Original Research

The Incidence of Enamel Hypoplasia In Children Between 8 and 15 Years in Anbar Governorate, Iraq

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Abstract

Aims: Hereditary and environmental factors can lead to enamel hypoplasia (EH). This defect can affect the baby teeth (primary) or permanent teeth. The study has been performed to estimate the incidence of the enamel hypoplasia among children between the age group of 8 and 15 years in Al-Anbar Governorate, Iraq and to try to find some solutions to protect the enamel in these ages. **Materials and Methods:** A total of 2652 pupils were selected from schools of primary and medium. All samples were chosen according to the randomized stratified clustered manner. The pupils' populations were classified into 1–3 groups. In each group, there were 884 pupils (442 males and 442 females) examined. The procedures of diagnosis were in calm status with daylight, using general surgical instruments, for example, disposable mirror, and forceps that have been used to retract the lips and cheeks. **Statistical Analysis:** The data have been collected were analyzed using the Chi-square statistic test (SPSS version 22 software). **Results:** The enamel hypoplasia was the most common widespread in both genders, in the boys, it was 122 (9.2%), whereas in the girls, it was 117 (8.82%), and there were no statistically significant *P* value differences between both genders ($P > 0.05$). Results also showed that hypoplastic enamel was significantly seen on the maxillary incisors compared with the canines and the premolars. **Conclusion:** Several factors can cause enamel hypoplasia among children between the age group of 8 and 15 years in Al Anbar Governorate such as nutritional factors, illness, or the range of acquired genetic factors that are eventually lead to esthetics problems and dental hypersensitivity. Accordingly, enamel hypoplasia in teeth can increase the risk of dental caries and tooth wear; therefore, one of the best options was effective preventive care and monitoring are required that is the helping to protect the enamel.

Keywords: Dental hypersensitivity, developmental defects, enamel hypoplasia

Introduction

The main composition of the teeth tissue, that is, embedded in the upper and lower jaws is enamel, dentin, and cementum.[1] The layer of tooth enamel that is visible part of the teeth is unique part due to this layer is considered the only epithelium-derived calcified tissue in human as well as vertebrate,[2] and the tooth enamel in the human body is the hardest and highly mineralized substance.[3] The structure of dental enamel has been studied in details; characteristically, it is a hardest substance such as iron or carbon steel, but it displays a very high elasticity.[4] There are several cells that are responsible to form the dental enamel, for example, the ameloblast that is covered the entire surface of the layer and these cells are unique types in the teeth and essentially found during the development of teeth deposit tooth enamel,[5] for example, ameloblasts, odontoblasts, and cementoblasts.[6] Tooth enamel is constituted through only a specific time of the tooth emergence and is irreplaceable.[7] Ameloblasts play a critical role in enamel production and regulating amelogenin deposition.[8] There is now strong evidence that exceedingly prevalent dental disorders among most of the Iraqi schools and among primary schoolchildren in Saudi Arabia, for example, Fallujah city, Al Anbar Governorate, especially with students between 8 and 15 years old and Riyadh in Saudi Arabia.[9,10] Therefore, a variety of factors, for instance, genetic defects cause dysfunction or abnormalities of ameloblasts and the lead to radical alteration in the appearance and color of the dental enamel in the adult dentition.[11] In addition, dysfunction or abnormalities of ameloblasts might happen as a result

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in an alteration in the appearance of the enamel during the long process of amylogenesis that is known developmental defects of enamel (DDE).[12] Effects of DDE might arise due to an enormous range of genetic diseases or even acquired etiological factors from environmental such as toxications, perinatal, and postnatal problems or maybe other medical conditions as well as might result in dental hypersensitivity and compromised esthetics.[13] While enamel hypoplasia with a localized distribution may be caused by trauma, localized infection, and irradiation treatment of DDE attempts to enhance the appearance, color, and function of the influenced teeth.[14] Due to the limitation of research in relation to enamel hypoplasia in Al Anbar Governorate, the study organized and carried out.

The goal of this survey was to estimate the enamel hypoplasia in schoolchildren between schoolchildren at age 8–15 years in Al Anbar Governorate, Iraq.

Materials and Methods

An observational study in Al-Anbar Province, Fallujah city, from October 2017 to November 2018 was conducted to estimate the enamel hypoplasia in primary and secondary schoolchildren. Before starting the questionnaire, the authoritative permission was provided from the University of Anbar, College of Dentistry, and Directorate of Fallujah education to complete this survey (reference 5220 in April 16, 2017). The study was conducted among 2652 schoolchildren of primary and medium classes between ages 8 and 15 years old. The number of males and females were equal in each one was 1326 (50%) of males and 1326 (50%) of females. The study samples were selected using the randomized stratified cluster. The vision to be clearer, lips and cheeks using disposable mirror were retracted, and the tests were achieved in calm conditions with the natural light. The developmental enamel defect of teeth was examined and diagnosed for all the teeth of 2652 schoolchildren in the absence of drying or even brushing their teeth before the checking.

The modified DDE index that had been reported by Clarkson and O'Mullane[15] was used to classify the localization and type of the DDE [Table 1].

The statistical analysis of data that is obtained from this study has been analyzed utilizing the SPSS version 23 software (IBM, Portsmouth, UK). This software provides important information on how the collected data and samples. Pearson's Chi-Square test was used to measure the differences of statistical significance.

Results

Of 2652 students, there were 1326 (50%) boys and 1326 (50%) girls. In our study, the enamel hypoplasia was more prevalent in both genders, i.e., boys 122 (9.2%) and girls 117 (8.82%) [Figure 1], and the statistical analysis showed that there were no statistically significant differences between boys and girls ($P > 0.05$). Total sample size of the enamel hypoplasia was distributed depending on the types of the enamel hypoplasia [Table 2].

Figure 1: Enamel hypoplasia affecting central tooth

The percentage prevalence of enamel hypoplasia according to age group of the patients for both genders is shown in Table 3. In comparison, the Chi-square test has been used to compare between the different age groups that suffering from enamel hypoplasia, the data analysis showed that the "*P*" value was >0.05. The results illustrated that the incisors teeth of students were the most teeth that have been influenced by the enamel hypoplasia within population between the different groups followed by the canines and the premolars [Table 4].

The distribution of enamel hypoplasia according to the involvement of teeth in the different age groups of individuals was recorded and it showed statistically no significant differences between groups ($P > 0.05$) [Table 5].

Discussion

The prevalence of enamel hypoplasia in this study has been estimated in schoolchildren among 8 and 15 years old in Al Anbar Governorate, Iraq. Even thoughthere were numerous studies that have been reported about the prevalence of enamel hypoplasia in Iraq as well as other nations worldwide, no research has been achieved in Al-Anbar Governorate. This study was generally attempted to compare, measure, and estimate the prevalence of the enamel hypoplasia among the primary and secondary schoolchildren. The ameloblasts cells that present only during

Table 1: Modified developmental defects of enamel index[15]

Symbol	Characteristics of defect	A statement of characteristics of defect
0	Standard or normal	-
1	Demarcated opacities	Opacity (5) can be described as the qualitative disorder in the enamel of teeth that can be discovered by the naked eye as an abnormal feature that presents in the enamel that should be translucency in the normal situation. The injured tooth can be described either a white or discolored, for example, yellowish or cream area, in contrast, in natural cases, the thickness of enamel is normal as well as enamel surface of tooth seems to be smooth, excluding some cases while connected within hypoplasia, it will be irregular, unclear, and patchy areas of opacity lacking clear-defined margins
2	Diffuse opacities	Visible opacity within clear-determine margins
3	Hypoplasia	Hypoplasia (5) is a generic term that can be known as a quantitative defect of enamel visually and histomorphologically and can be observed as involving the surface of enamel that related with the weaker thickness of enamel. Defects in the hard surfaces (enamel) can appear as superficies or deep pits or may be wide or narrow grooves. The defects in the enamel can be arranged either horizontally in a linear fashion that is found across the tooth surface or in some cases spreading over an area around the whole or section of the enamel superficial
4	Other defects	The rest cases of defects that are not diagnosis into these categories have been scored as others cases

Table 2: Pattern of developmental defects of enamel among studied population

Patterns of defects	Boys (1326), *n* (%)	Girls (1326), *n* (%)	Total (2652), *n* (%)	*Chi-square Tests*
Demarcated opacities	82 (6.18)	72 (5.4)	154 (5.8)	0.99*
Diffuse opacities	36 (2.71)	35 (2.6)	71 (2.67)	0.94*
Hypoplasia	4 (0.3)	10 (0.75)	14 (0.52)	0.08*
Total	122 (9.2)	117 (8.82)	239 (9.01)	

*Not significant $P>0.05$

Table 3: Prevalence of enamel hypoplasia according to age groups

Age group	Enamel hypoplasia			Total, *n* (%)	*Chi-square Tests*
	8-10 years, *n* (%)	11-13 years, *n* (%)	14-15 years, *n* (%)		
Boys	45 (3.39)	56 (4.22)	21 (1.58)	122 (9.2)	0.27*
Girls	49 (3.69)	42 (3.16)	26 (1.96)	117 (8.82)	
Total	94 (3.54)	98 (3.69)	47 (1.77)	239 (9.01)	

*Not Significant $P>0.05$

Table 4: Prevalence of affected teeth among gender

Teeth	Jaw	Boys (1326), *n* (%)	Girls (1326), *n* (%)	Total (2652), *n* (%)
Incisors	Maxillary	87 (6.56)	85 (6.41)	172 (6.48)
	Mandibular	13 (0.98)	12 (0.9)	25 (0.94)
Canines	Maxillary	8 (0.6)	9 (0.67)	17 (0.64)
	Mandibular	6 (0.45)	6 (0.45)	12 (0.45)
Premolars	Maxillary	4 (0.3)	3 (0.22)	7 (0.26)
	Mandibular	4 (0.3)	2 (0.15)	6 (0.22)
Total		122 (4.6)	117 (4.41)	239 (9.01)

stages of tooth development which are incapable to recover when exposed to damage were quite sensitive to the systemic and genetic disturbances.[16] This study has shown that the prevalence of the enamel hypoplasia among the schoolchildren was 9.01% and that was higher than another study that is reported by Al-Nori and Al-Talabani,[17] Ruan,[8] Mohammed *et al*.,[18] Mahmood *et al*.,[19] Mohanad, and Wasan,[20,21] which were 6.61%, 5.8%, 3.06%, 2.07%, and 2.04%, respectively.

Al-Nori and Al-Talabani *et al*. reported enamel hypoplasia were 10%, 7.8%, and 10%, respectively,[14,18] and these results were close prevalence of enamel hypoplasia that has been found in this study. The main differences in these results may be due to local trauma, local factors, and nutritional deficiency, for example, Vitamin D as well as calcium that is led to enamel hypoplasia.[17] This study has been unable to demonstrate that a higher prevalence of enamel hypoplasia that was noticed between malnourished children.[18,22]

Table 5: Distribution types of enamel hypoplasia among gender

Enamel hypoplasia	Boys (1326), *n* (%)	Girls (1326), *n* (%)	Total (2652), *n* (%)	*Chi-square Tests*
Localize enamel hypoplasia	118 (8.89)	107 (8.06)	225 (8.48)	0.1*
Generalize enamel hypoplasia	4 (0.3)	10 (0.75)	14 (0.52)	0.1*
Total	122 (9.2)	117 (8.82)	239 (9.01)	

*No significant difference $P>0.05$

In the present study, most of the teeth that were examined, there was more qualitative (demarcated opacities) in both boys and the girls; 6.18% and 5.4%, respectively, than the quantitative defects of hypoplasia that has been accounted only for 0.3% and 0.75%, respectively, as illustrated in Table 2. Contrary to expectations, these findings did not agree with Clarkson J *et al.*[15] and Jindal C *et al*.,[16] their results has revealed that demarcated opacities and hypoplasia are more commonly noted in teeth which had sustained a localized and transient injury.

Approximately, 431 samples of public preschool children have been analyzed by Lunardelli and Peres,[19] noted 6.1% of marked opacity, 11.1% of hypoplasia, and prevalence of 17.9% of diffuse opacity. A possible explanation for this might be that the teeth have exposure to damage through calcification and enamel maturation, instead of throughout the cellular differentiation and the matrix secretion.[16] The present study has demonstrated that, among the primary and secondary schoolchildren, the enamel hypoplasia was found to be highest in the maxillary (6.48%) and mandibular incisors (6.48% and 0.94%, respectively), followed by the maxillary and mandibular canine (0.64% and 0.45%, respectively) and the least affected the maxillary and mandibular premolars (0.26% and 0.22%, respectively).

In the present study, enamel hypoplasia in the upper incisors had a higher incidence than in the lower incisors. There is evidence that, during the ameloblasts synthesis, these cells were processed protrude toward the forming dentin, and it is responsible to thick enamel was more sensitive to the systemic defects than the ameloblasts that have been linked with the thin enamel.[20,21] It is possible that calcium ions diffusion into the matrix through ameloblasts as well as the removal of organic compounds from the matrix teeth was slower in the deep enamel compared within the surface enamel.[23]

Conclusion

There is growing evidence that the fact of existing of enamel hypoplasia can make greater the danger of primary teeth to early babyhood caries; therefore, enamel hypoplasia has profound effects on health and well-being from childhood to old age. The enamel hypoplasia was more prevalent in both genders, boys 122 (9.2%) and girls 117 (8.82%). However, enamel hypoplasia in the dentition possible occurs as a result of several genetic conditions or acquired etiological factors that can lead to hypersensitivity and esthetics problems in teeth. As result of the complications of enamel hypoplasia that are included an increasing risk of tooth wear and dental caries, it is important to protect the enamel and successful preventive care and observation to prevent the loss of teeth.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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