

The prevalence of enamel hypoplasia on permanent teeth among children ages 9-12 years based on the type and teeth that are affected

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ABSTRACT

Introduction: Enamel hypoplasia is defect which is an abnormality on the enamel structure. The abnormality causes an aesthetic problems that affects the psychology of a child, and also makes it easier to form a caries. The purpose of this research was to find the prevalence of enamel hypoplasia on permanent teeth among children ages 9-12 years based on the type and teeth that are affected. **Methods:** The research was descriptive with survey technique. The samples were taken by purposive sampling technique, which were 96 children. The research was done on erupted permanent teeth. Location of research is in dental hospital faculty of dentistry Universitas Padjadjaran. **Results:** The result of this research shows that seven children (7.29%) have enamel hypoplasia on their permanent teeth, the amount of teeth that are affected are 15. Enamel hypoplasia has occurred to one child (1.04%) ages nine, three children (3.13%) ages ten, one child (1.04%) ages 11, and two children (2.08%) ages 12. **Conclusion:** Prevalence of enamel hypoplasia on permanent teeth among children ages 9-12 years UNPAD was 7.29%. Enamel hypoplasia occurred to 15 teeth, which are six of them (40%) was type III. The most common teeth that are affected is premolar, which are eight teeth (53.33%).

Keywords: Enamel hypoplasia, permanent teeth, teeth that are affected

INTRODUCTION

Growth and development can lead to various changes in an individual, including physical, psychological, and physiological alterations¹. Teeth are one of the body parts that undergo growth and development. They play an essential role in chewing, speaking, and aesthetics².

To perform these functions optimally, teeth must be healthy, white, clean, and well-aligned. Any abnormalities in the teeth can result in problems that may eventually affect an individual's psychological development³. Oral and dental health is of critical importance. According to the World Health Organization (WHO), the mouth and teeth are vital organs that must be maintained in good health, as they serve as the primary entry point for nutrients required by the body⁴. When oral health is compromised, the digestion of food is also adversely affected.

Additionally, teeth should be well-aligned, white, and clean to support effective mastication and enhance one's

appearance. Nowadays, many patients visit dental clinics not only for issues such as tooth decay but also to fulfill psychological needs related to aesthetics⁵. Enamel is the outermost layer of the tooth, covering the entire crown². It is a hard, thin, and translucent calcified substance that protects the underlying dentin⁶. Enamel possesses a unique composition and structure, being almost entirely composed of calcium salts, which allows it to withstand prolonged trauma and masticatory forces. Despite its strength, enamel can experience structural abnormalities due to disturbances during its development. Such abnormalities include enamel hypoplasia, hypocalcification, and hypomaturation. Hypoplasia refers to the incomplete development of a tissue or organ, characterized by a reduction in size due to a decreased number of functional cells⁷.

Enamel hypoplasia is a structural defect in the tooth enamel resulting from

disturbances in ameloblast activity during the amelogenesis process, leading to insufficient organic matrix formation and disrupted matrix apposition, although the calcification process remains normal⁸⁻¹¹. Enamel hypoplasia can be either hereditary or non-hereditary¹².

Clinically, enamel hypoplasia presents as enamel that remains hard but is insufficient in thickness. In severe cases, enamel may be completely absent¹³. Affected crowns may appear pale, yellow-brown, pitted, or grooved⁷. The condition may affect primary teeth, permanent teeth, or both, with varying clinical presentations^{10, 11, 14}. Enamel hypoplasia can involve all teeth or only a subset¹³. Because the enamel structure is incomplete due to impaired matrix formation and may be accompanied by reduced calcification, individuals with enamel hypoplasia are at increased risk for plaque retention compared to those with normal enamel structure¹⁵.

This heightened plaque retention makes affected individuals more susceptible to caries, increasing the likelihood of infections and complaints involving the oral cavity, including periodontal tissues. These issues can disrupt both the masticatory and aesthetic functions of the teeth. In children, enamel hypoplasia can lead to significant aesthetic disturbances¹⁶. Environmental factors account for a substantial portion of enamel damage in children's permanent teeth in industrialized nations—up to 68.4% among a sample of 1500 children. Of these, 14.6% represented enamel hypoplasia¹⁴. A study involving preterm children reported a 20.3% prevalence of enamel hypoplasia in primary

teeth¹⁷. According to Budipramana, the prevalence of enamel hypoplasia is already relatively high, affecting approximately 3% of primary teeth and 2-5% of permanent teeth¹⁸.

In Northern populations, 60-73% of Amelogenesis Imperfecta cases are of the hypoplastic type, with a prevalence of 1:718¹⁰. Monteron reported that enamel hypoplasia in children's permanent teeth has a prevalence ranging from 3-15%¹⁹. A study conducted at Krayak Public Elementary School in Serang Regency found a prevalence of enamel hypoplasia of 13.18%²⁰.

The Dental and Oral Hospital of the Faculty of Dentistry, Universitas Padjadjaran (RSGM FKG UNPAD), is the largest dental teaching hospital in Bandung and serves as a referral center. However, the prevalence of enamel hypoplasia at RSGM FKG UNPAD is currently unknown, as no prior studies have been conducted on this condition.

Identifying the prevalence of enamel hypoplasia at RSGM FKG UNPAD can provide a valuable basis for developing oral health programs, especially those aimed at prevention and management. Based on the above rationale, the authors were motivated to conduct a study to determine the prevalence of enamel hypoplasia in permanent teeth among children. Healthy, strong, white, and clean teeth significantly influence patients' functional, aesthetic, and psychological well-being. The purpose of this research was to determine the prevalence of enamel hypoplasia in permanent teeth among children aged 9-12 years, based on the type and location of the affected teeth.

METHODS

This study employed a descriptive research design using a survey technique. The study population consisted of children who received treatment at the Pedodontics Department of the Dental and Oral Hospital, Faculty of Dentistry, Universitas

Padjadjaran (RSGM FKG UNPAD). Inclusion criteria were as follows: children aged 9-12 years, possessing permanent teeth, and not undergoing treatment with fixed orthodontic appliances or restorations that obstructed the surfaces to be examined.

Purposive sampling was used to select the subjects. Each subject underwent an anamnesis to gather information about complaints or characteristics potentially associated with enamel hypoplasia.



Figure 1 A case of enamel hypoplasia identified during the study.

In addition, a clinical dental examination was performed, during which the examiner recorded the presence of permanent teeth on an examination sheet and assessed whether each tooth exhibited signs of enamel hypoplasia. Teeth identified as having enamel hypoplasia were marked with a check (✓), whereas those without were left unmarked.

The type of enamel hypoplasia observed in each case was recorded in the remarks column on the examination sheet. This study, which aimed to determine the prevalence of enamel hypoplasia in

permanent teeth among children aged 9-12 years based on hypoplasia type and the affected teeth, was conducted in April 2010.

Table 1. Prevalence of permanent teeth with enamel hypoplasia at RSGM FKG UNPAD, based on hypoplasia type.

Enamel Hypoplasia	Teeth with Enamel Hypoplasia	
	Amount	Prevalence(%)
Type I	2	13.3
Type II	5	33.4
Type III	6	40.0
Type IV	2	13.3
Total	15	100

A total of 96 children who met the inclusion criteria were examined. Enamel hypoplasia in permanent teeth was identified in seven children, affecting a total of 15 teeth.

The hypoplastic lesions were classified into four types: Type I, Type II, Type III, and Type IV. According to the classification data presented in Table 1, Type I enamel hypoplasia was observed in two teeth (13.3%), Type II in five teeth (33.4%), Type III in six teeth (40%), and Type IV in two teeth (13.3%).

Table 2. Prevalence of Children's Teeth with Enamel Hypoplasia at RSGM FKG UNPAD Based on the Affected Teeth

Tooth	Number of Affected Permanent Teeth		Prevalence of Affected Permanent Teeth (%)		Total Number	Total Prevalence(%)
	Maxillary	Mandibular	Maxillary	Mandibular		
Central Incisor	1	4	6.67	26.66	5	33.33
Lateral Incisor	0	1	0	6.67	1	6.67
Canine	0	1	0	6.67	1	6.67
First Premolar	2	1	13.33	6.67	3	20.00
Second Premolar	3	2	20.00	13.33	5	33.33
Total	6	9	40.00	60.00	15	100

RESULTS

The prevalence of children's teeth affected by enamel hypoplasia at RSGM FKG UNPAD, based on the type of affected tooth, is presented in Table 2. A total of 96 children were examined, among whom seven were found to have enamel hypoplasia, involving

15 permanent teeth. Of these, six cases (40.00%) occurred in the maxillary arch and nine cases (60.00%) in the mandibular arch. The affected teeth included the central incisors, lateral incisors, canines, first premolars, and second premolars. No cases

of enamel hypoplasia were found in the molars.

Enamel hypoplasia was identified in one maxillary central incisor (6.67%) and four mandibular central incisors (26.66%). No cases of enamel hypoplasia were found in the maxillary lateral incisors (0%), but one mandibular lateral incisor (6.67%) was affected. Similarly, no hypoplasia was observed in the maxillary canines (0%), while one mandibular canine (6.67%) was involved. First premolars with enamel hypoplasia included two maxillary teeth (13.33%) and one mandibular tooth (6.67%). Second premolars with enamel hypoplasia consisted of three maxillary teeth (20.00%) and two mandibular teeth (13.33%).

Table 3. Prevalence of Children with Enamel Hypoplasia at RSGM FKG Universitas Padjadjaran Based on Gender

Gender	Number of Children		
	Examined	With Enamel Hypoplasia	Prevalence (%)
Male	72	1	1.04
Female	24	6	6.25
Total	96	7	7.29

The prevalence of enamel hypoplasia in children at RSGM FKG UNPAD based on gender is shown in Table 3. Of the 96 children examined, 24 were male and 72 were female. Among these, one male (1.04%) and six females (6.25%) were diagnosed with enamel hypoplasia in their permanent teeth.

Table 4. Prevalence of Children with Enamel Hypoplasia at RSGM FKG UNPAD Based on Age

Age (Years)	Number of children examined	Number of Pr Children with Enamel Hypoplasia	Prevalence %
9	37	1	1.04
10	32	3	3.13
11	20	1	1.04
12	7	2	2.08
Total	96	7	7.29

Table 4 presents the overall prevalence of enamel hypoplasia in the study. Of the 96 children examined, seven

children were diagnosed with enamel hypoplasia, yielding a prevalence rate of 7.29%. One child aged nine years (1.04%) had enamel hypoplasia. Among ten-year-olds, three children (3.13%) were affected; among eleven-year-olds, one child (1.04%) was affected; and among twelve-year-olds, two children (2.08%) were affected. According to Budipramana, the prevalence of enamel hypoplasia in permanent teeth is approximately 2-5%.¹⁸

A higher prevalence was reported in a study by Oktaviani (2008) conducted among elementary school children in Serang Regency, which found a prevalence of 13.18%.²⁰ Monteron's study also indicated a prevalence ranging from 3% to 15%.¹⁹

The results of this study, conducted at RSGM FKG Universitas Padjadjaran in April 2010, showed a prevalence of 7.29% for enamel hypoplasia in permanent teeth among children aged 9-12 years. The prevalence found in this study was lower than that reported by Oktaviani, which may be attributed to the differing locations of the studies. Oktaviani's study was conducted in an area classified as having a high incidence of malnutrition by the Serang District Health Office in 2006.²⁰

Based on this study's findings, seven children (7.29%) were affected by enamel hypoplasia involving 15 permanent teeth. Of these 15 teeth, six (40.00%) were diagnosed as Type III enamel hypoplasia, which was the most common type observed (as shown in Table 1). Clinically, Type III enamel hypoplasia is characterized by the partial or complete loss of enamel. In this study, six teeth exhibited partial enamel loss.

Although the hardness of the remaining enamel was normal, parts of the enamel appeared chipped. This localized enamel loss is thought to result from the cessation of ameloblast activity in that specific area. One contributing factor to this cessation could be prolonged high fever.¹²

In such cases, ameloblasts fail to form the matrix, although the calcification and maturation processes proceed

normally. The observed defects suggest the possibility of frequent febrile illnesses in the study region. These fevers likely occurred during the enamel formation stage of the permanent teeth, generally before the child reached two years of age.^{12, 14}

Table 2 indicates that 15 permanent teeth were affected, with six (40.00%) in the maxillary arch and nine (60.00%) in the mandibular arch. The involved teeth were central and lateral incisors, canines, first premolars, and second premolars. Enamel hypoplasia caused by local factors typically affects a single tooth or a small group of adjacent teeth.^{10, 20} The most frequently affected teeth, according to the literature, are the maxillary permanent incisors and both maxillary and mandibular premolars.¹⁰

In this study, the highest prevalence was found in the premolars, with eight teeth (53.33%) involved. This was followed by six incisors (40.00%) with enamel hypoplasia. Among the incisors, the mandibular teeth showed a higher prevalence (33.33%) compared to the maxillary teeth (6.67%), which contrasts with the findings of Shafer (2006), who reported higher prevalence in the maxillary arch.¹⁰

All cases of enamel hypoplasia identified in this study were found in permanent teeth that had corresponding primary predecessors. No hypoplasia was detected in permanent molars, which do not have primary precursors. This finding supports the notion that enamel hypoplasia in permanent teeth may result from local factors such as trauma or periapical infection in the preceding primary teeth.^{10, 21, 13}

The hypoplasia observed in the permanent teeth of children treated at RSGM may thus have been caused by trauma or infection associated with the primary teeth that were replaced. Additionally, these defects may be attributed to prolonged high fever occurring before the age of two years.^{12, 14}

Periapical infections in primary teeth indicate a lack of public awareness

regarding dental and oral health. This could be due to limited knowledge or a generally low socioeconomic status in the area. Lower socioeconomic conditions are associated with a higher prevalence of enamel hypoplasia, as they are linked to nutritional deficiencies and a higher incidence of diseases that result in prolonged fevers.

The prevalence of enamel hypoplasia among children at RSGM FKG UNPAD by gender, as shown in Table 3, reveals a substantial difference: of the seven children affected, six were female. However, it has been suggested that enamel hypoplasia does not correlate with gender, except in the case of hereditary enamel hypoplasia Type IF.^{13, 14}

The results in Table 4 show that enamel hypoplasia was found across all age groups examined. This may indicate that age does not directly influence the occurrence of enamel hypoplasia. It is also possible that the narrow age range selected for this study (9-12 years) limited the influence of age-related factors. Had the age range included younger children, such as those aged 6-12 years, six-year-olds might have shown a prevalence rate of 0% because only the first molars and some mandibular central incisors would have erupted by that time, and thus enamel hypoplasia might not have been detectable.

This could result in underestimation of prevalence. Therefore, the age range of 9-12 years was chosen to ensure the presence of at least 12 erupted permanent teeth in the oral cavity, allowing for a more reliable assessment. Environmentally induced enamel defects can be classified into three types: hypoplasia, diffuse opacity, and demarcated opacity.¹⁴

Teeth that show defects as a result of trauma or infection are known as Turner's teeth. Their defects may manifest as hypoplasia, hypocalcification, or a combination of both.¹³ Turner's teeth with demarcated opacity are found to be twice as prevalent when the corresponding primary tooth had caries, and five times

more prevalent when the primary tooth was extracted for reasons other than decay.¹⁴

In this study, numerous cases of demarcated and diffuse opacity were identified, although these were not

accompanied by hypoplasia. Even though these defects were not classified as hypoplasia, they suggest a high likelihood of caries in the primary teeth of children living in the study area

CONCLUSION

The prevalence of enamel hypoplasia in permanent teeth among children aged 9-12 years at Universitas Padjadjaran (UNPAD) was found to be 7.29%. A total of 15 permanent teeth were affected, with six teeth (40%) classified as Type III enamel hypoplasia. The most commonly affected teeth were the premolars, accounting for eight cases (53.33%).

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