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INCIDENCE AND CLASSIFICATION OF SYSTEMICALLY INDUCED DISCOLOURATION ON TEETH OF PATIENTS OF WESTERN MAHARASHTRA.

Dental Sciences

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ABSTRACT

The appearance of teeth plays a major factor that helps in reflecting the personality of a person. Hence, it is important that we as dental practitioners know the type and etiology of the discolouration in order to treat it effectively.

Objective: The main objective of this study was evaluation of systemically induced discolouration on teeth due to trauma, Enamel Hypoplasia, Fluorosis, Tetracycline stains, Amelogenesis Imperfecta, Dentinogenesis Imperfecta, its incidence and classification in patients of Western Maharashtra.

Methodology: 300 willing patients who reported were examined clinically along with a detailed history for presence of discoloration due to trauma, Enamel Hypoplasia, Fluorosis, Tetracycline stains, Amelogenesis Imperfecta and Dentinogenesis Imperfecta with diagnostic instruments such as mouth mirror, probe and tweezers. The patients were categorized into three age groups for convenience that is Category1: Age group from 0-20, Age group from 21-40, Category 3: Age group from 40 and above.

Result: After statistical analysis, it was concluded that discolouration due to trauma had highest incidence in the Category 1 and 3 and discolouration due Enamel Hypoplasia had highest incidence in category 2.

KEYWORDS

Introduction: The aesthetic appearance of teeth plays a fundamental role in allurement of an individual. Along with other dental problems, discoloration of teeth has emerged to be a grave concern for today's progressive generation seeking dental treatments. According to a recent study of Samorodnizky-Naveh, 37.3% of subjects were dissatisfied with their dental appearance and tooth colour was the main reason for about 90% of them [1].

Therefore, it is essential for dental practitioners to identify the type of stains and its etiology in order to come up with an appropriate diagnosis and to opt for the most suitable treatment depending on each case. Also, the knowledge of the cause of the discoloration will help the dental practitioner to explain the exact nature of the condition to the patient since they differ in etiology, appearance, composition, location, severity and degree of adherence to the tooth [2].

This study aims at evaluation of the systemically induced discoloration on teeth due to trauma, Enamel Hypoplasia, Fluorosis, Tetracycline Stains, Amelogenesis Imperfecta, Dentinogenesis Imperfecta, its incidence and classification in the patients of Western Maharashtra.

Materials and Methods: After the proposed study was reviewed and sanctioned by the ethics committee of the Institute, an informed consent was acquired from the patients and the guardians for pediatric patients before their enrollment in the study. 300 willing patients who reported to the Department of Oral Medicine and Radiology and the Department of Conservative and Endodontics at School of Dental Sciences, KIMSDU, Karad were examined.

The examination included recording of detailed history of the patients and they were clinically examined for presence of discoloration due to trauma, Enamel Hypoplasia, Fluorosis, Tetracycline Stains, Amelogenesis Imperfecta, and Dentinogenesis Imperfecta with diagnostic instruments such as mouth mirror, probe and tweezers.

The patients examined for the study were categorized into three age groups for convenience which were:

Category 1: Age from 0-20.

Category 2: Age from 21-40.

Category 3: Age from 40 and above.

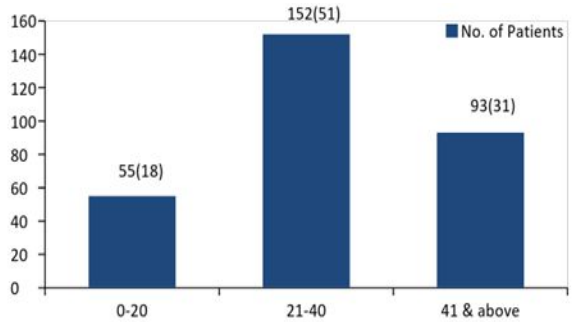
Highest Prevalence of any of those discolorations pertaining to each age group mentioned above was noted. The data collected was subjected to statistical analysis and the results were obtained. The study was carried out in strict compliance with Helsinki Declaration on studies involving human subjects in which all participants were treated equally and no harm was inflicted.

Statistical Analysis: After clinical examination of 300 patients that reported to the department, records were obtained which were subjected to a cross sectional study using Kish and Leslie formula at a prevalence of 20%.

Table1: Demographic characteristics of patients (n=300).

Demographic Characteristics	No. of patients	%
Age (in years)		
0-20	55	18
21-40	152	51
41 & above	93	31

Figure.1: Graphical representation of age group wise distribution of patient.



The age range of study patients was 0 to 70 years, with a mean age of 35 ± 16.94 years.

Table 1 shows the demographic characteristics of study patients and Figure 1 shows graphical representation of demographic characteristics. According to age, out of 300(100%) patients maximum 152 (51%) were in the age group of 21-40 years, 93(31%) were in age group of 40 & above years and remaining 55(18%) were in the age group of 0-20 years.

Table 2: Types of tooth discoloration among patients (n = 300).

Types of tooth discoloration	No. of Patients	%
Trauma		
Ellis Class I	10	3.33
Ellis Class II	5	1.67
Ellis Class IV	5	1.67
Enamel Hypoplasia		
Mild	15	5
Moderate	4	1.33
Severe	2	0.67
Flurosis		
Localised	2	0.67
Generalized	9	3
Tetracycline stains	1	0.5
Amelogenesis Imperfecta	1	0.5
Dentinogenesis Imperfecta	6	2
None	240	80

Figure.2: Graphical representation of types of teeth discoloration of patient.

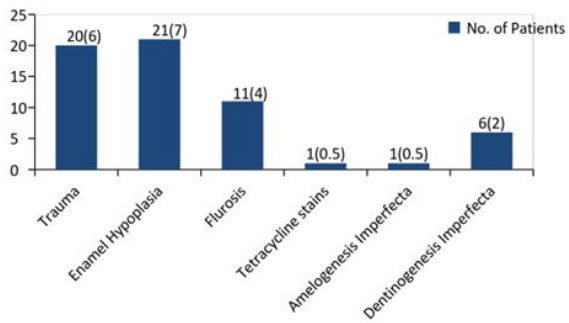


Table 2 shows the distribution of types of tooth discolouration amongst patients. Out of 300(100%) patients, 60 (20%) patients had one form of tooth discolouration. The discolouration in the majority 21 (7%) patients were due to enamel hypoplasia. out of that 15(5%) patients were found with mild enamel hypoplasia, 4(1.33%) patients were moderate enamel hypoplasia and remaining 2(0.67%) patients were severe signs of enamel hypoplasia.20 (6%) patients suffered from trauma, out of which 10(3.33%) patients were sign of ellis class I, 5(1.67%) patients were ellis class II and 5(1.67%) patient were ellis class IV.11(4%). 11(4%)patients had signs of fluorosis. 2(0.67%) patients were found as localized fluorosis and 9(3%) patients were found as generalized fluorosis.6(2%) patients had dentinogenesis imperfecta and very few patients that is 1(0.5%) had tetracycline stains and amelogenesis imperfect respectively. On basis of Table 2 we can say that the incidence rate was 20%. Overall the percentage of enamel hypoplasia was more as compared to other types of discolouration.

Table 3: Association between age and types of tooth discolouration among patients (n = 300).

Age in Years	Trauma	Enamel Hypoplasia	Fluorosis	Tetracycline stains	Amelogenesis Imperfecta	Dentinogenesis Imperfecta
0-20	6(2)	5(1.67)	3(1)	0(0)	0(0)	0(0)
21-40	9(3)	15(5)	7(2.33)	1(0.3)	1(0.3)	5(1.67)
41 & above	5(1.67)	1(0.3)	1(0.3)	0(0)	0(0)	1(0.3)

{P-value – 0.6221 NS, Chi-square - 8.069}

Figure.3: Age wise distribution of types of tooth discolouration among patients

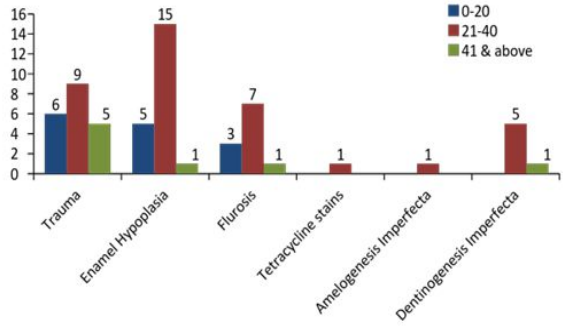


Table 3 & Figure 3 reveal the association between age and types of tooth discolouration among study patients. In overall 300(100%) patients in age group of 0-20 years 6(2%) patients had trauma, 5(1.67%) patients had enamel hypoplasia, 3(1%) patients had fluorosis and none of them had tetracycline stains, Amelogenesis Imperfecta and Dentinogenesis Imperfecta. In age group of 21-40 years 9(3%) patients had trauma, 15(5%) patients had Enamel Hypoplasia, 7(2.33%) patients had fluorosis, 1(0.3%) patient had Tetracycline stains, 1(0.3%) patient had Amelogenesis Imperfecta, 5(1.67%) patient had Dentinogenesis Imperfecta. In age group 41 & more years 5(1.67%) patients had trauma 1(0.3%) patients, had Enamel Hypoplasia, 1(0.3%) patient had Fluorosis, no patient had Tetracycline stains or Amelogenesis Imperfecta, 1(0.3%)patient had Dentinogenesis Imperfecta. The chi-square test was used to find out the association between age groups and various types of discolouration of patient and found P-value – 0.6221, Chi-square - 8.069. It means there was no significant difference between age group and various types of discolouration. Here we can also state that maximum tooth discolouration was found in age group of 21-40 years.

Discussion: The appearance of the dentition is of concern to a large number of people seeking dental treatment and the colour of the teeth is of particular cosmetic importance [3]. There has been a recent increasing interest in the management of dental staining as shown by the tooth whitening materials appearing in the market.

The tooth has three distinct layers; the enamel which covers the crown, the root cementum on the root surface and an inner layer of dentin in the crown and the root. The pulp, which contains arteries, veins and nerves, is in the inner part of the tooth. Any changes of these structures are likely to cause an alteration in the outward appearance of the tooth caused by changes of its light transmitting and reflecting properties [3]. Some discolorations are located on the outer surface of the tooth structure, others are caused by stain taken up by the enamel or dentin, and some occur during tooth development and result in an alteration of the light transmitting properties of the tooth structures. Tooth discolorations are caused by multiple factors; medications, genetic defects, diseases, trauma, caries and normal aging processes, fluorosis is some of the examples [4]

In this study, we concentrate on the following six factors causing discolouration:

Trauma: The major cause for trauma can be either due to fall or road traffic accidents which can lead to discolouration of teeth. The most important cause for dental trauma was falling, which is in agreement with previous literature. [5 6] This can be explained by the imbalance of the newly walking children leading to falling accidents. Thus, children should be cared more prudently, reinforced by measures to eliminate the risk of falling. The other important cause of dental trauma was sports, which is in line with previous research [6 7].

Mechanism of tooth discoloration: Traumatic injury of the tooth may cause the blood vessels in the pulp to rupture, with diffusion of blood into the dentinal tubules. Such teeth have a dark pinkish hue immediately after the accident and turn pinkish brown later. The discolouration persists even after the pulp is extirpated or after the pulp recovers. In young patients there is breakdown of erythrocytes in dentinal tubules causing discolouration if it persists. The pulp however succumbs to trauma causing hemoglobin to breakdown with formation of coloured compounds such as hemin, Hematin, Hematoidin, Hematoporphyrin and Hemosiderin.The hydrogen sulfide gas

produced by bacteria combines with hemoglobin to darken the tooth.

Treatment: Discoloration of tooth caused by trauma due to excessive pulp extirpation causing hemorrhage. The pulp chamber and root canal should be thoroughly irrigated, to prevent discoloration, by removing blood elements from dentinal tubules. For severe staining caused to trauma bleaching can be done after the tooth is treated endodontically. Bleaching is lightening of tooth colour through application of chemical agents such as Hydrogen Peroxide, Sodium Perborate, and Carbamide Peroxide to oxidize the organic pigmentation of the tooth to restore normal colour of the tooth. If the staining is not reduced even after bleaching, Veneers that are tooth coloured dental material for covering the labial surface of the tooth can be placed on the affected teeth. In certain cases, tooth extraction is followed by implant. For cases of open apex, apexification is preferred followed by crown replacement.



Discolouration of tooth due to Trauma [21]

Enamel Hypoplasia: Enamel hypoplasia is a condition of deficient amelogenesis, resulting from an injury to the formative cells, the ameloblasts. The quantitative defects of EH on the tooth surface appear as thin, or pitted - single or multiple, shallow or deep, or scattered or arranged in horizontal rows, or grooved – single or multiple, narrow or wide, or evident as partial or total absence of enamel over substantial areas [8]. The pits and grooves are exposed to extrinsic staining of the enamel and it often becomes internalized [3]. The thickness of the enamel is reduced, and may be translucent or opaque [8]. A tooth with enamel hyperplasia will have spots that are white, brown or yellow in colour.

Treatment: Treatment of enamel hyperplasia is as follow:

- Application of a resin-bonded sealant to eliminate sensitivity.
- Restoration using a resin-based composite alone.
- Restoration using a stratified resin-based composite overlying RMGI cement. [9]



Discoration of teeth due to Tetracycline stains [22]

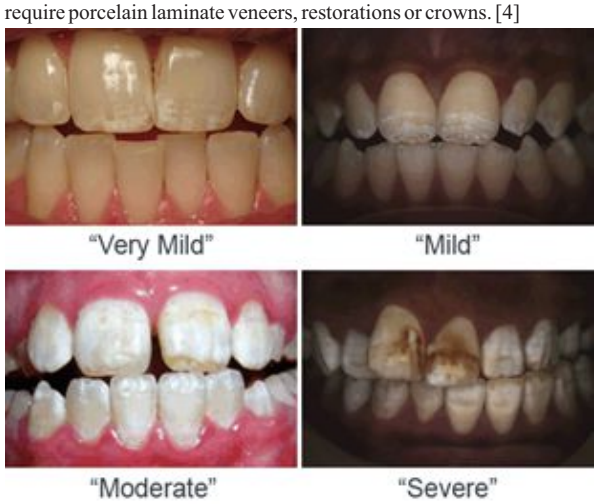
Fluorosis: An excess ingestion of fluoride that induces multiple changes in the developing enamel [10] The ingestion of fluorides is particularly important in infants as dental fluorosis can originate during the tooth development [11]. Dental fluorosis may arise endemically from natural water supplies, or fluoride containing products. Fluorosis occurs when concentrations of fluoride exceeds 1 ppm in drinking water. The severity of pigmentation is age and dose dependent. Both primary and permanent dentitions can be affected [12,13]. Discoloration due to fluorosis causes the tooth to stain white, yellow, brown, gray black. Fluorosis can be Mild. Moderate and severe. Localized and generalized.

Mild fluorosis: It involves chalky white lines or opaque white patches or flecks dispersed over a region.

Moderate: It is spread over a greater region and more tooth surface displaying staining and sometimes presence of pits is evident. Yellow or brown black discoloration is seen.

Severe: Enamel might be deminerelized and fragile. Hence, damaged easily

Treatment: The choice between different treatments depends on the severity of the fluorosis and may be determined by the Thylstrup and Fejerskov index. The aesthetic of mild fluorosis can be improved successfully with bleaching. Moderate fluorosis can be corrected with bleaching or in combination with microabrasion. Severe fluorosis may require porcelain laminate veneers, restorations or crowns. [4]



Discoloration of teeth due to fluorosis [23]

Tetracycline Stains: Tetracycline was first introduced in 1948 as a group of broad-spectrum antibiotics for treatment of various infections [14]. Systemic administration of tetracycline due to drugs such as minocycline and doxycycline during development is associated with deposition of tetracycline within bone and the dental hard tissues. [15,16]. Tetracycline can cause brown or brown –grey tooth pigmentation. Tetracycline stains are classified as

First degree: Light yellow to light gray staining without banding.

Second degree: Darker and more extensive yellow or gray staining without banding.

Third Degree: Severe Staining characterized with dark grey or blue discoloration with banding.

Treatment: Leonard et al. (2003) stated in their study that night guard vital bleaching indicates that tetracycline-stained teeth can be whitened successfully using a 6-month active treatment with 10% carbamide peroxide, and that shade stability may last at least 90 months post treatment [4]. In cases where the teeth are severely stained in the gingival area and a bleaching treatment has no effect, porcelain veneers or placement of a crown will be options to restore esthetics and function. According to Haywood it is best to try bleaching first, and then abrasion, or bonded technique, because one of the mentioned treatment options may have a satisfactory effect and eliminate the need for more conventional treatments [4].



Discoloration due to Tetracycline stains [24]

Amelogenesis imperfecta: AI is a group of hereditary disorders characterized by abnormal amelogenesis, affecting both primary and permanent dentitions. [17]. The condition may be associated with morphologic or biochemical changes elsewhere in the body [17]. AI can be transmitted as an autosomal dominant, autosomal recessive, X-linked or sporadic cases [17].

AI is caused by mutations in the genes that control the enamel formation. There is now known that mutations in 5 different genes are associated with AI; ENAM, AMELX, KLK4, MMP20 and DLX3[17].

The prevalence of these conditions has been studied in a few populations, spanning from one in 700 to one in 14.000[18]. There are

three types of Amelogeneis Imperfecta namely:

1. Hypoplastic AI
2. Hypomaturation AI
3. Hypocalcified AI.

Treatment: The treatment of different AI types depends on the AI type and the phenotype of the affected enamel. The treatment can range from preventive care using sealants, tooth whitening, microabrasion, and bonded technique for esthetic improvement to prosthetic reconstruction [4].



Discolouration of teeth due to Amelogenesis Imperfecta [25]

Dentinogenesis Imperfecta: Dentinogenesis imperfecta is a hereditary defect of the dentin affecting both the primary and permanent dentitions. Dentine defects may occur genetically or through environmental influences. [19]. The genetically determined dentine defects may be in isolation or associated with a systemic disorder.

-Classification of DI.
Type I Dentinogenesis imperfecta. (Is associated with osteogenesis imperfecta)
Type II Dentinogenesis imperfecta.
Type III Dentinogenesis imperfecta [20].

Treatment: The treatment of Dentinogenesis Imperfecta includes bleaching and prosthetic crowns.



Discolouration of teeth due to Dentinogenesis Imperfecta [26]

Result: According to age, out of 300(100%) patients' maximum 152 (51%) were in the age group of 21-40 years, 93(31%) were in age group of 40 & above years and remaining 55(18%) were in the age group of 0-20 years. Out of 300(100%) patients, 60 (20%) patients had one form of tooth discolouration. The discolouration in the majority 21 (7%) patients were due to enamel hypoplasia. out of that 15(5%) patients were found with mild enamel hypoplasia, 4(1.33%) patients were moderate enamel hypoplasia and remaining 2(0.67%) patients were severe signs of enamel hypoplasia.20 (6%) patients suffered from trauma.out of which 10(3.33%) patients were sign of ellis class I, 5(1.67%) patients were ellis class II and 5(1.67%) patient were ellis class IV.11(4%). 11(4%)patients had signs of fluorosis. 2(0.67%) patients were found as localized flurosis and 9(3%) patients were found as generalized flurosis.6(2%) patients had dentinogenesis imperfecta and very few patients that is 1(0.5%) had tetracycline stains and amelogenesis imperfect respectively. Thus, we can say that the incidence rate was 20%. Overall the percentage of enamel hypoplasia was more as compared to other types of discolouration.

Conclusion: Thus, from the above study we can conclude that discoloration due to trauma has the highest incidence in the category 1 and 3 of age group (0-20years and 41 and above respectively).

Trauma can be effectively managed by:
- Removing blood elements from the dentinal tubules carefully during pulp extirpation.
- Bleaching.
- Veneer Placement
- Extraction followed by implant, fixed partial dentures and removable partial dentures or crown replacemet.

And discolouration due to Enamel Hypoplasia has the highest incidence in category 2 of age group(21-40years).

The treatment for Enamel Hypoplasia is:
- Application of a resin-bonded sealant to eliminate sensitivity.
- Restoration using a resin-based composite alone.
- Restoration using a stratified resin-based composite overlying RMGI cement. [9]

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