Classification of tooth staining

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Tooth Staining can be classified on several bases i.e. on the basis of location, aetiology, number of teeth involved, etc.

Classification based on location of discoloration (most recent classification):

1. Extrinsic stains.
2. Intrinsic stains.
3. Internalised stains.

The most common classification based on the location of discoloration was given by Dayan et al 1983, Hayes et al 1989, according to them they classified tooth staining into two:

1. Extrinsic stains.
2. Intrinsic stains.

Extrinsic stains

1. This kind of stains is found located at the outer surfaces of the teeth.
2. Discoloration includes brown, black, grey, green, orange and yellow.
3. Extrinsic discoloration can be removed by scratch test.
4. This kind of stains are very common and are caused by topical or extrinsic agents may be a result of various causes:
    - Predisposing factors.
    - Other factors.

Pre-disposing factors

1. There are certain factors which predispose children and adults to extrinsic stains, include enamel defects, salivary dysfunction, and poor oral hygiene.
2. Small and microscopic pits and defects in the outer layer of the enamel can accumulate stain producing substances (food and beverages) and other topical agents.
3. Decreased saliva can also be the cause of extrinsic discoloration as saliva helps in removal of food debris and dental plaque from outer and interproximal tooth surfaces.

Other factors include

1. Ageing changes of tooth
2. Poor oral hygiene
3. Gingival bleeding
4. Plaque and calculus accumulation: It can cause brown and black stains.
5. Food and beverages: Tannins can be deposited from the tea, coffee and other beverage products which may finally lead to the brown coloured stains, foods rich in polyphones can also be the cause of tooth discoloration.
6. Tobacco: Chewing tobacco, taking cigars, cigarette, pipes can cause dark brown and black stains that cover the cervical about one third to half of the tooth. Pan chewing can lead to red-black coloured stains, gingiva and oral mucosal surfaces.
7. Chromogenic bacteria: Chromogenic bacteria create the gingival margin of the tooth. The colour which appears is mainly black caused by *Actinomyces* species. Green stains occur due to the presence of fluorescent bacteria and fungi such as *Penicillium* and *Aspergillum* species. Orange stains arise due to the presence of chromogenic bacteria such as *Flavobacterium lutescens*. Orange stains are less common in comparison to green and brown stains.
8. Mouth washes and rinses such as chlorhexidine
9. Metallic compounds: metals may also impart discolouration due to their interaction with dental plaque and finally producing surface stains. Industrial exposure to Fe, Mn, and Ag

may stain the teeth in black colour while Hg and Pb dust can impart blue-green stain.

10. Topical medications: chlorhexidine rinse create brown staining particularly on acrylic and porcelain restorations oral solutions containing iron can cause black stains, potassium permanganate mouth wash can create violet-black stains, silver nitrate can cause black stain and stannous fluoride can create brown stain. Some medications which include minocycline, doxycycline can also cause extrinsic staining.

Extrinsic factors	Characteristics
Chromogenic bacteria	Green, black ,brown and orange
Tobacco	Black, brown
Amalgam	Black, grey
Medicaments	Silver nitrate: grey black Stannous fluoride: black brown Chlorhexidine: black brown
Foods and beverages	Colour of food items
Iron	Black cervical discoloration

Intrinsic stains

1. This type of stain is found in internal surfaces of teeth, and can be defined as discoloration which is incorporated into the structure of either enamel or dentine which cannot be removed by prophylaxis, toothpaste or pumice.
2. Discoloration may be brown, black, green, grey, orange, and yellow. Intrinsic discoloration cannot be removed by scratch test. Also they may be red or pink.
3. Intrinsic stains are caused by deeper internal stains or enamel defects. Staining may be located in enamel or in dentin. Stain distribution varies from localized (i.e. 1 or 2 teeth) to a regional or generalized involvement of primary or secondary teeth.
4. This type of stains is caused due to:

Hereditary disorders and genetic defects

1. The hereditary diseases in enamel or dentin formation are like amelogenesis imperfecta, dentinogenesis imperfect, dental dysplasia causing intrinsic tooth discoloration.
2. Amelogenesis imperfecta affects both primary and secondary dentitions
3. Dental dysplasia occurs in two types; teeth with type 2 dental dysplasia have amber, blue or brown translucence.
4. Other dental diseases may be as Erithropoietic porphyria and epidermolysis bullosa.

Medications

1. Tetracycline diffuses through dentin to enamel interface, chelating Calcium ions and incorporating into hydroxyapatite as a stable orthophosphate complex. The incorporated amount can be determined by distribution of discoloration. The affected teeth first have bright yellow band like appearance which fluoresces in presence of U.V light and when exposed to sunlight the colour of teeth colour changes to grey.
2. Minocycline (prescribed for long term acne therapy in adults) a derivative of tetracycline can create green-grey or blue-grey staining to teeth. This medication has now been replaced.
3. Doxycycline causes extrinsic staining in those having poor oral hygiene. It causes staining by binding glycoproteins in dental pellicle.
4. Due to the excess intake of fluoride content during the early maturation of enamel formation, enamel discoloration may result from subsurface hypo-mineralization causing dental fluorosis.

High fevers associated with early childhood illness, and other types of trauma

1. Trauma to un-erupted teeth can disturb enamel formation and may result in enamel hypoplasia.
2. Trauma that occurs to erupted teeth may also cause discoloration this type of discoloration occurs in teeth having fully formed roots and have sustained irreversible pulpal injury caused by avulsions, intrusions, or fractures involving the pulp chamber.
3. Due to intrapulpal haemorrhagic and FeS_2 deposition along the dentinal tubules bluish black colour may occur.

Dental material

1. Dental restorations such as amalgam restorations may produce corrosion products producing grey black colour in the tooth.
2. Composites, acrylic restorations, and glass ionomer can give grey colour to the tooth adjacent to the material.
3. Several other dental materials are like eugenol, root canal sealers and poly anti-microbial paste.

Infections

1. Infections like maternal rubella or cytomegalovirus and toxaemia of pregnancy can lead to tooth discoloration.
2. Some postnatal infections such as measles, chicken pox, scarlet fever, streptococcal infection can also cause enamel hypoplasia.

Excess fluoride

Nutritional deficiencies

Intrinsic factors	Characteristics
Dentinogenesis imperfecta	Yellow or grey brown
Amelogenesis imperfecta	Yellow-brown
Dental fluorosis	Opaque white to yellow brown patches
Sulphur drugs	Black staining
Tetracycline: Chlortetracycline Oxytetracycline Tetracycline HCL Dimethyl chlortetracycline Minocycline doxycycline	 Grey- brown Brown yellow to yellow Brown yellow to yellow Brown yellow to yellow Blue-grey to grey No change
Dental trauma	Transiently red through to black
Hyperbillirubinemia	Yellow-green to blue brown and grey
Erithropoietic porphyria	Red or brown
Ochronosis	Brown

Internalised stains

It is the incorporation of extrinsic stain within the tooth following dental development it mainly occurs in enamel defects and in porous surface of exposed dentine. Dental defects which allow chromogenic material are classified into:

Developmental defects

1. These defects create their own changes which are caused by influences on light transmission through dentine and enamel.
2. These defects are either caused by increased enamel porosity or presence of enamel defects, such examples would include fluorosis and other enamel conditions which result in enamel hypoplasia or hypo-calcification
3. Alternatively development defects may expose dentine directly or may later cause dentinogenesis imperfecta, chromogens then enters dentine directly or by the tubule system.

Acquired defects

Tooth wear and gingival recession

1. The progressive loss of enamel and dentine due to erosion, abrasion and attrition is termed tooth wear.
2. With the thinning of the enamel teeth becomes darker and dentine colour becomes more apparent.
3. As the dentine is exposed the potential chromogens enters the tooth body.
4. If any physical trauma occurs in teeth it can result in a bulk loss of enamel or enamel cracks which may cause internalisation of extrinsic stains.
5. Exposure of dentine is more likely to be caused by gingival recession as wear of tooth mainly occurs in cervical area where enamel is very thin.

Dental caries

1. The various stages of tooth damage can be easily recognized by change in colour as the disease progresses.
2. The initial stage of injury shows an opaque white spot, the white spot lesion differ in

colour from adjacent enamel because of its increased porosity and the effect it has on refractive index.

3. Drying makes the white spot injury clearly visible by altering its light transmitting properties.
4. The hard arrested injury is black due to exogenous sources.

Restorative materials

1. Some materials used in restorative dental treatment may have effect on teeth colour such as eugenol and phenolic compounds used for root canal therapy contain pigments which could stain dentine.
2. Polyantibiotic pastes used as root canal medicaments may cause darkening of root dentine.
3. Earlier this discoloration was thought to be because of mercury penetration through the dentinal tubes and react with sulphide ions. But later it was discovered according to electron microscopic studies discoloration is caused by the migration of tin into tubules.

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