BMC Oral Health

RESEARCH ARTICLE Open Access

The prevalence, pattern and clinical presentation of developmental dental hard-tissue anomalies in children with primary and mix dentition from Ile-Ife, Nigeria

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Abstract

Background: The study of dental anomalies is important because it generates information that is important for both the anthropological and clinical management of patients. The objective of this study is to determine the prevalence and pattern of presentation of dental hard-tissue developmental anomalies in the mix dentition of children residing in Ile-Ife, a suburban region of Nigeria.

Methods: Information on age, sex and socioeconomic status was collected from 1,036 children aged four months to 12 years through a household survey. Clinical examination was conducted to assess the presence of dental anomalies. Associations between age, sex, socioeconomic status, prevalence, and pattern of presentation of the developmental hard-tissue dental anomalies were determined.

Result: Two hundred and seventy six (26.6%) children had dental anomalies. Of these, 23.8% had one anomaly, 2.5% had two anomalies, and 0.3% had more than two anomalies. Of the children with anomalies, 49.3%were male, 50.7% were female, and 47.8%, 28.6% and 23.6% were children from low, middle and high socioeconomic classes, respectively. More anomalies were seen in permanent than primary dentition. Anomalies of tooth structure were most prevalent (16.1%); anomalies which affect tooth number were least prevalent (1.3%). Dens evaginatus, peg-shaped lateral, macrodontia, and talon cusp were more prevalent in the permanent dentition, and dens evaginatus peg-shaped lateral and macrodontia were more prevalent in the maxilla. There were significantly more macrodontia anomalies in males and in children of high socioeconomic status.

Conclusion: This large survey of dental hard-tissue anomalies found in the primary dentition and mixed dentition of children in Nigeria provides anthropological and clinical data that may aid the detection and management of dental problems of children in Nigeria.

Keywords: Prevalence, Nigeria, Sex, Socioeconomic, Dental anomalies

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Background

Developmental dental anomalies are an important category of dental morphologic variations. Anomalies of shape, form, number and structure of the teeth may occur due to abnormal events in embryologic development. These events may be caused by genetic and environmental factors during the morpho-differentiation or histo-differentiation stages of tooth development [1]. Although asymptomatic, these anomalies can lead to clinical problems, including delayed or non-eruption of the normal series of teeth; attrition; breast feeding problems; compromised esthetics; occlusal interference; accidental cusp fracture; interference with tongue space, causing difficulty in speech and mastication; temporomandibular joint pain and dysfunction; malocclusion; periodontal problems because of excessive occlusal force; post-eruptive tooth breakdown; and increased susceptibility to caries [2-6].

Several studies [1,7-10] have reported prevalence values for selected dental anomalies, including microdontia, talon cusps, congenitally missing teeth, supernumerary teeth, peg-shaped lateral incisors, fusion, gemination, and non-carious defects of enamel. Brook [10] reported a prevalence of 0.5% for microdontia, 1.6% for gemination and 0.1% for dens invaginatus in the primary dentition of children in Slough, England. Sex differences in the prevalence of these dental anomalies were not observed.

Hyperdontia in the primary dentition is rare [11]. However, there is significant racial difference in its incidence, ranging from 0.2% to 1.8% for Caucasians, compared with 7.8% for Mongoloids [12,13]. Similar population differences have been reported also for hypodontia: a frequency of 0.4% was observed for Swedish children, which is midway of the range of 0.0% to 0.9% reported for Caucasians [12].

Little information is available about dental anomalies in any West African population. A few studies conducted in Nigeria focused only on very few developmental defects. Oredugba and Odukoya [14] reported a prevalence of 7.5% for chronological enamel hypoplasia. Before that, Adeniji [15] observed that the most prevalent dental anomaly observed clinically in school children in Lagos, Nigeria was enamel defect (10.4%), of which chronological enamel hypoplasia accounted for 6.7%. The prevalence of hypodontia in the permanent dentition was 0.4%, while that in primary dentition was 0.05% [15].

Data on dental anomalies are important for both the anthropological and clinical management of patients. The incidence and degree of expression of the anomalies can provide important information for phylogenic and genetic studies and help in the understanding of differences within and between populations [7]. Complications associated with dental hard- tissue anomalies include increased predisposition to caries and periodontal diseases, aesthetic impairment, pulpitis-induced pain, and crowding [2-6] all of which can negatively affect the oral health-related quality of life of affected children [15-17]. In view of this, it is important to conduct studies that could provide data on population-specific prevalence of dental anomalies. This is of specific importance in Nigeria, where evidence shows that the hard dental tissue profile of Nigerians differs from that of Caucasians [18,19]. This study is an effort in that direction. The study determined the prevalence, pattern and clinical presentation of developmental anomalies in hard dental tissues in the primary dentition and mix dentition of children resident in Ile-Ife, a suburban region of Nigeria. It also examined the association between the presence of developmental anomalies in hard dental tissues, sex and socioeconomic status of the children.

Methods

This cross-sectional study was conducted in Ile-Ife Central Local Government Area (LGA). According to the 2006 National Population Census, the population of the LGA was 138,818, with about 14,000 (10%) being children [20]. Recruitment of study participants was done at the National Population Enumeration sites in the LGA which had been for past national surveys [21,22]. The enumeration sites in the LGA were used as recruitment sites because it was assumed that participants in these sites were familiar with the conduct of such surveys and, thus, were more likely to be open to discussions with the field workers.

Study population

The study population included all children who were between four months and 12 years of age. Children excluded from the study were those who had a medical condition or syndrome associated with tooth anomalies, those who had cleft palate, and those with a history of diseases that could increase the risk for developing dental anomalies, such as maternal syphilis.

Sample size

Sample size was estimated by use of the Leslie Fischer's formula [23] for study populations of more than 10,000 at a 95% confidence level with a 50.0% prevalence [8] and a degree of freedom set at 0.05; sample size was 351. Based on a prevalence of 35.3% [8], it was determined that it would be necessary to examine a minimum of 993 children to identify 351 children with dental anomalies.

Sampling technique

The sampling procedure was a multi-stage (three-level) cluster sampling aimed at selecting eligible persons: Stage 1, selection of enumeration areas within the LGA; Stage 2, enlistment of eligible individuals within households; Stage 3, selection of respondents for interview and examination. Enumeration areas in the LGA were also randomly selected. At the enumeration sites, every third house on each street was considered for recruitment of study participants. In each

house, when more than one child was eligible for study, only one was selected. Eligibility was determined according to sex and age; male and female subjects were selected from consecutive houses, and the child who fell within the next age group was selected from each consecutive household. Recruitment of study participants continued in the enumeration site until the study sample was reached.

Data collection tool

Data were collected by a personal interview method, using a structured questionnaire. A dentist conversant with normal and pathological dental features and who had been engaged in a similar household dental survey in the same LGA, was engaged as a field worker for the study.

Data collected included information on the child's socio-demographic characteristics (age, sex, and socioeconomic status). Socioeconomic status for the purpose of this study was obtained through a multiple item scoring index [24] used in prior studies in Nigeria [25,26]. The status designation combines the mother's level of education with the occupation of the father; each child was allocated to a social class I to V, with social class V being lowest. Each child's social class was classified as Class I (upper class), class II (upper middle class), class III (middle class), class IV (lower middle class) and class V (lower class).

All children eligible to participate in the study had an oral examination. The examinations were conducted under natural light, with the children sitting on a chair. The teeth were examined wet after debris had been removed by use of a piece of gauze.

Ethical consideration

Ethical approval was obtained from the Obafemi Awolowo University Teaching Hospital Complex Ile-Ife. Approval for community entry was obtained from the LGA office. Written informed consent was obtained from a parent or legal guardian of each study participant prior to enrollment and assent was also sought from children who were 12 years of age.

Questionnaire administration

Information on the socio-demographic profile of the children was obtained from either of the consenting parent or legal guardian and, where feasible, was corroborated by the child.

Clinical examination

The diagnosis of dental hard-tissue anomaly was based exclusively on clinical examination. Detailed examination was conducted with sterile dental mirrors and probes. Gross debris was removed with gauze before examination of each tooth. The teeth present were charted. All dental anomalies observed were recorded. A tooth was considered present when any part of it was visible. A tooth present was scored as 1, and tooth absent as 0. Radiographs were not used. The following diagnostic criteria were used for the most common dental anomalies:

- Peg-shaped lateral: Any upper lateral incisor with a reduction in its mesio-distal size in a gingivo-incisal direction.
- Mesiodens: a supernumerary tooth present in the pre-maxilla between the two central incisors [7].
- Talon cusp: A prominent accessory cusp-like structure projecting incisally from the cingulum area of an incisor [8].
- Microdontia: Teeth which are physically smaller than usual [9].
- Macrodontia: Teeth which are physically larger than usual [9].
- Gemination: Anomalies which arise from an attempt at division of a single tooth germ by an invagination, with resultant incomplete formation of two teeth and corresponding increase in the number of teeth in the dental arch [7].
- Fusion: the union of two normally separated tooth buds with the resultant formation of a joined tooth with confluence of dentine [27].
- Enamel hypoplasia: is defined as a deficiency of enamel formation and is seen clinically as pits, grooves or generalized [28].
- Dens evaginatus: an accessory cusp whose morphology makes it an abnormal tubercle [29].
- Dens invaginatus: an invagination of enamel in the crown of the tooth [30].
- Supernumerary: an additional tooth to the normal series [31].
- Supplemental: an additional tooth to the normal series resembling the tooth with which it is associated [32].
- Hypodontia: The absence of a tooth or teeth, exclusive of the third molars [33].
- Tooth transposition: The positional interchange of two adjacent teeth [34].
- Notch shaped incisor: A condition of the teeth in which the incisal edge is notched and narrower than the neck area at the gums associated with maternal syphilis infection [35].

Standardization of examiner

An intra-examiner reliability test was done to calibrate the principal investigator on consistency of diagnosis for dental anomalies. The test was done by examining pictures of various dental anomalies. The scoring for each of the pictures identified correctly was recorded and repeated twice at an interval of one week. The intra-examiner reliability score for each of the 16 dental anomalies studies was high.

Data analysis

The ages of the study participants were divided into three categories for data analysis: ≤4 years, 5–8 years, and 9–12 years. The socioeconomic status of the children was also re-categorized into three classes: social classes I and II, high socioeconomic status; social class III, middle socioeconomic status; and social class IV and V, low socioeconomic status. Descriptive and bivariate analyses were conducted to test the association between dependent variables (presence of dental hard-tissue anomalies) and the child's socioeconomic status and sex. Where appropriate, the Pearson's Chi-squared test or Fisher's exact test was used to calculate the test of association. Statistical analysis was done with Intercooled STATA (release 12) for windows. Simple proportions were computed. Statistical significance was inferred at $p < 0.05$.

Results

One thousand and thirty-six children were recruited into the study. No child eligible to participate in the study met the exclusion criteria. Age, sex, and socioeconomic class of study participants recruited for the study are highlighted in Table 1. Two hundred and seventy six (26.6%) children had dental hard-tissue anomalies. The most prevalent anomaly was hypoplastic enamel (16.1%), followed by dens evaginatus (6.4%). An anomaly of tooth structure was significantly more frequent than an anomaly of tooth size (16.1%vs 3.4% - $p < 0.001$), tooth shape (16.1 vs 8.4% - $p < 0.001$), and tooth number (16.1 vs 1.3% - $p < 0.001$). See Table 2. There was no significant sex difference in the prevalence of the anomalies, except for macrodontia: significantly more males than female had macrodontia ($p < 0.001$). Also, there was no significant difference in the prevalence of dental hard-tissue anomaly based on socioeconomic status, except for macrodontia: more children from the high socioeconomic status had macrodontia ($p = 0.003$). See Table 2.

Table 1 Age, sex and socioeconomic status of study participants

	Male (%)	Female (%)	Total (%) N = 1,036
Age			
≤4 years	193(37.4%)	199(38.3%)	392(37.8%)
5-8 years	199(38.6%)	189(36.3%)	388(37.5%)
9-12 years	124(24.0%)	132(25.4%)	256(24.7%)
Total	516(100%)	520(100%)	1,036(100%)
Socioeconomic Status			
Low	223(21.5%)	227(21.9%)	450(43.4%)
Middle	171(16.5%)	185(17.9%)	356(34.4%)
High	122(11.8%)	108(10.4%)	230(22.2%)
Total	516(49.8%)	520(50.2%)	1,036(100%)

Significantly more cases of dental hard-tissue anomalies were identified in the permanent than in the primary dentition (5.4%vs 2.8%; $p < 0.001$). There were significantly more cases of densevaginatus ($p < 0.001$), macrodontia ($p < 0.001$), peg-shaped laterals ($p < 0.001$), talon cusp ($p = 0.009$) and notch shaped incisor ($p = 0.002$) in the permanent dentition than in the primary dentition. However, there were significantly more cases of hypoplastic enamel ($p < 0.001$) in the primary than permanent. See Table 3.

Table 4 shows the number of teeth with anomalies in the maxilla and in the mandible. There were more lesions in the maxilla than in the mandible (4.4% vs 2.7%; $p < 0.001$). More children had dens evaginatus ($p < 0.001$), macrodontia ($p = 0.002$), peg-shaped laterals ($p < 0.001$) and notch shaped incisor ($p = 0.04$) in the maxilla than in the mandible. There were no significant differences in the number of teeth that had anomalies on the left side of the face when compared with the right ($p = 0.77$). See Table 5.

Of the 1,036 children examined, 247(23.8%) had at least one dental anomaly, 26(2.5%) had two anomalies, and 3(0.3%) had more than two. There was no difference in the number of male and female participants who had one or more dental hard-tissue anomalies. Significantly fewer children from the middle socio economic strata had two or more dental anomalies. See Table 6.

Discussion

This study makes a unique contribution to the growing literature on the epidemiology of dental hard-tissue anomalies. Studies such as ours are important because of evidence of regional and racial disparity in the occurrence of dental anomalies. Currently, there is paucity of information from Nigeria on this subject, as previous studies examined only a limited number of dental hard-tissue anomalies.

This study has a methodological strength: it conducted a household survey, thus increasing the chances of including both in- and out-of-school children of all age groups and socioeconomic class. School-based studies in Nigeria have limited access to children from all socioeconomic strata since about 20% of children of primary-school age and 60% of children of secondary-school age are out of school. Nigeria accounts for 47% of the world's out-of-school population [36].

Our study, however, had limitations. First, the study did not conduct radiographic examinations to rule out dental anomalies that could be present within the jaw bone, such as supplemental teeth, mesiodens, supernumerary teeth, dens invaginatus and hypodontia. Second, the diagnosis of microdontia and macrodontia was based on visual examination and not by measuring the dimensions of the teeth using casts; the dependence on visual examination for the diagnosis of these anomalies may have introduced bias. However, within the limits of the design of the study, the

Table 2 Prevalence of dental anomaly by sex and socioeconomic status

Dental hard-tissue anomaly	Number of cases affecting Male	Number of cases affecting Female	Number of cases affecting low SES	Number of cases affecting middle SES	Number of cases affecting high SES	*Prevalence of lesion N = 1,036
	n = 516	n =520	n =451	n =357	n =228	
Enamel hypoplasia	76(14.7%)	91(17.5%)	77(17.1%)	47(13.2%)	43(18.9%)	167(16.1%)
Dens evaginatus	33(6.4%)	33(6.3%)	38(8.4%)	17(4.8%)	11(4.8%)	66(6.4%)
Macrodontia	19(3.7%)	2(0.4%)	6(1.3%)	4(1.1%)	11(4.8%)	21(2.0%)
Peg shape lateral	9(1.7%)	7(1.3%)	4(0.9%)	8(2.2%)	4(1.8%)	16(1.5%)
Microdontia	5(0.9%)	10(1.9%)	4(0.9%)	7(2.0%)	4(1.8%)	15(1.4%)
Supernumerary	2(0.4%)	2(0.4%)	2(0.4%)	2(0.6%)	0(0.0%)	4(0.4%)
Fusion/Gemination	2(0.4%)	2(0.2%)	1(0.2%)	1(0.3%)	2(0.4%)	4(0.4%)
Supplemental	2(0.4%)	1(0.2%)	2(0.4%)	1(0.3%)	0(0.0%)	3(0.3%)
Talon cusp	1(0.2%)	2(0.4%)	2(0.2%)	0(0.0%)	1(0.3%)	3(0.3%)
Mesioden	1(0.2%)	0(0.0%)	0(0.0%)	0(0.0%)	1(0.3%)	1(0.1%)
Dens Invaginatus	1(0.2%)	0(0.0%)	1(0.2%)	0(0.0%)	0(0.0%)	1(0.1%)
Transposition	0(0.0%)	1(0.2%)	1(0.2%)	0(0.0%)	0(0.0%)	1(0.1%)
Notch incisor	0(0.0%)	1(0.2%)	1(0.2%)	0(0.0%)	0(0.0%)	1(0.1%)
Hypodontia	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%
Total	151(29.3%)	152(29.2%)	139(30.8%)	87(24.4%)	77(33.8%)	303(29.2%)

*number of persons with lesion divided by the number of study participants.

Table 3 Prevalence of dental anomaly by type of dentition

Dental hard-tissue anomaly	Number of primary tooth affected by lesion	Number of permanent tooth affected by lesion	*Prevalence of lesion N = 23,591
	n = 16,456	n = 7,135	
Hypoplastic enamel	371(2.3%)	254(3.6%)	625(2.7%)
Dens evaginatus	57(0.3%)	60(0.8%)	117(0.5%)
Macrodontia	0(0.0%)	34(0.5%)	104(0.4%)
Peg-shape lateral	8(0.05%)	16(0.2%)	24(0.1%)
Microdontia	13(0.08%)	9(0.1%)	22(0.09%)
Supernumerary	2(0.01%)	2(0.03%)	4(0.02%)
Fusion/Gemination	4(0.02%)	0(0.0%)	4(0.02%)
Supplemental	2(0.01%)	1(0.01%)	3(0.01%)
Talon cusp	0(0.0%)	3(0.04%)	3(0.01%)
Mesioden	0(0.0%)	1(0.01%)	1(0.004%)
Dens invaginatus	1(0.006%)	0(0.0%)	1(0.004%)
Transposition	0(0.0%)	2(0.03%)	2(0.008%)
Notch-shape incisor	0(0.0%)	4(0.06%)	4(0.02%)
Hypodontia	0(0.0%)	0(0.0%)	0(0.0%)
Total	458(2.8%)	386(5.4%)	844(3.6%)

*number of persons with lesion divided by the number of study participants.

data still provide useful information that addresses the objective of the study.

We found that the prevalence of anomalies associated with number, form and size of dental hard tissues was low. Also, the prevalence of fusion/gemination was lower

Table 4 Number and percentage of teeth with dental anomalies in the maxilla and mandible

Anomaly	Maxillary	Mandible	Total
	n = 11,732	n = 11,859	N = 23,591
Hypoplasia	324(2.8%)	301(2.5%)	625(2.7%)
Dens evaginatus	112(0.9%)	5(0.04%)	117(0.5%)
Macrodontia	32(0.3%)	2(0.02%)	34(0.1%)
Peg shaped lateral	23(0.2%)	1(0.008%)	24(0.1%)
Microdontia	13(0.1%)	9(0.08%)	22(0.09%)
Notch shaped incisor	4(0.03%)	0(0.0%)	4(0.02%)
Fusion/Gemination	3(0.03%)	1(0.008%)	4(0.02%)
Talon cusp	3(0.03%)	0(0.0%)	3(0.01%)
Supernumerary	2(0.02%)	2(0.02%)	4(0.02%)
Supplemental	1(0.008%)	2(0.02%)	3(0.01%)
Mesioden	1(0.008%)	0(0.0%)	1(0.008%)
Transposition	0(0.0%)	2(0.02%)	2(0.004%)
Dens invaginatus	1(0.008%)	0(0.0%)	1(0.008%)
Hypodontia	0(0.0%)	0(0.0%)	0(0.0%)
Total	519(4.4%)	325(2.7%)	844(3.6%)

Table 5 Number and percentage of teeth with dental anomalies in the right and left sides of the jaws

Anomaly	Right side (%)	Left side (%)	Total
	n = 11,776	n = 11,815	n = 23,591
Hypolasia	308(2.6%)	317(2.7%)	625(2.7%)
Dens evaginatus	64(0.5%)	53(0.4%)	117(0.5%)
Macrodintia	16(0.1%)	18(0.2%)	34(0.1%)
Peg shaped lateral	12(0.1%)	12(0.1%)	24(0.1%)
Microdontia	11(0.1%)	11(0.09%)	22(0.09%)
Notch shaped incisor	2(0.02%)	2(0.02%)	4(0.02%)
Fusion/Gemination	2(0.02%)	2(0.02%)	4(0.02%)
Talon cusp	2(0.02%)	1(0.008%)	3(0.01%)
Supernumerary	3(0.03%)	1(0.008%)	4(0.02%)
Supplemental	2(0.02%)	1(0.008%)	3(0.01%)
Transposition	2(0.02%)	0(0.0%)	2(0.008%)
Dens invaginatus	1(0.008%)	0(0.0%)	1(0.004%)
Hypodontia	0(0.0%)	0(0.0%)	0(0.0%)
Total	425(3.6%)	418(3.5%)	843(3.6%)

than the 1.9% previously reported in Nigeria [37], while the prevalence of macrodontia was higher than reported [38-40]. Significant sex and socioeconomic differences were also observed in the prevalence of macrodontia: the prevalence was higher in males and in those from the high socioeconomic strata. Brooks and Johns [41] had noted that males had a higher frequency of macrodontia in modern populations. The authors postulated that microdontia was an anomaly resulting from the interaction between genetic and environmental factors [42]. The association found between sex, socioeconomic status and macrodontia may further substantiate this postulation.

We reported one case of notched incisor. The mother of the child denied a history of syphilis. The child did not have other features of perinatal syphilis infection such as saddle nose, saber shins, protruding mandible, swollen knees. We decided to include this case in the study report since we could not exclude maternal syphilis as the etiological factor: there may therefore be other possible causes of notched incisors. However, we do realize that many families in Nigeria give birth in unorthodox health care centres; thus the diagnosis of maternal syphilis may have been missed. We may also have received a false-negative response to the question on syphilis.

Some of the study findings differ from those of prior reports. First, although this study, like a study in Nigeria [43], did not find a sex predilection for the prevalence of peg-shaped laterals, others [44-46] have reported a predilection for the condition in either male or female participants. Second, this study also reports a higher prevalence of dens evaginatus than had been reported in Mongoloids [47-49], although it found a similar prevalence to that observed in Hong Kong Chinese [50]. Prior studies had reported traits of dens evaginatus in blacks [51]. We were, however, not able to identify any study that reported on the prevalence of dens evaginatus in a predominantly black population. Third, the high prevalence of anomalies associated with dental structures reported in this study is not unusual, as prior studies had shown a greater prevalence of enamel hypoplasia in children from developing countries [52,53] and in children with chronic or acute malnutrition [52,53] or very low birth weight [54], which are common disorders in children from resource-limited settings. Studies conducted in metropolitan Nigerians reported a prevalence of enamel hypoplasia of 4% and 0.13% in primary dentition [55] permanent dentition [56,57], respectively. The higher prevalence of enamel hypoplasia that we found in this study may reflect the more frequent exposure of children in this suburban setting to the various aetiological factors for enamel hypoplasia. Finally, our results suggest that the clinical presence of hypodontia in the mixed dentition is rare in this study population when the third molar is excluded from the surveyed dentition. This finding is contrary to the findings of Magnusson [58], and Amini, et al. [59], who found a high prevalence of hypodontia in the permanent dentition. Prior studies had highlighted the lower prevalence of hypodontia in the primary dentition when compared to the permanent

Table 6 Prevalence of children with single and multiple hard dental tissue anomalies

	Number (%) of male study participants with dental anomaly	Number (%) female study participants with dental anomaly	Total	Number (%) of study participants with dental anomaly in the low SES	Number (%) of study participants with dental anomaly In the middle SES	Number (%) of study participants with dental anomaly of in the high SES	Total
	n = 516	n = 520	N = 1036	n = 451	n = 357	n = 228	N = 1036
One anomaly	122(23.6%)	125(24.0%)	247(23.8%)	116(25.7%)	76(21.3%)	55(24.1%)	247(23.8%)
Two anomalies	13(2.5%)	13(2.5%)	26(2.5%)	15(3.3%)	2(0.6%)	9(3.9%)	26(2.5%)
More than two anomalies	1(0.2%)	2(0.4%)	3(0.3%)	1(0.1%)	1(0.3%)	1(0.4%)	3(0.3%)
Total	136(26.4%)	140(26.9%)	276(26.6%)	132(29.3%)	79(22.1%)	65(28.5%)	276(26.6%)

dentition [60]. There, however, seemed to be no difference in the clinical presentation of hypodontia in the primary and mixed dentition of our study population.

Conclusion

This large survey of dental hard-tissue anomalies in Nigerian children has provided anthropological and clinical data that may aid in the detection and management of dental problems in this nation's children and perhaps elsewhere in the world. This information will enable paedodontists and public health specialists to prioritize screening measures for early diagnosis of childhood dental anomalies. Further studies may help in understanding the impact of these dental anomalies on the oral-health quality of life of the children.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

ODT conceived the idea of the study. ODT, MOF, OF, NMC, KAK, NO, TO, EO and HA participated in its design, data collection, and development of the manuscript. All the authors read and approved the final manuscript.

Acknowledgements

We are grateful to Dr. T Owoeye, for his contributions towards the collection of the data for this study. We are also grateful to Williams Brown for the editing of this manuscript. The study was funded through personal contributions by the authors.

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Received: 11 July 2014 Accepted: 9 October 2014
Published: 16 October 2014

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doi:10.1186/1472-6831-14-125
Cite this article as: Temilola *et al.*: The prevalence, pattern and clinical presentation of developmental dental hard-tissue anomalies in children with primary and mix dentition from Ile-Ife, Nigeria. *BMC Oral Health* 2014 **14**:125.