Dental caries pattern of first and second permanent molars and treatment needs among adolescents in Lagos

Umesi-Koleoso D C

Department of Restorative Dentistry,
College of Medicine University of Lagos, Nigeria

Correspondence: **Umesi-Koleoso D C**
Email: ukchioma@yahoo.com

Abstract

Objective: The study was carried out to assess the dental caries pattern of first and second permanent molars and treatment needs among adolescent Nigerians in Lagos.
Method: Examinations for dental caries and treatment needs in accordance with the criteria of the World Health Organization Basic Methods for oral health surveys were carried out among six hundred 11-16 year-old urban Nigerians (307 boys and 293 girls) from six schools in Lagos.
Results: A low caries prevalence rate and severity was found in this study. Only 421(2.5%) teeth were carious in 143(23.8%) subjects. First permanent molars had the highest caries prevalence rate (9.3%), followed by second permanent molars (7.8%), while premolars (0.13%), incisors (0.08%) and canines (0%) had the lowest rates. Pit and fissure caries on occlusal surfaces was the most prevalent lesion as evidenced by the fact that one-surface filling was the commonest restoration need among the subjects. Caries prevalence rate was higher in the lower jaw than upper jaw but similar on left and right sides of each jaw.
Conclusion: There was a higher caries prevalence rate in the first permanent molars compared to the second permanent molars in this study contrary to previous Nigerian studies. This suggests a change in lifestyle and diet towards consumption of sugars at an earlier age when these teeth are still very susceptible to caries.

Keywords: Caries pattern, permanent molars, urban adolescents

Introduction

The dentition status and treatment needs of adolescent Nigerians have been the subject of study by several authors[1-6]. These studies have recorded caries-free prevalence rates ranging from 49% to 94.6% and mean decayed, missing and filled teeth (DMFT) of 0.10 to 13.25. Although the prevalence rate is presently still quite low, there appears to be an upward trend in dental caries prevalence and severity among adolescent Nigerians[6].
The subject of whether the first or second permanent molars are more likely to be carious in Nigerian and other populations has been a focus of caries research for decades[7-22]. While the first molar has been found to have a higher caries prevalence than the second molar among adolescents in the Western countries[17-21], the reverse has been reported in Nigeria and other parts of Africa[7-11,15]. Most notably, three decades ago, the difference was so great as to have the DMFT of second permanent molars approaching twice that of first permanent molars among urban Nigerians living in Lagos[9,10].
The purpose of this study was to assess the caries distribution pattern of the first and second permanent molars and restorative treatment needs among adolescents in Lagos. The hypothesis noted three decades ago that the second permanent molars are more likely to be carious than first permanent molars among adolescent Nigerians[9] was tested to see if it still holds true. This assessment of dentition status and treatment needs would also provide the basis for appropriate interventions and resource allocation for caries prevention and treatment.

Materials and Method

The present study is a cross-sectional study of urban adolescent Nigerians living in Lagos, South-west Nigeria. Lagos is divided into twenty geopolitical divisions called local government areas (LGAs). The study was conducted in Surulere, one of the LGAs from January to April 2004. Surulere LGA is quite urban having people from all parts of Nigeria. The LGA has 32 secondary schools and 94 primary schools. Six hundred adolescents comprising about one hundred subjects of each age category 11-16 years were included in the study. Selection of subjects was by stratified random sampling. The strata were first the schools and secondly the different arms of primary class 6 and secondary classes 1-6 at the schools. Six schools were randomly selected from the list of schools obtained from the Education Department at the LGA headquarters. Permission was sought and obtained from the local school authorities at the LGA before carrying out the study. One hundred boys and girls were seen at each school ensuring

an equal mix of the sexes and the ages as outlined in the World Health Organization basic methods for oral health surveys[23]. Each school was inspected for sales of sweets and other confectionaries within the premises.

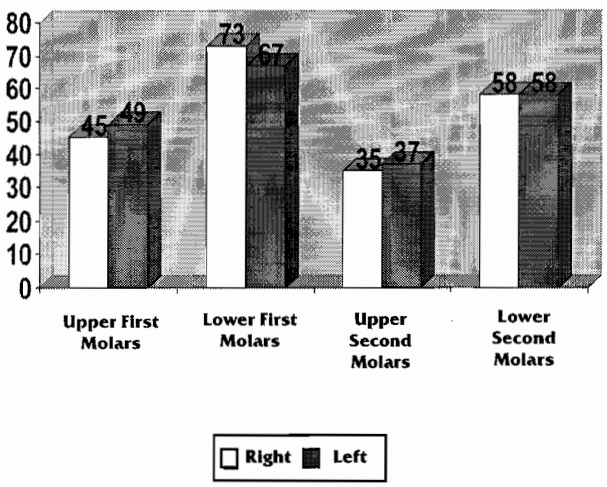
At the schools the subjects were examined, seated on an ordinary straight back chair by one calibrated examiner. The dentition of each subject was examined for the dental caries status of each tooth and the treatment need appropriate for the tooth was determined using the criteria outlined by the World Health Organization[23]. The third molars were excluded as these teeth are usually not erupted in the age range examined. Carious lesions were noted as being present on the occlusal, approximal or labial surface. The total caries experience for each tooth type was calculated as the total of such tooth that was decayed, filled without decay, filled with decay and missing due to caries[23]. Data were analyzed using the SPSS version 10.0 for windows. Chi square was used to test for association at an alpha level of 0.5.

Result

Six hundred adolescents aged 11 to 16 years, 307 boys and 293 girls, were examined during the study for dental caries and treatment needs of their dentition. The sale of sweets and confectionaries within the school premises was noted in all the schools visited. Dental caries was found in 143 subjects (23.8%). The results of dental caries status are presented based on tooth type and whether located on upper or lower jaw in Tables 1 & 2. A total of 16,696 teeth were recorded as erupted. Looking at all tooth types, 96.7% were sound, 2.5% were carious, 0.04% missing due to caries, 0.03% filled with no decay, 0.02% missing for reasons other than caries, 0.15% had suffered trauma and 0.62% were unerupted. The majority of unerupted teeth were second permanent molars and permanent canines. More than 89% of any of the tooth types were sound. Dental caries was found on 411 (8.6%) of the permanent molars, 95.6% (393) of these were pit and fissure caries on occlusal surfaces while the rest were caries on smooth approximal surfaces. Caries was found on 6(0.13%) of the premolars and these were fissure caries on occlusal surfaces. Caries was present on 4(0.08%) of the lower incisors and these were all on smooth labial surfaces. All the canines and upper incisors were caries free.

No significant difference was observed in caries prevalence among the same tooth type on the two sides of a jaw ($p > 0.05$), this showed a right-left symmetry in caries prevalence rate (Figure 1). A statistical difference was observed in caries prevalence rate between the jaws ($p < 0.05$), with caries prevalence rate being higher in the lower jaw than the upper jaw (Figure 1). A comparison of caries prevalence rates of first and second permanent molars shows that the caries prevalence rate of the first permanent molars was significantly higher than that of the second permanent molars ($p< 0.05$) (Figure 1). The totality of the caries experience is expressed as the sum of the numbers of teeth that are carious, filled and missing due to caries.

Figure 1. Comparison of caries prevalence rates among molars



$X^2 = 0.480$, $p > 0.05$ (Right molars vs Left molars),
$X^2 = 25.145$, $p < 0.05$ (Upper molars vs Lower molars),
$X^2 = 6.78$, $p < 0.05$ (First molars vs Second molars)

Treatment needs of the teeth are presented based on tooth type having added the results for all four quadrants together (Table 3). Caries arresting/sealant care was needed for 19(0.11%) teeth, one surface restoration was required for 370(2.2%) teeth, two or more surface

Table 1. Dental caries pattern by tooth type (maxillary teeth) among adolescents in Lagos

	C. Incisor	L. Incisor	Canine	1st PreM	2nd PreM	1st Molar	2nd Molar
Decayed	3(0.25)	1(0.08)	0	1(0.08)	3(0.25)	93(7.75)	72(6.0)
Missing due caries	0	0	0	0	0	0	0
Filled no decay	0	0	0	0	0	1(0.08)	0
Missing other reason	3(0.25)	1(0.08)	0	0	0	0	0
Trauma	24(2.0)	0	0	0	0	0	0
Unerupted	0	5(0.42)	19(1.6)	1(0.08)	5(0.42)	0	36(3.0)
Sound	1170(97.5)	1193(99.4)	1187(98.9)	1198(99.8)	1191(99.3)	1106(92.2)	1092(91.0)

Table 2. Dental caries pattern by tooth type (mandibular teeth) among adolescents in Lagos

	C. Incisor	L. Incisor	Canine	1st PreM	2nd PreM	1st Molar	2nd Molar
Decayed	0	0	0	1(0.08)	1(0.08)	131(10.9)	115(9.6)
Missing due caries	0	0	0	0	0	5(0.42)	1(0.08)
Filled no decay	0	0	0	0	0	4(0.33)	0
Missing other reason	0	0	0	0	0	0	0
Trauma	1(0.08)	1(0.08)	0	0	0	0	0
Unerupted	0	0	7(0.6)	1(0.08)	8(0.7)	0	22(1.8)
Sound	1199(99.9)	1199(99.9)	1193(99.4)	1198(99.8)	1191(99.3)	1060(88.3)	1062(88.5)

Table 3. Restorative Treatment Needs by Tooth type among Adolescents in Lagos

	C. Incisor	L. Incisor	Canine	1st PreM	2nd PreM	1st Molar	2nd Molar	Total
Caries arresting/ Sealant care	0	0	0	0	0	15(0.63)	4(0.17)	19(0.11)
One Surface Filling	3(0.13)	1(0.04)	0	2(0.08)	4(0.17)	182(7.6)	178(7.4)	370(2.2)
Two or more Surface filling	16(0.67)	0	0	0	0	9(0.38)	2(0.08)	27(0.16)
Pulp care	5(0.21)	0	0	0	0	2(0.08)	0	7(0.04)
Crown	4(0.17)	1(0.04)	0	0	0	1(0.04)	1(0.04)	7(0.04)
Extraction	0	0	0	0	0	15(0.63)	2(0.08)	17(0.1)
Tooth Replacement	3(0.13)	1(0.04)	0	0	0	5(0.21)	1(0.04)	10(0.06)

restoration was needed for 27(0.167%) teeth, pulp care was required for 7(0.04%) teeth, crowns were needed for 7(0.04%) teeth, extraction was indicated for 17(0.1%) teeth, and tooth replacement was required for 10(0.06%) missing teeth and the 17(0.1%) teeth that were due for extraction.

Discussion

Dental caries is a bacterial disease process, which affects teeth exposed to the oral environment of saliva, microbial deposits, food debris and other dietary constituents. Whether caries commences or not depends on the quality of the micro environment, the ability of the tooth to resist demineralisation, the interplay of host factors and the length of time for which these factors are in operation.The first permanent molars were found to be the most susceptible to caries in the present study. The second permanent molars were the next susceptible to caries then the premolars while the canines and incisors were the least susceptible. Indeed the canines were caries-free, while only four carious incisors were recorded among the study subjects. More than 90% of the caries found in this study were pit and fissure caries on occlusal surfaces making them more prevalent than smooth surface caries (4.4%). This is in agreement with other studies which show approximal surfaces of anterior teeth as being the least susceptible while pits and fissures of posterior teeth are the most susceptible to caries[10,15,17,20]. A right-left symmetry was noted in caries prevalence rates in this study, with no statistical difference ($p>0.05$) observed among same tooth type in the same jaw. A similar pattern of symmetry about the midline has been reported in other studies[14,19]. Caries was found to be more prevalent in the lower jaw ($p<0.05$) than in the upper jaw especially in the posterior region. This is contrary to western studies where caries prevalence rate is similar in both jaws[14,21]. However, a similar pattern of caries being more prevalent in the lower jaw has been reported in other African countries like Uganda and Tanzania[13,15]. Expectedly, teeth in the upper anterior region were found to have suffered trauma more than those in the lower anterior region. The significantly lower caries prevalence found in the second permanent molars shows a different trend from the molar caries pattern that was reported by Akpata and his co-workers among adolescent urban Nigerians and some other authors in Uganda, Zambia and Vietnamese refugees newly arrived in Norway[7,8,9,10,11,15,16]. In these studies, the second permanent molars were more likely to be carious than the first

permanent molars. Akpata[10] had attributed the molar caries distribution pattern he observed as being due to the change to a more cariogenic diet at a time when maturation of the enamel had rendered the first permanent molars more caries resistant while the second permanent molars were yet very vulnerable to caries. Enwonwu[24,25] suggested that the relative inaccessibility of the second molar by oral hygiene measures is a possible explanation. He also suggested that rural immigrants in an urban setting adopted as status symbols the life style of the economically prosperous groups.

The molar caries pattern seen in the present study is, however, similar to that reported among urban adolescents in some other African countries like East Africa, Tanzania and Botswana[12,13,22]. It is also similar to the pattern seen in studies in Western countries and Australia[17,18,20,21]. In Nigeria, like other African countries, urbanization and adoption of urban habits thus, will include increased use and frequency of intake of refined sugars and sweets[6,24,25]. The molar caries pattern of higher caries prevalence rate in first permanent molars seen in Western countries has been attributed to the fact that first permanent molars erupt 6 years earlier than second permanent molars and had thus been exposed to cariogenic factors for a longer period of time[17,18,21].

The change in molar caries distribution pattern to higher caries prevalence rates in first permanent molars than second permanent molars seen among adolescent Nigerians in the present study could be a reflection of greater urbanization with a change in lifestyle and diet towards the consumption of sugars at a much earlier age than in the past thus exposing these teeth to cariogenic influences while they were yet immature. It may also be a reflection of the ready availability of sweets and other confectionaries within school premises in the present study.

The treatment needs observed among the study population further buttresses the caries pattern observed among the tooth surfaces. One-surface restoration was the predominant treatment need for the carious posterior teeth (>7% of the molars) indicating that the carious lesions were mostly pit and fissure caries, while two or more surface restoration was required in less than 1% of the carious molars, which had approximal caries. One surface restoration was required for all of the carious incisors, which had only smooth surface caries involving the labial surface.

Conclusion

A low caries prevalence rate was observed in this study of urban adolescent Nigerians. The molar caries pattern was, however, different from that observed in past Nigerian studies with caries prevalence rate being significantly higher in the first permanent molars compared to the second permanent molars. There is a need for caries preventive measures to be put in place to curb the rising caries prevalence among first permanent molars. Legislation is needed to outlaw the sales of sweets and confectionaries within and around schools premises. The placement of fissure sealants on newly erupted permanent molars is advocated as a routine preventive measure and in school oral healthcare programmes which should be established in all local government areas across the country

References

1. Henshaw EN. A survey of dental caries and oral hygiene in the southern zone of Nigeria. Nig Med J 1974; 4: 185-196.
2. Henshaw EN, Adenubi JO. The increase in dental disease in the northern states of Nigeria and its manpower implications. J Dent 1975; 3(6): 243-250.
3. Adegbembo AO, El-Nadeef MAI, Adeyinka A. National survey of dental caries status and treatment needs in Nigeria. Int Dent J 1995; 45: 35-44.
4. Adeniji OO. Oral health status of 4-16 year-old Nigerian school children in Lagos. Nig Qt J Hosp Med 1997; 7: 36-38.
5. Umesi DC, Savage KO. Dental caries status and treatment needs in 12 year-old Nigerians. J Comm Med Prim Hlth Care 2002; 14: 5-14.
6. Umesi-Koleoso DC, Ayanbadejo PO, Oremosu OA. Dental caries prevalence among adolescents in Lagos, Nigeria. 5th Conference of IADR (Nigerian Div), Abstract 2006; 87850.
7. Jensen KK, Langeback EK, Nyika T. Dental caries, gingivitis and oral hygiene among school children in Kampala, Uganda. Comm Dent Oral Epidemiol 1973; 1:74-83.
8. Westwater K. A study of the relative caries prevalence in first and second permanent molars of rural Zambian school children. J Dent 1977; 5: 42-46.
9. Akpata ES, Jackson D. Caries vulnerability of first and second permanent molars in urban Nigerians. Arch Oral Biol 1978; 23: 795-800.
10. Akpata ES. Pit, fissure and smooth surface caries of first and second permanent molars in urban Nigerians. Caries Res 1981; 15: 318-323.
11. Akpata ES, Anekwe GE. Enamel solubility rates of first and second permanent molars in urban Nigerians. Nig Dent J 1983; Suppl 1; 4-10.
12. Manji F, Mosha H, Frencken J. Tooth and surface patterns of dental caries in 12-year-old urban children in East Africa. Comm Dent Oral Epidemiol 1986; 14: 99- 110.
13. Rugarabamu PGN, Poulsen S, Masalu JRP. A longitudinal study of occlusal caries among schoolchildren in Dar es salaam, Tanzania. Comm Dent Oral Epidemiol 2002; 30: 47-51.
14. Wyne AH. The bilateral occurrence of dental caries among 12-13 and 15-19 year-old school children. J Contemp Dent Pract 2004; 5: 42-52.
15. Kutesa A, Mwanika A, Wandera M. Pattern of dental caries in Mulago Dental School Clinic, Uganda. Afr Hlth Sci 2005; 5: 65-68.
16. Selikowitz HS. Prevalence of dental caries in a group of adult Vietnamese refugees in Norway. Comm Dent Oral Epidemiol 1984; 12: 51-54.
17. Dummer PMH, Addy M, Oliver SJ, Hicks R, Kingdon A, Shaw WC. Changes in the distribution of decayed and filled tooth surfaces and the progression of approximal caries in children between the ages of 11-12 years and 15-16 years. Br Dent J 1988; 164: 277-282.
18. Dummer PMH, Oliver SJ, Hicks R, Kingdon A, Addy M, Shaw WC. Factors influencing the initiation of carious lesions in specific tooth surfaces over a 4-year period in children between the ages of 11-12 and 15-16 years. J Dent 1980; 18; 190-197.

19. Hujoel PP, Lamont RJ, DeRowen TA, Davis S, Leroux BG. Within-subject coronal caries distribution patterns: an evaluation of randomness with respect to the midline. J Dent Rest 1994; 73(9): 1575-1580.
20. Slade GD, Spencer AJ, Davies MJ, Burrow D. Intra oral distribution and impact of caries experience among South Australian school children. Aust Dent J 1996; 41: 343-350.
21. Batchelor A Paul, Sheiham A. Grouping of tooth surfaces by susceptibility to caries: a study of 5-16 year-old children. BMC Oral Hlth 2004; 4: 2.
22. Johnson AS, Gjermo P. Pattern of caries experience in permanent molars in a 15 year-old African population. Caries Res 1989; 23: 423-426.
23. World Health Organization, Geneva. Oral health surveys: Basic methods. 3rd Edition, 1987: 1-53
24. Enwonwu CO. Socio-economic factors in dental caries prevalence and frequency in Nigerians. Caries Res 1974; 8: 155-171.
25. Enwonwu CO. Review of oral disease in Africa and the influence of socio-economic factors. Br Dent J 1967; 123; 144-148.19.