

Pattern of tooth discoloration and care-seeking behavior among adolescents in an underserved rural community in Nigeria

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ABSTRACT

Objective: The objective of this study was to assess the pattern of tooth discoloration and care-seeking behavior among adolescents in a Nigerian community. **Materials and Methods:** A cross-sectional study using a questionnaire was carried out among 384 adolescents in Idere, Southwestern Nigeria. The questionnaire comprised questions on sociodemographic data, presence of tooth discoloration, and care-seeking behavior. Two calibrated examiners examined the labial and buccal surfaces of the teeth for the presence of tooth discoloration. Frequencies and bar charts were generated, and Chi-square test was used to test the association between categorical variables at $P < 0.05$. **Results:** The mean age of the study participants was 14.7 ± 2.3 years, comprising 222 (57.8%) and 162 (42.2%) in junior and senior secondary schools, respectively. Intraoral examination revealed 167 (43.9%) had discolored teeth while 127 (33.1%) perceived that they had discolored teeth. Extrinsic stains were the major cause of tooth discoloration in both anterior and posterior teeth (18%–84%) except in upper anterior teeth where enamel hypoplasia was the major cause (20%–30%). Among participants who perceived that they had tooth discoloration, 81.9% mentioned that they did not know that the discoloration can be treated. Older participants had more discolored teeth than their counterparts ($P = 0.01$). Age group, sex, and class of participants were associated with frequency of tooth brushing ($P < 0.05$). Participants who had anterior or intrinsic tooth discoloration sought care more often than those with posterior or extrinsic tooth discoloration ($P < 0.05$). **Conclusions:** Extrinsic staining was the major cause of tooth discoloration. Many adolescents did not know that the discoloration can be treated.

Key words

Care seeking, teenagers, tooth staining

INTRODUCTION

Tooth discoloration presenting as enamel hypoplasia, tetracycline stain, dental fluorosis, pulp necrosis, and extrinsic stains embedded in plaque and calculus is an esthetic problem. Several studies^[1-3] have reported an increased concern of adolescents about esthetics and its relationship to self-esteem. It is essential to recognize the etiology and pattern of the tooth discoloration among adolescents so as to manage the discoloration effectively and efficiently.

Adolescents may seek professional advice and treatment or opt for nonprofessional quick-fix solutions, intentional mutilation, and modification, even when the discoloration to the teeth is minimal. Nonprofessional treatment of discolored teeth can be dangerous to their oral and general health. The previous studies^[4,5] on tooth discoloration among a group of adolescents in Nigeria only reported the prevalence of the various types of tooth discoloration. There is a dearth of information on the distribution of tooth discoloration and care-seeking

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behavior among adolescents living in an underserved rural community in Nigeria which this study sought to assess.

MATERIALS AND METHODS

This cross-sectional study was carried out among adolescents aged 10–19 years who lived in Idere, a rural community in Ibarapa Central Local Government Area of Oyo State Nigeria. Idere is inhabited by about 9900 people and is situated about 116 km from Lagos – the Nigerian economic capital. There are three public secondary schools in Idere, and the majority of inhabitants of Idere are native Yorubas,^[6] who are mostly farmers or petty traders.

The study was undertaken in the secondary schools in Idere, and permission to conduct the study was obtained from the Local Government Educational Authority and the school authorities. Written informed consent was obtained from parents/guardians of the study participants and the participants assented to participate in the study. The study was undertaken in accordance with the ethical standards provided by the Faculty of Dentistry, University of Ibadan, Nigeria, and in strict compliance with the Helsinki Declaration principles on studies involving human subjects.

Using the Kish and Leslie formula for cross-sectional studies, a sample size of 384 was determined assuming that the prevalence of discolored teeth among adolescents was 50.0% since there was no local study among adolescents and no international studies undertaken in an environment with similar sociodemographic characteristics as that of where this present study was undertaken. The participants included adolescents who had only permanent teeth, and among them, 384 were randomly selected. A 15-item semi-structured questionnaire which sought to gather information on sociodemographics, presence of tooth discoloration, and care-seeking behavior was administered by trained research assistants. Before administering the questionnaire, it was pretested among twenty adolescents in Igbo-Ora, a rural community located about 8 km away from the study location. Validation of the questionnaire was undertaken by asking experts to assess it to establish that the items were representative of the outcome. The experts also ensured that items and questions cover the full range of the issues or problems being measured and each question or item had a logical link to the objective of the study. In addition, a good background of the study, questionnaire conceptualization and formatting were undertaken before pretesting the questionnaire. The questionnaire was modified after the pretest was done to ensure that it was reliable and valid. Participants who were found to have discolored teeth were probed further on what steps had been taken to ameliorate the same.

The intraoral examination was conducted on a comfortable chair at the corridor of a designated classroom of the participating schools under natural daylight between 9 and 11 am. Two calibrated examiners clinically examined the labial and buccal surfaces of the teeth for the presence of discoloration. The discoloration was determined by comparing the color of a particular tooth with the color of the adjacent and contralateral tooth. The shade of the tooth was recorded using VITA shade guide (C-101) and the difference in value between the normal colored tooth and the suspected discoloration aided the diagnosis. The Dean index for fluorosis and the World Health Organization criteria for recording enamel disorders as outlined in its basic methods for oral health surveys^[7] were used for this study. Other enamel disorders, such as tetracycline stain, opacities, and hypoplasia, were recorded if present. Teeth that were suggestive of pulp necrosis were examined for sensibility test using a sterilized rechargeable pulp tester (DY 310 Pulp Tester, USA). Extrinsic stains due to the incorporation of metallic and nonmetallic stains into plaque and calculus were also recorded.

To monitor the inter- and intra-examiner reproducibility in assessing the type of tooth discoloration throughout the study, twenty duplicate examinations were carried out during the study. The reliability was assessed using the unweighted kappa statistic which gave a value of 0.92 for interexaminer reproducibility and the values of 0.90 and 0.94 for intraexaminer agreement of examiners.

Data were coded and entered into Statistical Package for Social Science version 15 (Chicago, USA).^[8] Frequencies, percentages, and means were generated. Chi-square test was used to test the association between categorical variables at 5% level of significance.

RESULTS

The age range of study participants was 10–19 years, with a mean age of 14.7 ± 2.3 years. The participants comprised 145 (41%) males and 239 (59%) females. The majority, i.e., 222 (57.8%) of the study participants were in junior secondary schools while 162 (42.2%) were in senior secondary schools.

Intraoral examination revealed that 167 (43.9%) of the study participants had tooth discoloration while 127 (33.1%) perceived that they had discolored teeth. Table 1 shows that older participants (15–19 years) had more discolored teeth than the younger ones (10–14 years) ($P < 0.05$). There was no statistically significant difference between sex, class of participants, and prevalence of tooth discoloration ($P > 0.05$).

The majority, i.e., 104 (81.9%) of those who perceived that they had tooth discoloration mentioned that they

Table 1: Relationship between sociodemographic characteristics and occurrence of tooth discoloration among study participants

Sociodemographic characteristics	Tooth discoloration, n (%)		Total, n (%)	P
	Yes	No		
Age group (years)				
10-14	64 (36.1)	113 (63.9)	177 (100.0)	0.01
15-19	103 (49.8)	104 (50.2)	207 (100.0)	
Total	167 (43.5)	217 (56.5)	384 (100.0)	
Sex				
Male	73 (45.9)	86 (54.1)	159 (100.0)	0.42
Female	94 (41.8)	131 (58.2)	225 (100.0)	
Total	167 (43.5)	217 (56.5)	384 (100.0)	
Class				
JSS	97 (43.7)	125 (56.3)	222 (100.0)	0.93
SSS	70 (43.2)	92 (57.8)	162 (100.0)	
Total	167 (43.5)	217 (56.5)	384 (100.0)	

JSS - Junior secondary school, SSS - Senior secondary school

did not know that the discoloration can be treated while 23 (18.1%) stated otherwise. Table 2 shows the care-seeking behavior of study participants who perceived that they had tooth discoloration. The majority, i.e., 82 (64.6%) sought for one form of care or the other; 39 (30.7%) reported that they brushed their teeth more than two times daily, 24 (18.9%) stated that they used sharp objects to remove discoloration on the tooth surface and 5 (3.9%) consulted dentist.

Table 3 shows that among participants who perceived that they had tooth discoloration, those who had anterior tooth discoloration sought care than those who had posterior tooth discoloration ($P < 0.05$). Similarly, those whose teeth had intrinsic discoloration sought care than those whose teeth had extrinsic discoloration ($P < 0.05$).

Table 4 shows that 32 (53.3%) younger age group (10–14 years), 30 (52.6%) females, and 29 (52.7%) junior secondary school students, who perceived that they had tooth discoloration, reported that they brushed their teeth more than two times daily while 7 (10.4%) older age group (15–19 years), 9 (12.9%) males, and 10 (13.9%) senior secondary school students reported likewise. These differences were statistically significant ($P < 0.05$). In addition, Table 5 shows that 18 (53.3%) younger age group (10–14 years) and 16 (30.8%) females, who perceived that they had tooth discoloration, reported that they used sharp objects to remove discoloration from tooth surface while 6 (10.4%) older age group (15–19 years) and 8 (10.7%) males reported likewise. These differences were statistically significant ($P < 0.05$).

Figure 1 shows the distribution of types of tooth discoloration in the upper dentition of study participants after intraoral examination. Extrinsic stains embedded in plaque and calculus were the major cause of tooth discoloration among posterior teeth accounting for between 18% and 84% while enamel hypoplasia was the

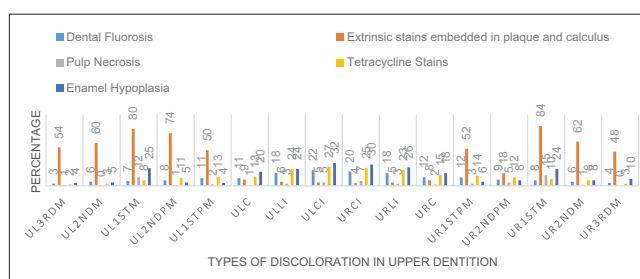


Figure 1: Distribution of types of tooth discoloration in upper dentition among study participants with discolored teeth. UL3RDM – Upper left third molar, UL2NDM – Upper left second molar, UL1STM – Upper left first molar, UL2NDPM – Upper left second premolar, UL1STPM – Upper left first premolar, ULC – Upper left canine, ULLI – Upper left lateral incisor, ULCL – Upper left central incisor, URCL – Upper right central incisor, URLI – Upper right lateral incisor, URC – Upper right canine, UR1STPM – Upper right first premolar, UR2NDPM – Upper right second premolar, UR1STM – Upper right first molar, UR2NDM – Upper right second molar, UR3RDM – Upper right third molar

major cause of tooth discoloration among anterior teeth accounting for 20%–32%. Tetracycline stains were the second major cause of tooth discoloration in anterior teeth accounting for between 13% and 27%. Pulp necrosis accounted for the least (1%–5% and 0%–5%) cause of tooth discoloration in both anterior and posterior teeth, respectively. The upper first molars were posterior teeth most commonly affected (80%–84%) by extrinsic stains embedded in plaque and calculus while upper central incisors were anterior teeth most commonly affected (30%–32%) by enamel hypoplasia. Upper molars were the posterior teeth most commonly affected (12%–15%) by pulp necrosis. Among the posterior teeth, dental fluorosis was commonly found on the first premolars (11%–12%), while among the anterior teeth, it was commonly found on central incisors (20%–22%).

Types of tooth discoloration in the lower dentition of study participants after the intraoral examination are shown in Figure 2. The major cause of tooth

Table 2: Care-seeking behavior of study participants who perceived that they had tooth discoloration

Care-seeking behavior	n (%)
Did nothing	45 (35.4)
Brushed the teeth more than two times daily	39 (30.7)
Used sharp objects to scrape tooth surface	24 (18.9)
Visited the medical doctor	7 (5.5)
Visited the herbalist	7 (5.5)
Visited the dentist	5 (3.9)
Total	127 (100.0)

Table 3: Relationship between types of tooth discoloration and care seeking among participants who perceived that they had tooth discoloration

Types of tooth discoloration	Care seeking, n (%)		Total, n (%)	P
	Yes	No		
Anterior	62 (77.5)	18 (22.5)	80 (100.0)	0.002
Posterior	40 (51.9)	37 (48.1)	77 (100.0)	
Total	102 (65.0)	55 (35.0)	157 (100.0)	
Intrinsic	54 (92.3)	16 (7.7)	70 (100.0)	0.004
Extrinsic	48 (81.1)	39 (18.9)	87 (100.0)	
Total	102 (65.0)	55 (35.0)	157 (100.0)	

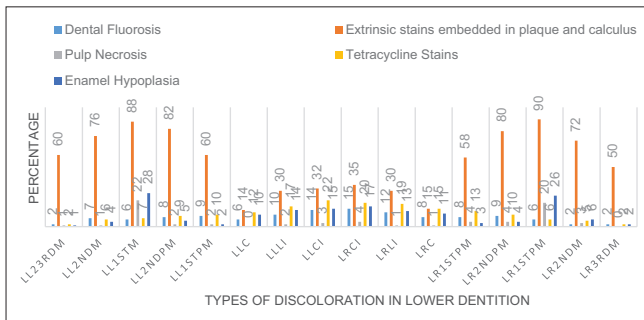


Figure 2: Distribution of types of tooth discoloration in lower dentition among study participants with discolored teeth. LL3RDM – Lower left third molar, LL2NDM – Lower left second molar, LL1STM – Lower left first molar, LL2NDPM – Lower left second premolar, LL1STPM – Lower left first premolar, LLC – Lower left canine, LLLI – Lower left lateral incisor, LLCI – Lower left central incisor, LRCI – Lower right central incisor, LRLI – Lower right lateral incisor, LRC – Lower right canine, LR1STPM – Lower right first premolar, LR2NDPM – Lower right second premolar, LR1STM – Lower right first molar, LR2NDM – Lower right second molar, LR3RDM – Lower right third molar

discoloration in both anterior and posterior teeth was extrinsic stains embedded in plaque and calculus ranging from 14% to 35% and 50% to 90%, respectively. Among the posterior teeth, lower first molars had the highest extrinsic stains (88%–90%), enamel hypoplasia (26%–28%), dental fluorosis (8%–9%), and pulp necrosis (20%–22%). Lower central incisors had the highest extrinsic stains embedded in plaque and calculus (32%–35%), enamel hypoplasia (15%–17%), tetracycline stains (20%–22%), and dental fluorosis (14%–15%) among anterior teeth.

Table 4: Relationship between sociodemographic characteristics and more than twice tooth brushing among participants who perceived that they had tooth discoloration

Sociodemographic characteristics	Less than twice tooth brushing, n (%)		Total, n (%)	P
	Yes	No		
Age group (years)				
10-14	32 (53.3)	28 (46.7)	60 (100.0)	0.00
15-19	7 (10.4)	60 (89.6)	67 (100.0)	
Total	39 (30.7)	88 (69.3)	127 (100.0)	
Gender				
Male	9 (12.9)	61 (87.1)	70 (100.0)	0.00
Female	30 (52.6)	27 (47.4)	57 (100.0)	
Total	39 (30.7)	88 (69.3)	127 (100.0)	
Class				
JSS	29 (52.7)	26 (47.3)	55 (100.0)	0.00
SSS	10 (13.9)	62 (86.1)	72 (100.0)	
Total	39 (30.7)	88 (69.3)	127 (100.0)	

JSS - Junior secondary school, SSS - Senior secondary school

Table 5: Relationship between sociodemographic characteristics and use of sharp objects to scrape tooth surface among participants who perceived that they had tooth discoloration

Sociodemographic characteristics	Use of sharp of sharp objects, n (%)		Total, n (%)	P
	Yes	No		
Age group (years)				
10-14	18 (53.3)	24 (46.7)	42 (100.0)	0.00
15-19	6 (10.4)	79 (89.6)	85 (100.0)	
Total	24 (18.9)	103 (81.1)	127 (100.0)	
Gender				
Male	8 (10.7)	67 (89.3)	75 (100.0)	0.00
Female	16 (30.8)	36 (69.2)	52 (100.0)	
Total	24 (18.9)	88 (81.1)	127 (100.0)	

DISCUSSION

The appearance of the dentition is of concern to a large number of people seeking dental treatment, and the color of the teeth is of particular cosmetic importance.^[9] Adolescents, the population group, investigated in this present study are usually conscious of their dental appearance. The appearance of the dentition could influence the changes in patients' needs. Knowledge of the etiology and pattern of presentation of tooth discoloration is important to dental surgeons because it aids accurate diagnosis of a discolored dentition as well as allowing the exact nature of the condition to be explained to the patient. Furthermore, it enables appropriate preventive measures to be carried out. In some instances, the pattern of staining may have an effect on the outcome of treatment and influence the treatment options the dentist offers to patients.

In this study, the intraoral examination of study participants by the two dental surgeons showed that 43.9% of the study participants had tooth discoloration while 33.1% perceived that they had discolored teeth and the reason for the observed differences might be due to the inability of some of the participants to diagnose some types of tooth discoloration such as dental fluorosis or enamel opacities. In addition, the inability of some participants to diagnose tooth discoloration in the posterior region of the oral cavity might also be the reason for the observed differences. Older age group aged 15–19 years in this study had more discolored teeth than younger age group aged 10–14 years, and sex or class of participants had no relationship with the prevalence of tooth discoloration. These findings were also reported by Koleoso *et al.* in their studies^[4,5] on intrinsic and extrinsic tooth discoloration in 11–16-year-old Nigerian children. The increase in tooth discoloration among the older age group may be due to longer exposure to the etiological factors of tooth discoloration.

In this study, the majority (81.9%) who perceived that they had discolored teeth did not know that tooth discoloration can be treated probably due to their poor knowledge of oral health care. In Idere, there is no oral health-care facility which contributed to their ignorance of oral health care. Many of the adolescents (80.3%) who perceived that they had discolored teeth sought one form of care and this might be due to the concern they had for their appearance. De Jongh *et al.*^[10] stated that preoccupation with a defect of appearance emerged as the only body dysmorphic disorder with a significant predictor of undergoing cosmetic dental treatments. They also stated that patients with such preoccupation were nine times more likely to consider tooth whitening. In the present study, among participants who perceived that they had tooth discoloration, those who had anterior or intrinsic tooth discoloration sought care than those who had posterior or extrinsic tooth discoloration, respectively. This is in agreement with the finding in a study that anterior tooth discoloration is one of the most frequent reasons for seeking dental treatment.^[11] This is because it is the part of the dentition that is exposed when someone smiles or talks. A study^[12] stated that satisfaction with tooth color decreased with increased discoloration. This might be the reason why participants with intrinsic tooth discoloration in this study sought care more than those with extrinsic tooth discoloration. This observation might be due to the intense discoloration of intrinsic stains such as tetracycline stain which is reported by Mountouris *et al.*^[13] to be the most severe anterior tooth discoloration from its increased discoloration.

Among participants who perceived that they had tooth discoloration, many (49.6%) brushed their teeth more than twice daily or used sharp objects

such as knives and blades to scrape tooth surface in a bid to remove the discoloration. Engaging in these practices demonstrated the concern of adolescents to the appearance of their teeth and further confirms the report that dental patients with discolored teeth opt for nonprofessional quick-fix solutions.^[14] Koster^[15] stated that physical unattractiveness seems to be of influence on the intellectual and emotional development and on the social relations of the individual. González *et al.*, their study^[16] on dental esthetics as an expression of culture and ritual, reported that some people intentionally mutilate their teeth to make them look good and socially acceptable to peers and other people. This may also be another reason why adolescents in this present study indulged in this practice. Younger age group (10–14 years) and females reported that they engaged in brushing their teeth more than twice daily or using sharp objects to remove discoloration than their counterparts which confirm reports from the previous studies^[12,17] that the appearance of the teeth was found to be significantly more important to the young than the old and women than men. Few participants sought care at the dental clinic as observed in other previous studies,^[4,5] where there was low level of utilization of dental services among 11–16 year olds who had discolored teeth. However, the reverse is the case in a study^[18] in Penang, Malaysia, where about 40% of the adolescents with tooth discoloration resulting from enamel defects visited a dentist to seek treatment. This observed difference may be due to poor knowledge about oral care among adolescents in the present study or lack of oral health-care facilities in the community where they live as compared to the Malaysian study.

Compounds incorporated into plaque and calculus which are extrinsic stains were the major cause of tooth discoloration in anterior teeth of lower dentition and posterior teeth of both upper and lower dentitions which is in agreement with findings in the previous studies.^[4,5] These extrinsic stains were more in the posterior teeth than in the anterior teeth and were derived from food consumption and the action of chromogenic bacteria. The presence of extrinsic stains on posterior teeth than on anterior teeth may be due to the difficulty of participants in cleaning the former as compared to the latter. In general, the high level of extrinsic stains shows poor oral hygiene and low utilization of oral health services, specifically professional oral prophylaxis among the participants. Enamel hypoplasia, tetracycline stain, and dental fluorosis contributed substantially to tooth discoloration in both upper and lower anterior teeth. The occurrence of enamel hypoplasia and tetracycline stains in anterior teeth might be due the effect of early childhood diseases and tetracycline administration during tooth formation. Likewise, excessive fluoride consumption during the early stage of life which falls within the period of tooth

development might be responsible for dental fluorosis in anterior teeth. Upper and lower first molars were the posterior teeth mostly affected by enamel hypoplasia and are probably due to early childhood diseases during tooth development. Upper and lower first molars were the teeth mostly affected by pulp necrosis which might be due to the effect of dental caries. Central incisors in both jaws were the anterior teeth mostly affected by pulp necrosis and might be due to the effect of trauma on them.

CONCLUSION

Many adolescents had tooth discoloration and were unaware of tooth whitening procedures, thereby resulting in nonprofessional quick-fix practices that were dangerous to their health. Compounds incorporated into plaque and calculus were the major cause of tooth discoloration. Therefore, oral health education on efficient oral hygiene maintenance should be given to parents and adolescents so as to prevent tooth discoloration resulting from the accumulation of plaque and calculus and the subsequent incorporation of compounds into them. This health education should also inform them about other causative factors, consequences, and treatment options of tooth discoloration. This will help prevent the occurrence of the condition and the unwholesome practice of mutilation of the teeth in a bid to remove the discoloration. The government should provide oral health facilities for the populace, especially those in underserved communities, and these facilities should provide tooth whitening procedures. This will enable adolescents with stains on their teeth to receive appropriate treatment.

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Conflicts of interest

There are no conflicts of interest.

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