Causes and Management of Tooth Discoloration

Abstract: Tooth discolouration is a common dental occurrence that is linked to both clinical and aesthetic issues. The treatment of tooth discolouration has grown into a multibillion-dollar, highly complex, scientific, and therapeutic field by the twenty-first century. Dental surgeons must understand the aetiology of tooth staining in order to provide an accurate diagnosis and thus management. Extrinsic causes produce tooth darkening, whereas intrinsic congenital or systemic influences cause tooth discoloration. Tooth bleaching is a safe and effective way to lighten the colour of the teeth. Today, the physician has a number of options, including at-home tray-based bleaching treatments with low hydrogen peroxide or carbamide peroxide concentrations. Surgical options include dental restorations which is may be indicated for some cases. In this article we'll be looking at tooth discoloration classification, it's causes, and management.

Introduction:

The treatment of tooth discolouration has grown into a multibillion-dollar, highly complex, scientific, and therapeutic field by the twenty-first century. The treatment's origins, on the other hand, may be traced back thousands of years to ancient doctors and beauticians who employed simple yet ingenious natural materials to conceal unpleasant teeth discolorations. [1] Dental surgeons must understand the aetiology of tooth staining in order to provide an accurate diagnosis when examining a discoloured dentition and to explain the nature of the problem to the patient. In rare cases, the process of staining may have an impact on the treatment outcome and the treatment choices available to the dentist. [2]

Tooth discolouration is a common dental occurrence that is linked to both clinical and aesthetic issues. The origin, appearance, content, location, severity, and tenacity of adhesion to the tooth surface are all different. Extrinsic causes produce tooth darkening, whereas intrinsic congenital or systemic influences cause tooth discoloration. If there are enamel flaws, the severity of the stains may be exacerbated. The dental staff has two significant issues when it comes to tooth discolouration. The first task is to figure out what caused the stain, and the second is to treat it. [3]

The mouth cavity is engaged in nutrient intake, communication, and host defence, and plays three crucial roles in the prevention and preservation of systemic health. All three functions are performed by the teeth, and dental illnesses can cause a variety of issues, including oral and systemic infections, as well as trouble eating, swallowing, or phonation. [1]

Teeth discoloration is a frequent dental disease that can impair not only the patient's self-image and psychological profile, but also their face attractiveness. Such discoloration, which can be localised or generalised, is becoming more well-known. Newer clinical approaches and better dental materials have also enhanced the restoration and repair of this clinical condition. The aetiology of discoloration is examined first since it determines the therapy technique to be used. Patient input and acceptability should be prioritised while considering management concepts. [4]

Tooth bleaching is a safe and effective way to lighten the colour of the teeth. Today, the physician has a number of options, including at-home tray-based bleaching treatments with low hydrogen peroxide or carbamide peroxide concentrations. On the other side, in-office bleaching systems employ a high concentration of hydrogen peroxide or carbamide peroxide, which is administered by a dentist. Both approaches have been found to be acceptable and safe in previous investigations. [5-9]

Causes and Classification:

Intrinsic discoloration: A change in the structural composition or thickness of the tooth hard tissues causes intrinsic discoloration. The blue, green, and pink tints of the enamel establish the usual colour of teeth, which is strengthened by the yellow to brown colours of dentine underneath. A variety of metabolic illnesses and systemic variables have been shown to have an impact on the growing dentition, resulting in discoloration. Local circumstances, such as injury, are also taken into account.

Intrinsic tooth discolouration can be caused by a variety of factors. Stain distribution ranges from limited involvement of primary and secondary teeth (e.g., 1 or 2 teeth) to regional or widespread involvement of primary and secondary teeth. Localized discolouration can be caused by preeruptive or posteruptive processes, whereas extensive involvement suggests a divergence

from normal tooth development. Understanding the period of tooth production (especially calcification and eruption sequences) might assist to explain why certain teeth are discoloured inside. [1]

These Factors may include: [2]

- Alkaptonuria
- Congenital Erythropoietic Porphyria
- Hyperbilirubinemia
- Amelogenesis imperfecta
- Imperfect Dentinogenesis
- tetracycline
- Fluorosis
- Hypoplasia of the enamel
- Products of pulpal haemorrhage
- Resorption of the roots
- Ageing

Dental fluorosis is characterised by enamel discolouration caused by subsurface hypomineralization caused by excessive fluoride consumption during enamel formation's early maturation stage. Fluorosis affects both primary and secondary dentitions, causing a variety of clinical signs and symptoms. Fluorosis occurs as thin white lines or streaks on the enamel in its mildest form. Moderate fluorosis is characterised by more visible opaque patches known as enamel mottling, but severe fluorosis is characterised by widespread mottling that easily crumbles and stains, resulting in pitting and brown discolouration. Even in locations with nonfluoridated public water sources, the frequency of mild-to-moderate fluorosis has increased in the United States during the previous decade. Early usage and ingestion of fluoridated toothpaste, improper use of fluoride supplements, and the use of powdered baby formula combined with local water in fluoridated regions all contribute to the tendency. Clinicians can assist prevent fluorosis by educating parents about the benefits of fluoride and how to clean their children's teeth properly. [1,10,11]

Minocycline is a tetracycline derivative that is semi-synthetic. It can cause green-gray or blue-gray intrinsic staining of the teeth if consumed over an extended period of time. Minocycline causes discoloration during and after the entire

creation and eruption of teeth, unlike other tetracyclines. To explain the likely mechanism of this side effect, four ideas have been offered. The first is the extrinsic hypothesis, in which minocycline is assumed to bind to the glycoprotein in acquired pellicle. When exposed to air or as a result of bacterial action, it oxidises. This causes the aromatic ring to degrade, resulting in an insoluble black compound. A demineralization/remineralization event may be responsible for the pigment's incorporation into the dentin. The second is the intrinsic theory, which states that minocycline linked to plasma proteins is deposited in collagen-rich tissues like the teeth. When exposed to light, this oxidises gradually over time. The medication chelates with iron to produce an insoluble complex, which is the third alternative. The fourth hypothesis is that minocycline is deposited in dentin during secondary dentinogenesis, and that this process is expedited in bruxists. [12]

Pulpal necrosis is a consequence of acute dental injury that manifests itself as a greyish black staining of the crown of the tooth. This, however, is contingent on the degree and severity of injury to the tooth's neurovascular supply. Trauma to the teeth is most commonly caused by a car accident, a fall, or an accident at home. It's not surprising that pulpal necrosis is the leading cause of intrinsic tooth discolouration, given that a large number of youngsters (57.3 percent 17 and 93.1 percent 18) leave injured teeth untreated, according to research conducted in Nigeria. Pulpal necrosis, with or without pain, is a complication of untreated injured teeth that have lost their neurovascular supply. [13-17]

Extrinsic Discoloration: Extrinsic stains are those that are generated by topical or extrinsic substances that appear on the outside surface of the tooth structure. [1] This may be separated into two categories: direct and indirect. Direct staining is created by substances integrated into the pellicle layer, and the stain is determined by the chromogen's basic hue. Direct staining is a multi-factorial aetiology, with chromogens generated from the food or items that are often placed in the mouth. On the other hand, indirect staining is induced by a chemical reaction at the tooth surface. It's generally related with metal salts and cationic antiseptics. These agents are either colourless or have a different hue than the stain on the tooth surface. [12]

Extrinsic dental stain is classified into three groups by the Nathoo categorization system [1,18]:

- Nathoo type 1 (N1): Colored substance (chromogen) bonds to the tooth surface. Dental stains formed by tea, coffee, wine, chromogenic bacteria, and metals have a similar hue to the chromogen.
- Nathoo type 2 (N2): After attaching to the tooth, N2-type coloured substance changes colour. The stains are really food stains of the N1 kind that deepen over time.
- Nathoo type 3 (N3): N3-type colourless substance or prechromogen adheres to the teeth and causes a stain through a chemical reaction. Carbohydrate-rich meals (e.g., apples, potatoes), stannous fluoride, and chlorhexidine all create N3-type stains.

The origin of the stain may be:

- Metallic
- Non-metallic

Extrinsic discoloration causes are caused by a variety of factors. [12]

- Diet: The deposition of tannins contained in tea, coffee, and other liquids might cause brown stains on the surface of the teeth.
- Hygiene of the mouth: Brown or black stains are caused by the accumulation of dental plaque, calculus, and food particles.
- Tobacco from cigarettes, cigars, pipes, and chewing tobacco generates stubborn dark brown and black stains on the cervical one third to midway of the teeth.
- Influencing medication: After continuous usage, cationic antiseptics such chlorhexidine, cetylpyridinium chloride, and other mouthwashes can induce discoloration.
- Stains are caused by chromogenic bacteria, which are most commonly found along the gingival border of the tooth. A black stain generated by Actinomyces species is the most prevalent. The stain is made up of ferric sulphide, which is created when hydrogen sulphide produced by bacterial activity reacts with iron in saliva and gingival exudates to form ferric sulphide. Fluorescent bacteria and fungus like Penicillium and Aspergillus species are responsible for green stains. Because the organisms can only

develop in light, they discolour the maxillary surface of the anterior teeth. Orange stains are formed by chromogenic bacteria such as Serratia marcescens and Flavobacterium lutescens, and are less prevalent than green or brown stains. [1,19,20]

- Extrinsic tooth discoloration has been linked to occupational exposure to metallic salts as well as the use of a variety of metal salt-containing drugs. Teeth staining is commonly reported in those who take iron supplements and iron foundry employees. Copper generates a green tint in mouthrinses containing copper salts, as well as in industrial employees who come into contact with the metal. Potassium permanganate, which is used in mouthrinses, produces a violet to black colour; silver nitrate salt, which is used in dentistry, produces a grey colour; and stannous fluoride produces a golden brown discoloration. The process of stain formation was previously assumed to be linked to the formation of the metal's sulphide salt. This is rather unsurprising, given that the extrinsic stain was the same colour as the metal's sulphide. Those who proposed the concept, on the other hand, did not appear to grasp the complexities of the chemical process required to form a metal sulphide. [2,21-26]

The change in colour as the condition develops can be used to identify the various phases of caries. In the early stages of dental caries, an incipient lesion localised to the enamel layer is seen. Carious lesions in the early stages are connected with plaque buildup and appear as chalky white regions of discolouration as a result of demineralization. The overlaying transparent enamel displays the colour of the underlying caries when caries spreads into the dentin and appears yellowish brown. The colour of extensive caries, which involves the deterioration of both enamel and dentin, can range from light brown to dark brown or virtually black. [12]

Management:

The most recent trend in teeth whitening methods is to acquire whiter teeth at home in less time, and trayless bleaching devices are the most common modalities for achieving this goal. Traditional professional bleaching systems are more costly and difficult to operate than trayless bleaching systems. Gels, rinses, dentifrices, strips, and paint-on films or pens containing varied quantities of

hydrogen peroxide or carbamide peroxide are examples of trayless products. [5,27-30]

Teeth stained by dental caries or restorative materials require the removal of the caries or restorative materials, followed by effective tooth repair. When bleaching is not needed or the cosmetic outcomes of bleaching do not fulfil the patient's expectations, partial (e.g. laminate veneers) or full-coverage dental restorations can be utilised to correct widespread intrinsic tooth discolouration. [12]

In regular dentistry practise, the single discoloured tooth is a common clinical concern. There are many different management methods available, and depending on the clinical situation, any of them may be the best option. As a result, general dentistry practitioners must be aware of the many alternatives available, as well as their indications, and should consider using minimally invasive treatments first before going on to more invasive therapies. [31]

Patients may have significant visual damage as a result of discoloration of the anterior tooth caused by trauma or endodontic therapy. Full veneers, laminates, crowns, and noninvasive techniques such as bleaching are used to treat postendodontic tooth discolouration. Even though a laminate veneer or a complete porcelain crown is one of the most predictable ways to handle such instances, it requires tooth structure removal. Nonvital bleaching provides a number of advantages, including the fact that it is a noninvasive, cost-effective, and time-saving process. The walking bleach technique, inside/outside bleaching, and in-office bleaching are the three most prevalent nonvital tooth whitening treatments. The walking bleach procedure is a pretty safe and straightforward method. The walking bleach procedure uses a paste made of SP and distilled water or H2O2 that is applied to the pulp chamber. [32]

Patients with widespread yellow, orange, or light brown extrinsic discoloration (including chlorhexidine staining) should have essential teeth bleached, while treatment may also assist with minor instances of tetracycline-induced intrinsic discoloration and fluorosis. Currently, carbamide and hydrogen peroxide are the most widely utilised bleaching chemicals. The agents create more substantial bleaching when used in higher concentrations than when used without these precautions. [1]

Hydrogen peroxide is an oxidising agent that may form highly reactive free radicals (H_2O+O_2); in its pure aqueous condition, hydrogen peroxide is mildly acidic. The outcome is the most powerful free radical, perhydroxyl (HO_2). Hydrogen peroxide must become alkaline in order to stimulate the synthesis of the ion perhydroxyl; the ideal pH for this is 9.5 to 10. A considerable quantity of H_2O perhydroxyl free radicals are detected in the ionisation of hydrogen peroxide buffered by this pH, resulting in a stronger bleaching effect in the same length of time. The most typical hydrogen peroxide concentration is 35%. The capacity of peroxides to penetrate or diffuse into enamel and dentin is directly connected to the efficacy of the tooth bleaching process. [33]

Nonvital bleaching is used to treat teeth that have discolouration as a result of pulpal deterioration. This method entails injecting a 30 percent hydrogen peroxide and sodium perborate solution into the pulp chamber for up to a week. A tooth with an unrestored crown is appropriate for nonvital bleaching. Cervical external root resorption is a risk, particularly in teeth that become pulpless before the patient reaches the age of 25. This unfavourable response can be reduced by special intracanal barrier repair. [1]

Dental Restoration: Teeth stained by dental caries or restorative materials require removal of the caries or materials, followed by effective tooth repair. When bleaching is not necessary or the visual outcomes of bleaching do not fulfil the patient's expectations, partial (e.g., laminate veneers as seen in the image below) or full-coverage dental restorations can be utilised to correct widespread intrinsic tooth discoloration.

Conclusion:

Tooth discoloration is a common dental occurrence that is linked to both clinical and aesthetic issues. Dentists have to understand the reason for the discoloration first in order to educate the patient about the cause and thus prevent it, secondly start appropriate management techniques. Luckily there’s multiple management options that can be used. Bleaching is one the most popular techniques which can be vital or non-vital. Choosing of appropriate method depends of the nature of the discoloration and the patient statues. concentrations. Surgical options include dental restorations which is may be indicated for some cases. In this article we’ll be looking at tooth discoloration classification, it’s causes, and management.

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