aid, while the up and down brushing technique was predominantly used. There was no statistically significant gender difference in toothbrushing frequency; however, significant gender differences were observed in PI and OHI scores (P < 0.05). Gingivitis was absent in 28.9% of the children, while 50.8% had mild, 13.6% moderate and 6.6% severe gingivitis. There was a weak but significant negative correlation between oral hygiene frequency and GI (P < 0.05). Socioeconomic status had no relationship with oral hygiene frequency, however it had low but significant correlation with OHI and GI (P < 0.05). A logistic regression analysis of the predictors on gingivitis showed that male gender and medium textured toothbrush had significant association with gingival health. Conclusions: Gingival health was influenced by gender, socioeconomic status, oral hygiene frequency and toothbrush texture. Motivation to apply instructions given on oral health care and regular reinforcement are essential.

Key words: children; gingivitis; oral hygiene; toothbrushing

Introduction

Bacterial plaque is the primary aetiologic agent in the development of periodontal disease and dental caries which have been the most common diseases afflicting the human mouth (1). Plaque is a tenaciously adherent deposit that forms on all tooth surfaces. It consists of an organic matrix containing a dense concentration of bacteria. Small amounts of plaque are compatible with gingival and periodontal health, (2) but larger amounts for prolonged periods lead to the development of periodontal diseases. Plaque becomes visible on the surfaces of teeth when tooth brushing stops for 12–24 h. It can be seen with the naked eye or with the use of disclosing agents. If tooth brushing is neglected for several days plaque



grows in thickness and becomes about 100–300 cells thick (3), reaching its maximum extent in about a week with occlusal and incisal extensions.

Periodontal disease may be as old as mankind itself (1). A relationship between oral hygiene and gingival disease is described in ancient writing and today a lot of evidence has been amassed to support this idea. Epidemiological studies in different parts of the world demonstrate a direct correlation between the amount of bacterial deposit as measured by oral hygiene indices and the severity of gingival inflammation (4). It has also been shown that oral hygiene control reduces the incidence of gingivitis and is essential to dental and periodontal health throughout life (5).

Plaque control, which involves its active removal, is a responsibility undertaken personally by individuals. Today, most people exercise some measure of oral hygiene especially tooth brushing however variations exist in toothbrush design, brushing techniques, frequency of brushing and brushing time. Very few people brush their teeth well enough at any time that all plaque is removed.

A number of factors may affect an individual's oral hygiene practices such as age, gender, education, level of awareness and socioeconomic status. It has been stated that there is an association between higher socioeconomic status and lower risk of unhealthy oral health related behaviours (6). Anagnou-Vareltzides et al. (7) found sex, toothbrushing frequency and socioeconomic class, were statistically significant in relation to GI among school children in Athens. In Nairobi, Ng'ang'a and Valderhaug (8) found that oral hygiene practices and status were poorer among children from low socioeconomic status. However, Sarita and Tuominen (9) reported that sociodemographic factors were not significantly associated with the occurrence of plaque calculus or gingival bleeding. Mahesh Kumar et al. (10) noted healthy oral hygiene practices in school children irrespective of their socioeconomic status while Santo et al. (11) in Brazil also found that oral hygiene habits were not associated with oral hygiene quality in the primary dentition of a group of children.

Certain groups of people are more receptive to information and instruction than others. Adolescents with a developing awareness of self and interest in their general appearance and wellbeing are expected to be very receptive and thus possess excellent oral hygiene practices.

Although studies have been carried out in other parts of the world, little attention has been focused on oral hygiene practices, socioeconomic status and gingival health in Nigeria. Periodontal disease and dental caries are still the two most common oral diseases affecting the Nigerian population (12). We therefore conducted this study to investigate the relationship between oral hygiene practices, socioeconomic status and gingival health of a group of Nigerian children.

Materials and methods

The study was conducted among school children in Ife central local government area of Ile-Ife, Nigeria. Ile-Ife is a city in

south-western Nigeria located in Osun State, with a population of 501 952. It is home to the Obafemi Awolowo University and Obafemi Awolowo University Teaching Hospitals Complex. The people are of the Yoruba ethnic group, one of the largest ethnic groups in Africa. The preponderant majority work in the public institutions while others are farmers, traders and artisans (13).

Ethical clearance was obtained from the Ethics Committee of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) Ile-Ife. Approval was also obtained from the appropriate school authorities. To obtain the sample, a list of all the government-approved public and private secondary schools in the local government was obtained. To ensure an even socioeconomic distribution, four of them were selected after stratifying into public and private schools. Children were thereafter selected by a two-stage sampling technique from each school. All the selected children were within the ages of 11–14 years.

After obtaining the consent of the children and their parents, self-administered pre-tested questionnaires were completed independently by the children. It was an 11-item questionnaire which focused on the frequency, method and cleaning aids used by respondents in their routine oral hygiene practices.

Socioeconomic status for the purpose of this study was determined by the standard occupation classification designed by the Office of Population Census and Surveys, London (OPCS 1991) (14). A scoring index is determined according to a person's occupation; for children of parents who are married to each other, according to the occupation of the father as stated at the registration of event; for children of parents who are not married to each other according to the occupation of the mother. The occupations were grouped into the following classes:

Social class I: Professional occupations

Social class II: Managerial and technical occupations

Social class III: (NM) Skilled occupations (Non manual)

Social class III: (M) Skilled occupations (manual)

Social class IV: Partly skilled occupations

Social class V: Unskilled

Social classes I and II were grouped as high, classes III (NM) and III(M), middle and classes IV and V as low-socio-economic class.

Following the completion of the questionnaires all the children were examined by one of the investigators (E.O.O). oral hygiene index (15) and plaque index (16) were used to assess the oral hygiene status of the children. The index of gingival inflammation (GI) (17) was used to assess gingival condition.

Data was analysed on computer using the statistical package for social sciences spss version 11. Descriptive statistics, chi-square and correlation coefficient tests were used to examine the relationship between oral hygiene frequency, socioeconomic status and the gingival health. Logistic regression analysis of the predictors on gingivitis was also done.

	Socioeconomic class				Toothbrushing frequency			
Sex	Upper	Middle	Lower	Total	Occasionally	Once daily	Twice daily or more	Total
Female	68 (28.1)	34 (14.0)	21 (8.7)	123 (50.8)	9 (7.3)	65 (52.9)	49 (39.8)	123 (50.8)
Male	57 (23.6)	30 (12.4)	32 (13.2)	119 (49.2)	7 (5.9)	61 (51.3)	51 (42.8)	119 (49.2)
Total	125 (51.7) χ ² 3.44, d.f	64 (26.4) . = 2, <i>P</i> = 0.17	53 (21.9) 79	242 (100)	16 (6.6) χ ² 0.35; d.f. =	126 (52.1) 2, <i>P</i> = 0.839	100 (41.3)	242 (100)

Table 1. Distribution of sample according to socioeconomic class and toothbrushing frequency

Results

There were 123 female and 119 male respondents, their mean age was 12.63 ± 1.06 years. Most of the children were in the upper social class (51.7%), 26.4% middle and 21.9% the lower socioeconomic class. There was no statistically significant gender difference in socioeconomic class distribution and tooth brushing frequency (Table 1).

The majority of the children brushed their teeth once a day (52.1%), 41.3% brushed twice or more daily while only 6.6% reported that they brushed occasionally. There was no statistically significant difference between the socioeconomic classes in their frequency of tooth brushing (P = 0.247).

Brushing up and down was the most common technique (68.2%), followed by scrubbing across (26.4%). Toothbrushing was carried out for less than a minute by 17.4%, about half (50.8%) brushed for a duration of 1-2 min, while 31.8% of the children brushed for a longer period.

Toothbrush with fluoride-containing toothpaste was used by the majority (83.1%), 8.7% used the toothbrush without any paste, one of the children used only the local chewing stick. The medium textured toothbrush was predominantly used (58.3%), 22.3% used the soft textured, while 19.4% used the hard textured brushes. The medium sized toothbrush head was also the most common (71.1%), 13.2% used toothbrushes with a small head, while 15.7% used toothbrushes with a large head. Most of the children changed their toothbrushes after 1 and 3 months of use (57.4%), 28.9% only when the bristles are bad. Four of the children reported that they do not change their tooth brushes regularly. Less than 10% of the children used dental floss, while majority reported not knowing about dental floss. About three quarters of the children (74.8%) had never visited a dentist.

The plaque index score showed that 3.7% of the participants had a score of 0, 38% had 1 i.e. film of plaque visible only by removal on probe, most of the children (55.8%) had 2 indicating moderate accumulation of plaque which can be seen by the naked eye, 2.5% had a score of 3 indicating heavy accumulation of soft material. There was a significant gender difference in plaque index scores (P = 0.002) (Table 2).

Table 3 shows the oral hygiene index scores, 17.8% had good oral hygiene, 50.4% were rated fair while 31.8% had poor oral hygiene. The male and female participants also had statistically significant differences in OHI scores (P = 0.029).

Table 2. Relationship of plaque index scores with toothbrushing frequency

PI score	Occasionally, n (%)	Once, n (%)	Twice or more, <i>n</i> (%)	Total, n (%)
0	0 (0)	3 (1.2)	6 (2.5)	9 (3.7)
1	3 (1.2)	46 (19.0)	43 (17.8)	92 (38.0)
2	13 (5.4)	72 (29.7)	50 (20.7)	135 (55.8)
3		5 (2.1)	1 (0.4)	6 (2.5)
	16 (6.6)	126 (52.0)	100 (41.4)	242 (100)

 $\chi^2 = 9.799$, d.f. = 6, P = 0.133.

r = -0.160, P = 0.012.

Gender difference $\chi^2 = 14.42$, d.f. = 3, P = 0.002.

Table 3. Relationship of oral hygiene index scores with toothbrushing frequency

OHI	Occasionally,	Once,	Twice or	Total, <i>n</i> (%)
score	n (%)	n (%)	more, <i>n</i> (%)	
Good	1 (0.4)	16 (6.6)	26 (10.7)	43 (17.7)
Fair	10 (4.1)	63 (26.0)	49 (20.2)	122 (50.4)
Poor	5 (2.1)	47 (19.4)	25 (10.3)	77 (31.8)
	16 (6.6)	126 (52.0)	100 (41.4)	242 (100)

 $\chi^2 = 9.99$, d.f. = 4, P = 0.041.

r = -0.168, P = 0.009.

Gender difference $\chi^2 = 7.08$, d.f. = 2, P = 0.029.

Table 4. Relationship of gingival index scores with tooth brushing frequency

GI score	Occasionally	Once	Twice or more	Total
0 (no gingivitis) 0.1–1.0 (mild ainaivitis)	2 (0.8) 11 (4.5)	31 (12.8) 66 (27.3)	37 (15.3) 46 (19.0)	70 (28.9) 123 (50.8)
1.1–2.0 (moderate gingivitis)	1 (0.4)	23 (9.5)	9 (3.7)	33 (13.6)
2.1–3.0 (severe gingivitis)	2 (0.8)	6 (2.5)	8 (3.3)	16 (6.6)
	16 (6.6)	126 (52.0)	100 (41.4)	242 (100)

 $\chi^2 = 12.06$, d.f. = 6, P = 0.061.

r = -0.136, P = 0.034.

Gender difference $\chi^2 = 2.86$, d.f. = 3, P = 0.414.

Based on the GI score, 28.9% had no gingivitis, 50.8% mild, 13.6% moderate and 6.6% severe gingivitis (Table 4), however there was no gender difference in gingival index score (P = 0.414).

Results of correlation tests between oral hygiene frequency, socioeconomic class and the gingival index gave weak but significant correlations (P < 0.05). Socioeconomic status had no relationship with oral hygiene frequency (P = 0.006), it was however significantly correlated with GI (Table 5).

A logistic regression analysis of the predictors on gingivitis showed that male gender and medium textured toothbrush had significant association with gingival health (OR 1.97, 0.41 respectively) (Table 6). Other factors such as toothbrushing frequency, method, duration or type of dentifrices were not significant predictors. Predictor selection was done using the best fit option and predictors were selected based on literature and pathophysiology of gingivitis.

A Hosmer-Lemeshow goodness-of-fit test was done to confirm the consistency of the model (P = 0.1560). A test of heterogeneity for the odds ratios of the different categories of oral

Table 5. Relationship of socioeconomic class with gingival index scores

GI score	Upper	Middle	Lower	Total
0 (no gingivitis) 0.1–1.0 (mild gingivitis)	45 (18.6) 58 (24.0)	14 (5.8) 41 (16.9)	11 (4.5) 24 (9.9)	70 (28.9) 123 (50.8)
1.1–2.0 (moderate aingivitis)	16 (6.6)	6 (2.5)	11 (4.5)	33 (13.6)
2.1–3.0 (severe	6 (2.5)	3 (1.2)	7 (2.9)	16 (6.6)
gingivitis)	125 (51.7)	64 (26.4)	53 (21.9)	242 (100)

 $\chi^2 = 14.85$, d.f. = 6, P = 0.021.

r = 0.175, P = 0.006.

Table 6. Logistic regression output on the predictors of gingivitis

Predictor	Odds ratio	95% CI	P value
Male sex	1.97	1.02, 3.71	0.041*
Age (in years)	1.37	1.00, 1.87	0.05
Socioeconomic class II	1.79	0.83, 3.84	0.136
Socioeconomic class III	1.37	0.55, 3.41	0.493
Oral hygiene frequency			
Once daily	0.59	0.11, 2.99	0.520
Twice or more daily	0.28	0.05, 1.43	0.126
Toothbrushing material			
Brush with nonfluoride paste	0.79	0.24, 2.57	0.69
Brush without paste	0.44	0.15, 1.27	0.13
Toothbrushing method			
Up and down	0.86	0.42, 1.75	0.67
Rolling motion	0.78	0.19, 3.26	0.73
Toothbrushing duration			
1–2 min	0.46	0.17, 1.25	0.12
≥5 min	0.56	0.20, 1.54	0.26
Toothbrush texture			
Medium	0.41	0.17, 0.98	0.045*
Hard	1.07	0.34, 3.34	0.91
Toothbrush head size			
Medium	1.29	0.44, 3.79	0.64
Large	0.67	0.18, 2.50	0.55

*Statistically significant, P < 0.05.

hygiene frequency was significant (P = 0.0433), however there was no observable trend (P = 0.1255).

Discussion

Poor oral health is a silent epidemic that can create a burden on quality of life if neglected (18). The objectives of this study were to investigate the oral hygiene practices of a group of children and examine the relationship between oral hygiene practices, socioeconomic status and gingival health. The results of this study showed that the majority of the children brushed their teeth once a day. Tewari *et al.* (19) showed that even after oral health education most of the participants in a study who were school children still practiced toothbrushing once daily. Santo *et al.* (11), however, reported brushing twice daily among Brazilian children although his sample consisted of young children in whom toothbrushing was the responsibility of their parents.

Despite an attempt to get an even socioeconomic spread by selecting children from both public and private schools, about half of the participants were in the upper socioeconomic class. This could be a limitation of the method of determining socioeconomic status which was based on the occupation of parents rather than the family income.

There was no statistically significant difference between the socioeconomic classes in their frequency of tooth brushing. This is similar to the findings of Mahesh Kumar *et al.* (10) who found healthy oral hygiene practices irrespective of socioeconomic status, but differs from the findings of Ng'ang'a and Valderhaug (8) in Nairobi. Reisine *et al.* (20) also found that individuals from the lower socioeconomic strata find it hard to obtain professional health care and live in healthy environment resulting in development of negative behaviours towards their oral health.

Although it is no longer accepted that only one method of toothbrushing is correct and the rest are not, brushing up and down was the most common method of tooth brushing in this study. This differs from Loe's report (1) that the most common brushing method used by individuals is a horizontal scrubbing technique characterized by back and forth motion on the occlusal and buccal surfaces of teeth. Children as well as adults need to understand that for effective plaque removal tooth brushing needs to be carried out methodically. A lot of individuals just carry out frantic activity with the tooth brush without effectively removing plaque.

The most common toothbrushing duration among children in this study is similar to the findings of Macgregor and Rugg-Gunn (21). Although market research indicates that females change their brushes more frequently than males, three of the four children who reported that they do not change their toothbrushes regularly were females.

The medium textured toothbrush which was the most commonly used toothbrush texture in this study had significant association with gingival health. Its use should therefore be encouraged as the abrasive wear of the hard toothbrush has been found to be one of the most common contributors to the presence of tooth sensitivity among a group of Nigerian University students (22).

The use of dental floss was not popular amongst the children. Many of them did not even know the dental floss. About three quarters of the children had never visited a dentist. This is a reflection of the low dental awareness exhibited by the preponderant majority of Nigerians (12). As expected most of those who had visited the dentist were from the upper socioeconomic class. In comparison to developed countries where people seek dental care regularly, many Nigerians face challenges accessing dental care and suffer a disproportionate share of dental disease. Financial constraints, non availability of dental services, transportation costs and lack of basic awareness of oral health issues, are some of these challenges (18). The most important of these challenges, however, appears to be low dental awareness. Nigerian secondary and university students have been found to be deficient in dental awareness (23, 24).

Although there was no significant gender difference in tooth brushing frequency statistically significant gender differences were found in PI and OHI scores. The female participants had better scores which is in agreement with previous studies (25, 26). A high frequency of tooth cleaning may not necessarily translate to thoroughness. Frequency and thoroughness with tooth brushing may really be separate issues. From the logistic regression analysis of the predictors on gingivitis, male gender was found to have significant association with gingival health. It is possible that the male participants were lax with their oral hygiene measures.

Reports on the relationship between tooth brushing frequency and the state of oral hygiene have given conflicting results (1). This study showed low correlations between oral hygiene frequency and the periodontal indices used (P < 0.05). This is similar to the report of Bergstom and Eliasson (27) and Ylostalo *et al.* (28). The accuracy of self-reported toothbrushing frequency is questionable. A lot of the children had a good knowledge of the ideal frequency of tooth brushing but may not actually practice it. This knowledge could have influenced the observed responses.

Improved socioeconomic status, better education and increased capabilities on the part of the profession in delivering state of the art preventive and therapeutic services have been stated as part of the means of improving oral health in this millennium (1). The dental profession has the responsibility of not only educating the children on good oral hygiene measures but motivating them to apply the advice given. Motivation involves an explanation of the advantages of taking professional advice as well as the disadvantages of ignoring them. Information given in abstract form may be difficult to understand and can be quickly forgotten. Oral health care instructions accompanied with practical demonstrations may be more meaningful to school children.

Involvement of school teachers in oral health education and inclusion of instructions on oral health care in the curriculum of schools may also be beneficial. Unlike the dental practitioner who visits occasionally, teachers are always on ground with the children. Their involvement in administering oral hygiene instructions may therefore make more impact through reinforcement. Traditionally, teachers carry out inspections of children's fingernails, clothing, hair, etc. There may be a need to also check on the oral hygiene of school children.

Conclusions

Our results show that toothbrushing once daily with a fluoride containing toothpaste was the most common practice among this group of children. There was no significant gender difference in toothbrushing frequency; however, statistically significant gender differences were observed in OHI and PI scores. Gingival health was influenced by the socioeconomic status and oral hygiene frequency. Male gender and medium textured toothbrush were also found to have significant association with gingival health.

The dental profession has the responsibility of educating children on good oral hygiene measures. Motivation to apply instructions given on oral health care especially to the male gender and regular reinforcement are essential.

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