Different Dental Discoloration Characteristics and Their Clinical Correlations (A Literature Review)

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ArticleHistory:Received:28.04.2023 **Revised:**28.05.2023 **Accepted:**04.06.2023

Abstract

White, healthy teeth improve personality and boost self-esteem. Teeth discoloration is a common dental finding linked to clinical and cosmeceutical issues that vary in severity, cause, composition, location, and appearance. Before beginning therapy, it is essential to determine the origin and extent of tooth discoloration. Trials constituted the majority of research on the elimination and treatment of tooth discoloration.

There has been a lot of discussion on the psychological and social effects of tooth discoloration on patients. Teeth can become discolored for a variety of etiological causes, which can also affect how they seem, where they are, and how severe they are. The major causes of tooth discoloration include inherent and external factors. Depending on the underlying cause and extent of the lesion, many treatment options are possible. Enamel micro abrasion, bleaching, veneers, and crowns are all possible forms of treatment.

A tooth's discoloration can dull a smile's luster. Managing individuals with discolored teeth requires an understanding of the origins of the condition since they may influence the course of treatment.In some circumstances, it may even have an impact on the effectiveness of the treatment. Understanding the pathological mechanism behind tooth discoloration can also help the dentist accurately describe the situation to the patient.

The goal of this study was to pinpoint the numerous causes of tooth discoloration as well as the numerous existing treatments for treating it, with a concentrate on their clinical connections.

Keywords: Staining,Discoloration, Esthetics, Extrinsic, Intrinsic.

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DOI: 10.48047/ecb/2023.12.7.02

1. Introduction

The last ten years have seen a significant rise in the public's desire for cosmetic dentistry due to the creation of new cosmetic products, the simplification of procedures, and more consumer awareness. Preston asserts that the goal of the cosmetic and restorative dentist is to identify and satisfy patient expectations. The dentist may find it challenging to meet the patient's demands and deliver a satisfactory outcome depending on how the patient interprets the need (ie, enhance beauty). [(1)]

One of the most common reasons people seek dental care is tooth discoloration[(2)]. Typically, tooth discoloration is distressing mentally and aesthetically. A dentist must be able to identify the cause of tooth discoloration to provide the appropriate treatment. The dentist will be better able to describe the patient's situation to them in detail if they are aware of the reason for the discoloration. The method of staining may, in some cases, affect the course of therapy and the alternatives for care that the dentist offers his or her patients. [(2)]

A comprehensive history of the patient should be obtained to determine the etiopathogenesis of the discoloration and stain. This includes medical history, personal history, family history, dental history, restorations, root canal treatment, trauma, mouthwashes, residence in natural water fluoridation areas, and social history of the work and exposure to the metal. [(3)]

The surface texture and luster characteristics of the tooth, which are regulated by the architecture of the tooth, determine tooth color (enamel, dentin, pulp). Any modifications to these structures before or after the eruptive phase will alter tooth color, leading to tooth discoloration. [(4)]

To correctly diagnose patients with tooth stains, it is crucial to understand the mechanisms underlying dental discolorations as well as the clinical characteristics of various forms of tooth staining. [(5)]

2. Color Perception of Different Dental Tissues

The external look of a tooth will also depend on the character of the dental structures. The light transmitting and light reflecting qualities of a tooth is

likely to vary if structures like the enamel, dentin, or pulp change. Different levels of translucency exist in both enamel and dentin. Higher translucency areas within a tooth or a restoration will have a lower value because light passes through and away from the observer. The opalescent blue regions are frequently the subject of the observer's attention while assessing enamel translucency. [6]

It's been suggested that the color scheme be enhanced with opacity and translucency, colors can be discussed in terms of hue, value, and chroma. Hue makes a distinction between several color families (red, blue, and green). Value describes how bright or dark a color is, whereas chroma describes how saturated or strong a color is (for example from pink to crimson).[7]

A tooth normally has a range of hues, and there is a gradation of color from the gingival border to the incisal edge. Normal enamel is transparent and white, and the color of the tooth is mostly determined by the color of the dentin. Where the enamel layer is thin and the dentin is composed of thick layers, the dentin has a greater impact on the color of the tooth. [8]

The clinic's various light sources are known to affect the dentists' sense of color. Natural, fluorescent, and incandescent lights are the three types of lighting that are frequently used in the clinic. The incandescent light source will concentrate on early morning and late evening sunlight, which has a reddish-orange hue and the sky appears blue around midday, while the fluorescent light source will focus on the blue-green end of the spectrum. A phenomenon known as metamerism occurs is the unfortunate characteristic of restorations matching well in operatory lighting or in photographs but then displaying differently when the patient smiles in other light conditions. [9] When assessing the color of the teeth, a uniform light source should be utilized to lessen the impact of metamerism. The perceived color depends on the nature of the light source illuminating the object and what wavelengths are reflected. The closer the sum is of the reflecting wavelengths of the two materials to be matched, the more successful the color match will be. [9]

3. Classification of Dental Discoloration

Intrinsic and extrinsic stains are the two basic kinds of tooth discoloration. Biological, genetic, iatrogenic, traumatic, idiopathic, or aging factors may all contribute to intrinsic stains.

Depending on where the stains are, it is possible to distinguish between intrinsic and extrinsic causes of tooth discoloration. The surface of the tooth or the pellicle that has developed through time may have extrinsic discoloration. The intrinsic color is the product of chromogen deposits inside most of the teeth, which may have local or systemic sources. [10]

A. Intrinsic Discoloration, table (1)

Alkaptonuria, congenital erythropoietic porphyria, and other metabolic diseases can stain teeth. Congenital erythropoietic porphyria results in a reddish purple-brown staining of the teeth, whereas alkaptonuria is an inborn metabolic mistake that causes a brown discoloration of the permanent dentition. [11]

Examples of hereditary reasons for tooth discoloration include Amelogenesis imperfecta and Dentinogenesis imperfecta. There are many manifestations of amelogenesis imperfecta; the mild variety is characterized by teeth with thin, hypoplastic enamel and a yellowish-to-brown color. The enamel's hypo mineralization is more severe on teeth that are darker in color (12). Dentinogenesis Imperfecta affects opalescent primary teeth more severely than permanent teeth.[13]

Tetracycline medications, which are routinely provided either by taking the medication or by mothers nursing their children, are iatrogenic causes of tooth discoloration. [14] Age, drug use frequency, and length of exposure all affect how noticeable the stain is. Teeth often seem worse just after the eruption, and after that, owing to photo-oxidation, discoloration begins to reduce (exposure to light). These teeth have a brownish-gray or yellowish tint, table (2). [15]

Fluorosis, which may be brought on by the naturally occurring fluoride in water, toothpaste, or tablets, is another reason for discoloration. Depending on the degree, teeth have either dark brown or chalky white enamel. [16]

Trauma is one of the most frequent causes of intrinsic tooth discoloration, which is thought to be caused by the buildup of hemoglobin molecules in the injured tooth. Another form of intrinsic coloring known as enamel hypoplasia is thought to result from damage to the tooth germ. [17]

First molars and incisors are both affected by the disorder known as molar incisor hypo mineralization, which has no recognized cause. [12]Enamel loss and discolorations, such as white, yellow, or brown patches, are characteristics of teeth. As teeth age and grow darker and more yellow, color changes linked with aging may be caused by dentin deposition thickening and enamel thinning. [18]

B. Extrinsic Discoloration, table (3)

The most important idea is that aging-related tooth discoloration is more controllable than intrinsic tooth discoloration. Non-metallic stains, which are absorbed onto the tooth surface deposits like plaque, are caused by dietary substances, drinks, cigarettes, and mouthwashes. Primary teeth in kids with poor dental hygiene may exhibit green and yellowish-orange stains, which are mostly brought on by bacteria in bacterial plaque. [19]

Usually, these extrinsic stains may be seen on the buccal surface of teeth. The dark brown to black discolorations on the cervical section of primary teeth are another stain brought on by bacteria; in this scenario, patients had acceptable oral hygiene and a low caries incidence. Metallic stains can appear as black stains from iron supplements and are most

frequently generated by contact with metallic salts. Copper-containing mouthwashes can leave green stains on the teeth. When used in mouthwashes, potassium permanganate produces a violet-to-black hue; when used in dentistry, silver nitrate salt results in a grey tint. [20]

Furthermore, black-brown discoloration is brought on by ferric sulfides. The creation of the metal's sulfide salt is thought to be the mechanism behind the metallic stain process. In actuality, the extrinsic stain matches the metal in question's sulfide's hue. However, there is a lack of convincing evidence supporting the chemical procedure required to generate metal sulfide. [21]

Uncontaminated by bacteria, brown stains are a relatively common form of stain. They are often caused by a thin pigmented pellicle that is most frequently observed on the buccal surface of maxillary molars and the lingual surface of lower anterior teeth. This kind of stain is typically linked to poor dental hygiene and ineffective brushing and is thought to be brought on by the deposition of tannin present in colored drinks. [22]

The gingival area of the tooth is typically hidden by tobacco stains, which mostly occupy enamel flaws. They appear as a dark brown or black discoloration that is mostly brought on by coal tar buildup with the potential for enamel penetration. The amount of previous coating and roughened enamel that will eventually allow tobacco products to attach is more important in determining the stain than the quantity of tobacco ingested. [23]

Boys are more likely than girls to develop green stains, which show up as a thick band on the buccal surface of the maxillary front teeth in the gingival third. Some people think it's a piece of the original enamel cuticle. Others speculate that luminous bacteria and fungi may be to blame. This sort of bacteria requires photo-activation, which explains why they are present on the maxillary anterior teeth. [24]

The least frequent type of stain is orange. They are typically linked to poor dental hygiene and develop on the labial surface of the upper and lower anterior teeth. They are mostly brought on by bacteria like Serratia marcescens and Flavobacterium lutescens. [25]

Table (1): Intrinsic Dental Discoloration Classification: [2]

Intrinsic Condition	Teeth Discoloration
amelogenesis imperfecta, Chlorhexidine ingestion, tetracycline ingestion, osteogenesis imperfecta, chlorhexidine gluconate, tetracycline, osteogenesis, internal resorption, periapical pathosis.	Yellow
Fluorosis, Sickle cell anemia, Osteogenesis imperfect	Opaque
Fluorosis, Chronic kidney failure, Hypo mineralization	White
Fluorosis, Calcific metamorphosis, Loss of vitality, Chlorhexidine ingestion, Iron, Tetracycline ingestion, Osteogenesis imperfect, Tanic acid, Ochronosis	Brown
Secondary Caries, Malformations, Caries	Black
Tetracycline ingestion, Osteogenesis imperfecta	Blue
Hyper bilirubinemia, Congenital bilaryarresia, Nasmyths membrane	Green
Internal Resorption, Congenital erythropoietic porphyria, Periapical granuloma in lepromatous leprosy, Death	Red
Tetracycline for cystic fibrosis, Minocycline for acne in adults, Dentinogenesis imperfecta, Cyclosporine	Grey

Table (2): Tetracycline Induced Dental Discoloration Correlation:[38]

Drug	Teeth Color
Chlortetracycline (Aureomycin)	Gray, Brown
Dimethyl Chlortetracycline (Ledermycin)	Yellow
Oxytetracycline (Terramycin)	
Tetracycline (Anchromycin)	

Doxycycline (Vibramycin)	No reported
Minocycline	Black

Table (3): Extrinsic Dental Discoloration Classification:[39]

Cause	Location	Teeth Color
Poor oral hygiene, tannic acid deposition by tea and coffee, inadequate cleaning and polishing	Buccal surface area of maxillary molars and lingual surface areas of mandibular molars and least on the labial surfaces of maxillary anterior teeth.	Brown
Chromogenic bacteria (Actinomycetes), Ferric sulfide formation by bacteria	Found on facial and lingual surfaces of the teeth near the gingival margin extending to the proximal surface	Black
Remnants of stained enamel cuticle formed by fluorescent bacteria and fungus, copper salts in mouthwashes	Facial surfaces of the maxillary anterior teeth at gingival one third	Green
Poor oral hygiene, Chromogenic bacteria	Labial surfaces of maxillary and mandibular anterior teeth at gingival one third	Orange
Combination of metals and enamel pellicle to produce metal stains penetrating enamel surface to cause permanent staining	Staining related to the exposed tooth to outer oral environment	Metallic
Using of essential oil and phenolic mouth washes	Cervical interproximal areas of the teeth and dorsum of the tongue	Yellow
Habitual betel palm leaf and nut chewer	Facial, lingual and occlusal surface of anterior and posterior teeth	Red-Black
Potassium permanganate in mouthwashes	Cervical interproximal areas of the teeth and dorsum of the tongue	Violet-Black

4.Different Treatment Modalities of Dental Discoloration

Many trials have been performed to remove blue and grey stain teeth discoloration resulting of alkaptonuria. Although bleaching should be performed initially, it does not effectively remove the stains, they must either be abraded away or covered up with restorative therapy. (26)

Regarding reddish-brown porphyrin pigments, laminated veneers, facings, and/or crowns are among the available dental treatments. Congenital hyperbilirubinemia can be treated by bleaching or the placement of cosmetic crowns. (27)

Poor aesthetics, sensitive teeth, and significant tooth wear are typical clinical issues with Amelogenesis Imperfect. The goals of treatment for affected kids and teenagers should be to improve aesthetics, lessen sensitivity, preserve, or correct vertical dimension, and regain masticatory function. (28)

Amelogenesis imperfecta may affect young patients' psychological well-being. To provide appropriate preventative and restorative therapies along different phases, early diagnosis is crucial. The "temporary phase" begins shortly after diagnosis in the primary or mixed dentition and is followed by a "transitional phase" to provide the patient with a functional and aesthetically pleasing permanent tooth before entering the "permanent treatment phase" in adulthood. (29)

Treatment for various Amelogenesis imperfecta types relies on both the phenotype of the afflicted enamel and the Amelogenesis imperfecta type. The course of therapy might include prosthetic rebuilding as well as preventative care employing sealants, teeth whitening, microabrasion, and bonded methods. (30)

The use of 10% carbamide peroxide in a specifically designed tray for at-home whitening was used to treat Dentinogenesis imperfecta discoloration. The patient wore it for several hours each day for two weeks. Higher value degrees could be obtained after six weeks, although, it could be darkened again. (31)

Long bleaching procedures may be effective on tetracycline-stained teeth; some of these discolorations can take up to 12 months of nightly bleaching. Tetracycline-stained teeth may be effectively whitened utilizing a 6-month active therapy with 10% carbamide peroxide,

and shade stability may endure for at least 90 months after treatment. (32)

Regarding tetracycline staining degree I, the outlook for essential bleaching is favorable. The quantity and location of the discoloration vary considerably in degree II. As a result, the prognosis might vary based on the precise type and level of staining. Banding is typically used to identify degrees III. Banding brought on by occasional recurrent tetracycline consumption is one of the most challenging tetracycline discolorations to correct. These bands could be more noticeable when bleaching becomes more successful on lighter stains. The outlook for successful and aesthetic vital bleaching is poor for stains of degrees III and IV, which are serious stains. (33)

Porcelain veneers or the insertion of a crown are possibilities to restore aesthetics and function when the teeth are significantly discolored in the gingival region and a whitening treatment is ineffective. Haywood advises trying bleaching, abrasion, or bonded method first since one of the treatment techniques can offer a good result and reduce the need for further traditional treatments. (34)

The Thylstrup and Fejerskov index may help decide the best course of therapy based on the degree of fluorosis. Bleaching can successfully enhance the aesthetics of moderate fluorosis. Bleaching alone or in conjunction with microabrasion can treat mild fluorosis. Crowns, restorations, or porcelain laminate veneers may be needed for severe fluorosis. (35)

Intra coronal bleaching is the preferred therapy for pulp necrosis. About 95% of cases with discoloration brought on by trauma or necrosis may be properly treated with bleaching, compared to lower percentages for teeth stained because of medications or restorations. The initial step in the therapy is to completely remove all the filling material up to the level of the bone. Then use a bur to clean the chamber. Finally, use intracoronal bleaching to treat the tooth. The prognosis will depend on the extent of the discoloration and the kind of sealer used. (36) Before beginning the bleaching treatments, the chamber must be thoroughly cleaned with a bur to get rid of all remnants. Bleaching makes it challenging to get rid of stains brought on by metallic ions. (36)

The exposure to bleaching agents typically necessitates lengthy sessions, lasting longer than is typical for the whitening of the enamel, to enhance the appearance of tooth roots that are stained. (37)

5. Conclusion

When an alternative treatment to prevent avoidable causes of tooth discolouration is available, the general dentist may be able to inform medical colleagues. Understanding the pathological processes that result in tooth discoloration might help you explain the explanation to worried or concerned parents. Dentists should be aware of the physiological processes involved in shade taking to better interact with technical workers and patients. Dentists should be aware of the physiological processes involved in shade taking to better interact with patients.

The dentist can better explain the problem to worried patients if they have a thorough grasp of the pathological process involved in stain production. Every patient's expectation should be considered by the dentist, and any discoloration should be treated properly. The knowledge will enable the practitioner to decide if he can treat the stains himself or whether he has to send the patient to a specialist.

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