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## Discoloration of Teeth: A Literature Review

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Received: 12-04-2020 / Revised: 16-05-2020 / Accepted: 20-05-2020

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### Abstract

The psychological and social impact of tooth staining on patient has been greatly reported. Tooth staining may be the result of different etiological factors, it may have different appearances, location and severity. Tooth discoloration is mainly caused by intrinsic and extrinsic factors. There are various types of treatment available and it depends upon the underlying etiology and depth of the lesion. Treatment can be microabrasion of enamel, bleaching, veneers and crowns.

**Keywords:** Staining, Intrinsic Stains, Discoloration.

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### Introduction

Smile has been said to be among men's most important interactive communication skill.[1] 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.[2]

Tooth discoloration is an esthetic problem.[3] As reported by several studies, concerns are increased in adolescents regarding esthetics.[4] Therefore, it is crucial for dental practitioners to have an understanding of the etiology and clinical presentation of tooth discoloration in order to make a diagnosis and select the most appropriate treatment for each case.[5]

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### Aetiology of Discolouration

Discoloration being the prime cause of esthetic dental treatment, etiology should be known to the clinician. There are numerous factors that result in tooth discoloration. Tooth discoloration can occur as a result of intrinsic or extrinsic factors. Also, it occurs as a result of surface stains due to actual changes in our tooth material, or because of a combination of both factors. Dental professionals have identified different categories of tooth discoloration.

#### Extrinsic discolouration

It is caused by agents resulting in staining of enamel or causing some kind of damage to the enamel. The involvement of outermost layer of the tooth is usually seen which can be prevented by simple oral prophylaxis.[1] Yellowish brown to black discoloration primarily on the lingual surfaces of the tooth involving cervical portion is caused by cigarettes, cigars and pipes. Stains penetrating the deep enamel are caused by

tobacco chewing. Brown to black tenacious discoloration is seen with the use of frequent intake of tea and coffee.[6]

### Intrinsic discoloration

The deposition and incorporation of substances within enamel and dentin causes this kind of staining, for instance, tetracycline stains, stains in dentinogenesis imperfecta, fluorosis, jaundice (greenish discoloration due to bilirubin), dental trauma (gray or blue gray discoloration due to the breakdown of haemoglobin), dental materials used in restorative dentistry (Table 1) and medicines.[7] Long standing non vital tooth and periapical pathology also contribute to intrinsic staining.[1]

### Tetracycline staining

Tetracycline staining was first reported in mid-1950s, less than a decade after widespread use of this antibiotic. Teeth are most susceptible to tetracycline discoloration during their formation (i.e. 2<sup>nd</sup> trimester to 8 year after birth) due to tetracycline chelate formation with calcium and its incorporation into hydroxyapatite crystals. It predominantly involves dentin and its severity depends on time, duration and dosage of the administration of tetracycline.[8] Different forms of tetracycline causes different kind of tooth discoloration. (Table 2)

**Table 1: Discoloration Caused by Endodontic Sealer[10]**

Endodontic Sealer	Color
Gross mains cement, Zinc oxide, eugenol, endomethasome & N2	Orange / Red stain
Diaket, tubli seal	Mild staining
AH 26	Grey
Riebler's paste	Dark Red stains

**Table 2: Classification of Tetracycline Stains[11]**

Drug	Color of Teeth
Chlortetracycline (Aureomycin)	Gray, Brown
Dimethyl Chlortetracycline (Ledermycin)	Yellow
Oxytetracycline (Terramycin)	Yellow
Tetracycline (Anchromycin)	Yellow
Doxycycline (Vibramycin)	No reported charges
Minocycline	Black

### Fluorosis staining

When child ingest excessive fluoride during developmental stages of enamel and dentin, mottling can be seen.[8] Damage can occur during third gestation month till 8<sup>th</sup> year of life. Moderate to severe discoloration is seen if concentration of fluoride is more than 4 ppm due to metabolic alterations in ameloblasts which results in defective matrix formation and improper calcifications.[1]

### Categories of tetracycline discoloration[9]

#### First degree tetracycline staining

Uniform distribution of light yellow, brown or gray staining throughout the crown with no evidence of banding or localized concentration. It responds well to bleaching in 2-3 sessions.

#### Second degree tracycline staining

Extensive dark or gray stains with no banding and it responds well to 4-6 sessions of bleaching.

#### Third degree tetracycline staining

Marked banding with dark gray or blue stains. Responds well to bleaching but not in areas of banding, which are difficult to remove even after extensive treatment. Veneers can be given in these kind of cases.

#### Fourth degree tetracycline staining

There are too dark stains which cannot be treated with vital bleaching.

### Types:[12]

- Simple fluorosis staining
  - Appear as brown pigmentation on enamel surface.
  - Responds well to bleaching.
- Opaque fluorosis
  - Appear as flat gray or white flecks on enamel surface.

- Responds poorly to bleaching.
- 3. Fluoride staining with pitting
- Dark pigmentation with surface defects
- Necessitates bleaching followed by composite resin bonding.

### Discolouration from pulp necrosis

Trauma-related

Hemorrhage caused by rupture of blood vessels in the pulp chamber. Hydraulic pressure drives the blood into dentinal tubules where hemolysis of RBC releases Hemoglobin which on further degradation release iron. Haemoglobin degradation releases iron that forms iron sulphide (black compound) by combining with hydrogen sulfide. Pink discoloration of crown is seen after immediate trauma which turns orange, then blue, then brown and finally brown to black.[1]

Pulp degeneration without haemorrhage

Necrotic tissue contains various protein degradation products which create a gray brown discoloration of the crown. This responds well to non-vital bleaching technique.[1]

### Iatrogenic Discolouration[13]

- a) Trauma during pulp extirpation → Haemorrhage.
- b) Failure to remove all pulpal remnants. Responds well to non-vital bleaching technique.
- c) Leakage from dental materials used in restorations and medications.
- d) Amalgam discoloration reflects through enamel.
- e) Breakdown of silicate cements, composite resins can result in grayer and discoloured teeth.
- f) Silver nitrates – cause black or bluish black discolourations.
- g) Yellowish discoloration is caused by volatile oils.
- h) Iodine-creates brown, yellow or orange stains.
- i) Black stains caused by silver containing root canal sealers.
- j) Pins causes blue grayish stains.

### Discolouration as a symptom of systemic condition[2]

Erythroblastic fetalis (Rh incompatibility between mother and foetus) characterized by breakdown of an excessive number of erythrocytes – degradation of these blood cells causes intrinsic staining of dentin of developing teeth.

- Jaundice results in staining of dentin bluish green or brown primary teeth by bilirubin.

- Purple brown discoloration is seen in porphyria, due to excessive pigment production and its infusion in dentin of primary and permanent teeth.
- Genetic conditions which interfere with normal enamel matrix formation such as amelogenesis imperfect.
- Other acquired illnesses such as cerebral palsy, renal damage, allergies, neurologic and other traumatic injuries can interfere with the normal development of tooth enamel.

Enamel Hypoplasia.[1]

Enamel hypoplasia is caused by deficiencies of vitamins A, C, D and calcium and phosphorous during the formative period. Tooth with enamel hypoplasia respond poorly to bleaching agents.

### Discolouration due to heredity and dental history[8]

Some people are genetically programmed to have lighter or darker teeth. Dental caries may be seen as an opaque halo or as a gray discoloration of teeth which in turn may affect the normal tooth structure breakdown. Bleaching is not effective until the cause of discoloration is removed.

Deeper pigmentation as a result of bacterial degradation of food debris in areas of tooth decay or decomposition contribute to dirty staining on tooth surfaces leading to recurrent infections. In such cases if breakdown is repaired, bleaching may not be necessary.

### Discolouration due to aging[8]

1. More stains of coffee and food.
2. Due to wearing away of enamel.

Pulp recession due to aging is advantageous in terms of bleaching as it makes tooth less sensitive to the bleaching agent.

### Classification of Discoloration

It has been classified as extrinsic or intrinsic (Dayan et al 1983, Hayes et al 1986, Teo 1989). Feinman et al (1987) describes extrinsic discoloration as that occurring when an agent stains or damages the enamel surface of the teeth and intrinsic tooth structure is pretreated by discoloring agent. However (Dayan et al 1983) defined extrinsic staining that can be removed by a normal prophylactic cleaning.

Where intrinsic discoloration is seen incorporated into the tooth matrix and thus its removal by prophylaxis cannot be done. Some discoloration is a combination of both types of staining & may be multifactorial.[14]

**Classification[5]**

<b>Tooth Discoloration</b>	<b>Associated Condition</b>
Yellow	amelogenesis imperfecta, Chlorhexidine ingestion, tetracycline ingestion, osteogenesis imperfecta, chlorhexidine gluconate, tetracycline, osteogenesis, internal resorption, periapical
Opaque	Fluorosis, Sickle cell anemia, Osteogenesis imperfect
White	Fluorosis, Chronic kidney failure, Hypominerilization
Brown	Fluorosis, Smoking, Coffee, Soy sauce, Cola, Tea, Calific metamorphosis, Loss of vitality, Chlorhexidine ingestion, Iron, Tetracycline ingestion, Antitartar tooth paste, Osteogenesis imperfect, Chlorhexidine gluconate, Tanic acid, Ochronosis, Dental materials (Pins )
Black	Occupational: glass blower, Betal nut chewers, Pipe/cigar smoker, Faulty Restorations, Secondary Caries, Malformations, Dental material(pins), Caries
Blue	Tetracycline ingestion, Osteogenesis imperfect
Green	Hyprebilirubinemia, Congenital bilaryarresia, Occupation: brass factory, Marjuna smoking, Nasmyths membrane
Orange	Poor oral hygiene, Chronic acid fumes
Red	Internal Resorption, Congenital erythropoetic porphyria Periapical granuloma in lepromatous leprosy, Death
Grey	Tetracycline for cystic fibrosis, Minocycline for acni in adults, Dentinogenesis imperfecta, Amalgam restoration (Faulty Restorations), Cyclosporine

**Clinical Appearance**

A brief description of clinical appearance of tooth discoloration due to different factors has been described below:

Single dark tooth (radiograph needed for diagnosis of pathology)-Vital: bloodborne pigments from trauma, calcific metamorphosis, internal resorption. [5]

Non vital: Blood stain during endodontic therapy, remaining pulp material in the chamber, internal resorption. [15]

Generalized discoloration of all the teeth- From smoking (extrinsic and intrinsic), chromatogenic foods, drug (tetracycline), disease or aging or genetically inherited. [5]

Localized discoloration of a single tooth- White spots: surface or subsurface fluorosis, white surface demineralization [2]

Brown spots: Fluorosis, formation defect. [5]

Localized discoloration to one area on all of the teeth- Chromagenic food, chlorhexidine, smoking (extrinsic), often associated with plaque and poor oral hygiene. [1]

Discoloration associated with the restoration- Amalgam: show through because of thin enamel, stained dentin (Faulty Restorations) 5 Composite: staining of the margins, staining beyond the margins complete discoloration of restoration. [2]

Discoloration associated with caries- Aproximal and occlusal stained additionally by food or saliva & Secondary Caries beneath restorations. [1]

Tooth defect: Pitted, poorly formed- Facial, lingual, or incisal defect from fever or trauma during development, genetics (peg laterals or deep groove). [2]  
Translucency: Dark incisal- Finger test on lingual to determine translucency; may appear darker with bleaching due to loss of further color & Fracture of the tooth. [5]

**Treatment modalities for discolored teeth includes**

- Removal of surface stains: Superficial stains caused by tobacco chewing can be removed by scaling and polishing of teeth.
- Micro abrasions: Enamel micro-abrasion technique associated with dental bleaching is an excellent and successful clinical technique for re-establishing esthetics of severe case of enamel fluorosis eliminating the use of dental restoration. The procedure involves removal of thin layer of enamel surface. It is followed by polishing with a fluoride prophylactic paste provides better surface smoothness and better hardness of the enamel. [16]
- Macro abrasions: This technique removes the superficial layer of fluoride that displays the most

unaesthetic colour and defective structure. The procedure can eliminate deepest stains in the enamel.[17]

- Veneering: Treatment of deeply penetrated intrinsic discoloration defects or considerable tooth structure loss entails placement of porcelain veneers.[12]
- Placement of porcelain crowns: Best aesthetic solution for a badly discolored tooth is a porcelain crown. But a large number of patients dislike their teeth cut down for crowns and are electing an alternative conservative approach such as bleaching and veneer placement.
- Bleaching: Bleaching is now the single most common esthetic treatment for adults. The popularity of bleaching is clearly understood for the appropriate patient with careful diagnosis, case selection and treatment planning.

It is least invasive, simplest yet least expensive means to lighten the discoloration of non vital and vital tooth<sup>16</sup> but consideration of type of cemento-enamel junction must be taken in consideration while implying this procedure.[18]

### Conclusion

Toothstaining has several etiologic factors ranging from simple enamel hypoplasia to severe dental fluorosis. Many colour changes can be encountered when dealing with tooth discoloration. An understanding of the disease process is essential in determining the appropriate treatment modalities.

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**Source of Support: Nil**

**Conflict of Interest: Nil**