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Original Research Article

Oral hygiene practices and their influence on the oral health of adolescents

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ABSTRACT

Background: Oral diseases are major public health problems due to their high prevalence and significant social impact. Oral hygiene practices play a critical role in their prevention and control. This study was carried out to evaluate oral hygiene practices and oral status among adolescents in Mangalore taluk, taking into account differences based on location and type of school.
Methods: A descriptive cross-sectional study was carried out among 1340 students enrolled in public and private high schools in urban and rural areas of Mangalore taluk. The study sample was equally distributed among urban and rural areas, and among public and private schools. Proforma was prepared to record demographic data, oral hygiene practices, dental caries and periodontal disease. Data were analyzed using Chi-squared test and t-test, with $p<0.05$ considered statistically significant.
Results: Majority of the students used toothbrush and toothpaste to clean their teeth. Horizontal tooth brushing motion and once/twice daily tooth brushing frequency was reported by the highest number of students. Good oral hygiene was found among 55.2% participants. Female participants, urban children and those attending private schools presented with better oral hygiene. Prevalence of dental caries was 59.2%. Prevalence of gingivitis was 83.2%, with higher prevalence among females and rural participants. Poor oral hygiene was found to be associated with gingivitis ($r=0.59$).
Conclusions: Although majority of the participants reported use of requisite oral hygiene aids and regular tooth brushing habits, the high prevalence of oral disease among them can be attributed to poor oral hygiene.

Keywords: Adolescents, Oral hygiene, Oral hygiene aids, Rural, Schools, Urban

INTRODUCTION

Oral health is a state of health of the oral and perioral tissues which enables an individual to eat, speak and socialize without discomfort or embarrassment and contributes to general well-being. Healthy oral tissues are a prerequisite for the physical, social, emotional and psychological development and well-being of a child, and therefore, a major influence on the quality of life. Oral diseases are major public health problems due to their high prevalence and significant social impact. Millions of people around the world suffer from dental caries and periodontal disease which, if untreated, lead to pain, difficulty in chewing, swallowing, speaking, and an increased financial burden.[1,2]

Children who suffer from poor oral health are 12 times more likely to have more restricted-activity days, including

missing school, than those who do not.[3] Oral diseases such as dental caries and gingivitis occur as a result of plaque accumulation and poor oral hygiene habits.[4,5]

Gingivitis, caused due to release of bacterial toxins from plaque, may manifest as redness, swelling and gingival bleeding.[6] Dental caries leads to destruction of calcified tissues of the teeth.[7,8] Therefore, oral hygiene practices play a very important role in their prevention and control. Plaque removal is the main goal of oral hygiene practice. Tooth brushing is the most commonly used method for plaque removal and oral hygiene maintenance while the toothpaste used contains various therapeutic compounds which play a role in the prevention and treatment of oral diseases. Regular twice daily tooth brushing is the best way to maintain oral health.

Oral hygiene practices depend on age, gender, awareness, economic status of an individual and availability of oral hygiene aids. These practices are usually formed and established during adolescence and continue to be practiced throughout life. During adolescence, the individual gains more independence in oral care as parental involvement reduces. Increased autonomy may lead to inadequate oral hygiene practices and a greater risk of dental caries and early periodontal disease.[4,5]

Schools in India are predominantly either public schools which are funded and managed by the government, or private schools which are privately managed and funded. Parental socio-economic status often determines the school a child attends and, therefore, can be considered an indicator for socioeconomic status.[9,10]

Oral diseases can be intercepted through formulation of appropriate policies and effective implementation of preventive programmes. This requires documentation of oral health practices followed by the target population. There is paucity of data on oral hygiene practices among adolescents in Mangalore taluk. Therefore, this study was carried out to evaluate oral hygiene practices and oral status among adolescents in Mangalore taluk, taking into account differences based on location and type of school.

METHODS

This descriptive cross-sectional study was carried out from January 2013 to March 2015 to evaluate oral hygiene practices and oral status of adolescents enrolled in public and private high schools in urban and rural areas of Mangalore taluk. Spread over an area of 834 square kilometres with a population of approximately 882,856, Mangalore taluk has a literacy rate of 89.9%, and a population density of 1048 persons per square kilometre.[11]

Selection of study sample

Schools in Mangalore taluk were bifurcated into urban and rural divisions based on location. The investigator explained the purpose of the study to the Block Educational Officers of both divisions and obtained permission to carry out the study. Totally, there were 191 schools, 70 urban (38 public and 32 private) and 121 rural (62 public and 59 private). Sample size was calculated based on available data12 and determined to be 1340. The study sample was equally distributed to urban and rural areas (670 children each), and then among public and private schools (i.e., 335 children each). After obtaining Ethical clearance (reference number YUEC/89/11/8/12), public and private high schools in urban and rural areas were selected by stratified cluster sampling and permission was obtained from school authorities.

In these schools, all students who fulfilled the inclusion criteria were examined till the required sample was obtained male and female children studying from eighth to 10th standard, present on the day of survey, and assenting to participate in the survey. Written informed consent was obtained from the parents of all participants.

Data collection instrument

A proforma was prepared to record demographic data (name of the student and school, date of birth, age, gender, class, and location and category of school), oral hygiene practices (oral hygiene aids used, method and frequency of tooth brushing, frequency of changing tooth brush), oral hygiene status (using Simplified Oral Hygiene Index - OHI-S), dental caries (using Decayed, Missing and Filled Teeth Index - DMFT Index), and periodontal status/gingivitis (using Community Periodontal Index - CPI).[13,14]

Examination procedure

The investigator was trained prior to starting the study. The oral status of 30 high schoolchildren was recorded using the study instrument on two occasions over two successive days. Intra-examiner reliability, assessed using kappa statistic, was found to be 0.84. Calibration of the investigator was also carried out in twice during the study period and the kappa statistic ranged from 0.80-0.84. The investigator was assisted by two recording clerks who attended the calibration exercises and accompanied the investigator to all the schools during data collection. Duplicate examinations of 70 randomly selected study subjects were carried out at the beginning, mid-way and at the end of the survey. Intra-examiner reliability (assessed using the kappa statistic) was found to average 0.82.

Autoclaved instruments were used for oral examination. Before starting examination, written assent was obtained from each participant. Oral examinations were performed under adequate natural light with the children positioned so as to receive maximum illumination.

Statistical analysis

Data were entered into the Statistical Package for the Social Sciences (SPSS) Version 21.0 and analyzed using

the Chi-squared ($\chi 2$) test and t-test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Demographic profile of study participants

The study population comprised 773 boys and 567 girls ranging in age from 11 to 18 years (mean age of 13.91±1.17 years) from six urban (three public and three private) and four rural (two public and two private) schools. Boys outnumbered girls among the participants, majority of whom (80.6% boys and 81.3% girls) were in the 13-15-year age group. Exclusions were those who refused to participate and numbered 23.

Type of dental cleaning aid and dental cleaning material used

Except one urban student from a public school who cleaned his teeth using finger, all other students used a toothbrush. Choice of cleaning aid was not influenced by gender, location or category of school. Majority of children (99.4%) used toothpaste to clean their teeth while 0.4% children used tooth powder. One rural male student from a private school reported use of both toothpaste and tooth powder, while a rural female student from a public school reported using ash to clean her teeth. It was seen that type of dental cleaning material used not influenced by gender, location or category of school.

Method of tooth brushing

Use of horizontal brushing motion was reported by the highest number of students. Significantly higher percentage of girls used horizontal brushing method (χ^2=18.18; p<0.001). When this variable was assessed according to location and category of school (Table 1), highly significant differences were found between urban and rural areas (χ^2=12.83; p=0.005) and between public and private schools (χ^2=14.05; p=0.003).

Frequency of tooth brushing

Most of the urban and rural students, and most children from public and private schools cleaned their teeth either once or twice a day (Table 1). Males showed greater frequency of once daily tooth brushing while female children reported a higher frequency of twice daily tooth brushing, the difference being statistically significant (χ^2=13.13; p=0.004). Comparison of once, twice and thrice daily brushing frequencies showed statistically significant differences between urban and rural children (χ^2=55.59; p<0.001), and also between children from public and private schools (χ^2=18.79; p<0.001).

Frequency of changing toothbrush

A majority of schoolchildren (88.1%) in both urban and rural areas, and in both public and private schools changed their toothbrush within 3 months of use. Frequency of change of toothbrush was not influenced by gender, location or category of school (p>0.05).

Table 1: Distribution of participants according to method and frequency of tooth brushing.

Variables	Urban schools	Rural schools	Public schools	Private schools
	N (%)	N (%)	N (%)	N (%)
Method of tooth brushing				
Horizontal	449 (67.0)	503 (75.1)	452 (67.5)	500 (74.7)
Vertical	87 (13.0)	59 (8.8)	72 (10.7)	74 (11.0)
Combined	132 (19.7)	108 (16.1)	144 (21.5)	96 (14.3)
Circular	02 (0.3)	00 (0.0)	02 (0.3)	00 (0.0)
Total	670 (100.0)	670 (100.0)	670 (100.0)	670 (100.0)
Frequency of tooth brushing				
Once daily	343 (51.2)	211 (31.5)	314 (46.8)	240 (35.8)
Twice daily	321 (47.9)	443 (66.1)	349 (52.1)	415 (61.9)
Thrice daily	05 (0.7)	15 (2.2)	06 (0.9)	14 (2.1)
More times	01 (0.2)	01 (0.2)	01 (0.2)	01 (0.2)
Total	670 (100.0)	670 (100.0)	670 (100.0)	670 (100.0)

Use of other oral hygiene aids

Three urban and seven rural children, and six students from public and four students from private schools reported the use of oral hygiene aids such as tooth pick, dental floss, tongue cleaner, mouth rinse and mango leaves. Use of these aids was not influenced by location or category of school (p>0.05); however, female children reported significantly higher use (χ^2=5.87; p=0.015).

Oral hygiene status

OHI-S scores for the study population ranged from 0 to 4.67 and the mean OHI-S score was 1.31±0.73. Approximately half of the study participants from urban and rural, and from public and private schools presented with good oral hygiene (Table 2). Mean OHI-S scores were higher among males (p>0.05), indicating that female participants had better oral hygiene.

Comparison of mean OHI-S scores of urban (1.27±0.70) and rural (1.36±0.75) schoolchildren showed statistically significant difference (t=2.27; p=0.023). Mean OHI-S scores of students from public (1.36±0.77) and private (1.27±0.68) schools also showed significant difference (t=2.29; p=0.022). These findings indicated presence of

better oral hygiene among urban children and those attending private schools.

Dental caries

Mean DMFT score for the study population was 1.97±2.40. Overall prevalence of decayed teeth was 56.9%, missing teeth was 2.1% and filled teeth was 7.3%. Overall prevalence of dental caries was 59.2% (urban - 59.6%; rural - 58.8%; public schools - 58.2%; private schools - 60.1%). Mean DMFT scores were not significantly different among participants based on gender, location of school, or category of school (p>0.05).

Table 2: Distribution based on oral hygiene status of the participants.

Oral hygiene status	Urban schools N (%)	Rural schools N (%)	Public schools N (%)	Private schools N (%)
Good	374 (55.8)	365 (54.5)	352 (52.6)	387 (57.8)
Fair	286 (42.7)	287 (42.8)	301 (44.9)	272 (40.6)
Poor	10 (1.5)	18 (2.7)	17 (2.5)	11 (1.6)
Total	670 (100.0)	670 (100.0)	670 (100.0)	670 (100.0)

Periodontal status/Gingivitis

Mean CPI score for the study population was 1.41±0.76. Overall prevalence of gingival bleeding and calculus was 83.2% (urban - 79.6%; rural - 86.9%; public schools - 82.2%; private schools - 84.2%). Mean CPI scores were higher among females (p>0.05), indicating a higher prevalence of gingivitis among them. Gingivitis was found to be more prevalent among rural participants in comparison to their urban counterparts (t=2.20; p=0.023).

Influence of oral hygiene practices on oral status

Good positive correlation was found between the OHI-S and CPI scores (r=0.59), indicating that poor oral hygiene (higher OHI-S scores) was associated with presence of gingivitis (higher CPI score). This study found that, among those using the horizontal tooth brushing method, there was a higher prevalence of poor oral hygiene (p<0.001) and gingivitis (p<0.001), and a lower prevalence of dental caries (p<0.001). However, the frequency of tooth brushing was not found to influence the oral hygiene (p=0.870), gingival (p=0.629) and dental caries (p=0.511) status.

DISCUSSION

Participants ranged in age from 11 to 18 years, and males outnumbered females. The male predominance was seen in urban and rural areas, and in public and private schools.

Majority of participants used toothbrush and toothpaste to clean their teeth.[5,15] Tooth powder and ash were among other materials used to clean teeth. Other authors have also reported use of tooth powder, paddy husk powder and Ayurvedic tooth powder.[16,17] Rao et al studied urban and rural schoolchildren and reported use of Manjan, ash, coal and dantum (twig of babul or neem).[18] While this study found that cleaning aids and dental cleaning materials used were not influenced by category of school.[17,19] Fotedar et al. reported statistically higher number of children in private schools using toothbrush and toothpaste when compared with public schools.[15]

As found in the present study, horizontal tooth brushing method was most commonly followed by children in Kerala.[17] Significantly higher proportion of girls practiced horizontal method of brushing while studies among Nigerian and Chinese schoolchildren found no gender differences.[5,20] Zhu et al. found urban participants using vertical method more frequently while horizontal technique was more common in rural areas, findings similar to the present study.[20] Significantly more participants from private schools practiced horizontal method of tooth brushing.[5]

Vadiakas et al., Ingle et al. and Zhu et al. reported that, as in the present investigation, most participants brushed their teeth once or twice daily.[6,8,20] Female subjects reported a significantly higher frequency of twice daily tooth brushing.[21,22] While investigations among Nigerian children found no significant differences in tooth brushing frequency by gender.[5] Frequency of once daily tooth brushing was significantly higher in urban areas, while twice and thrice daily brushing frequency was significantly higher in rural areas. In contrast, Zhu et al. found once daily brushing more prevalent in rural areas and twice daily brushing more prevalent in urban areas.[20] Frequency of once daily tooth brushing was significantly higher among children from public schools, while twice and thrice daily tooth brushing was higher in private schools.[15] Ogunrinde et al. and Adekoya et al., however, reported that frequency of tooth brushing was not associated with type of school attended.[5,23] While the present study found no significant differences between mean OHI-S scores among those who brushed once daily or more than once daily, Vadiakas et al. reported that frequent tooth brushing was associated with better oral hygiene.[6]

Majority of children changed their toothbrush within 3 months of use.[24] Changing a toothbrush is dictated not only by duration of use, but also by fraying of bristles which reduces efficiency of the toothbrush. Ten participants reported use of toothpick, dental floss, tongue cleaner, etc. Reported use was significantly higher among females. Rise et al. and Honkala et al. found girls more frequent users of dental floss than boys.[21,22] Muttappillymyalil et al. reported 58.0% prevalence of inter-dental cleaning habit (males greater than females) and use of coconut leaf toothpicks for inter-dental cleaning.[17] Other authors have reported the use

of neem twigs, toothpicks, charcoal, chewstick, miswak, dental floss and mouth rinses.[5,19,20]

Comparison of mean OHI-S scores between genders found higher scores among males, however, the difference was insignificant.[25,26] This may be attributed to poor oral hygiene practices. Females usually are more concerned more about their appearance, personal hygiene and oral health.[6,25] Majority of urban and rural schoolchildren presented with fair to good oral hygiene. However, mean OHI-S scores were significantly higher among rural children.[25] Better oral hygiene among children enrolled in urban schools may be related to better access to oral hygiene aids. Majority of participants from public and private schools also presented with fair to good oral hygiene, similar to findings among adolescents in Greece and Hyderabad, India.[6,27] However, mean OHI-S scores were significantly higher among children from public schools, which may be attributed to socio-economic factors.[27,28] Oral hygiene status is an indicator of the individual's tooth brushing practices, and depends on frequency and method of tooth brushing. It was also possible that some of the children did not brush as they claimed as over-reporting is a possibility when reporting desirable outcomes like the frequency of tooth brushing.

In the present study, 25.5% participants presented with gingival bleeding which was less than found by Vadiakas et al. and Fotedar et al, but higher than reported by Antunes et al.[6,15,29] The reason for the high prevalence of gingival bleeding and calculus may be ineffective oral hygiene maintenance due to inadequate brushing time, faulty brushing technique or both. Gingival status was significantly better among urban children. Vadiakas et al. and Antunes et al. also found adolescents from rural areas more likely to present with gingival bleeding.[6,29] As in the present study, Fotedar et al., Taani DQ and Antunes et al. found a higher percentage of children from private schools presenting with a healthy periodontium.[15,28,29] The difference may be attributed to irregular oral hygiene practices among public schoolchildren which in turn may be due to a lower socio-economic status and lower utilization of dental services.

Prevalence of dental caries in the study population was 59.2%. Higher caries prevalence has been reported by Darwish et al. among Qatari schoolchildren (85.0%) and Babu et al. among schoolchildren in Nellore (65.6%).[7,25] Sofowora et al. found a lower prevalence among Nigerian schoolchildren (13.9%).[23] Dental caries prevalence and mean DMFT scores were not significantly different among participants based on location or category of school. In a finding similar to the present study, Sofowora et al. found higher caries experience among children from private schools.[23] In contrast, Ingle et al., Fotedar et al. and Sukhabogi et al. found a significantly higher caries prevalence among children in public schools.[8,15,27]

This study was limited to school-going adolescents. Therefore, the findings cannot be generalized to all children of this age range. Another limitation was that the data collected on oral hygiene practices were self-reported and there may have been under- or over-reporting of these behaviours.

CONCLUSION

Although majority of the study participants reported use of the requisite oral hygiene aids and regular once/twice daily tooth brushing, there was a high prevalence of dental caries and gingivitis among them which can be attributed to poor hygiene. Lack of knowledge regarding importance of healthy oral tissues and poor oral hygiene practices are responsible for the occurrence of oral diseases. This indicates a need for instituting oral health promotion activities for schoolchildren and their caregivers with focus on improving knowledge and oral self-care practices, and promoting regular dental visits for controlling oral diseases.

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