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Management of discolorizationdue to cavities with root canal treatment and bleaching: case report

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Abstract
Background *:Tooth discoloration is often experienced by people worldwide and one of main aesthetic problems that can affect person's self-confidence.*
Aim *:This report aims to describe cases of tooth discoloration due to cavities which were treated with bleaching and root canal treatment.*
Case Report *:Male patient 19-year-old came with chief complaints of discolorization and cavities on front teeth. The patient found his cavities since 2 years ago. The diagnosis was determined according to tooth severity, namely Element 22: D6, site 1 size 3 with pulp necrosis and normal apical tissue, tooth 22 with PSA Non vital, internal bleaching and direct restoration.*
Conclusion *:Internal bleaching is treatment of choice for non-vital teeth discolorization.*
Keywords: *Tooth discoloration, Internal bleaching, non-vital teeth, root canal treatment*

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I. Introduction

Aesthetic needs of dental patients have continuously increased over the years.A beautiful smile can be jeopardized by tooth and gum disease (caries, trauma, gingivitis), by tooth and bone architecture (orthodontic problems), and by tooth discoloration. Tooth discoloration (dyschromia) has been widely described in the scientific literature and can be due to extrinsic, intrinsic, and internalized discolorations.[1] For example, pulp necrosis may cause tooth discoloration due to bacterial substance, mechanical or chemical irritation of the pulp, then the product can enter the dentinal tubules.[2]

The non-vital teeth whitening technique puts the oxidizing agent inside the pulp chamber in direct contact with dentine. Chemicals which are often used as bleach are hydrogen peroxide 35%.Walking bleach technique is a bleaching method by placing the active ingredient in the pulp chamber, followed by closing the tooth cavities.[3]Hydrogen peroxide is an active ingredient in bleaching materials. It can penetrate the dentin and releases oxygen, which breaks double bonds of the organic and inorganic compounds inside dental tubules. Hydrogen peroxide is applied directly or might be formed as a result of a chemical reaction from sodium perborate or carbamide peroxide. Whitening improves the color of the discolored tooth.[4]

II. Case Report

Male patient 19-year-old came with chief complaints of discolorization and cavities on front teeth. The patient found his cavities since 2 years ago but because of fear, he decided to postpone dental treatment. The patient wish to normalized his teeth color and fix his teeth cavities. The patient had been restore right upper molar and had applied orthodontic fitted by dentist in 2017 and removed in 2018. On objective examination, face and lips were symmetrical, lymph nodes were not palpable and painless. Examination of vital signs found within normal limit which is blood pressure 120/80 mmHg, pulse 75 bpm, temperature 36^{o}C, respiration 20 rpm. On intraoral examination, plaque and calculus were found with moderate oral hygiene and oral mucosa within normal limits.

Anterior

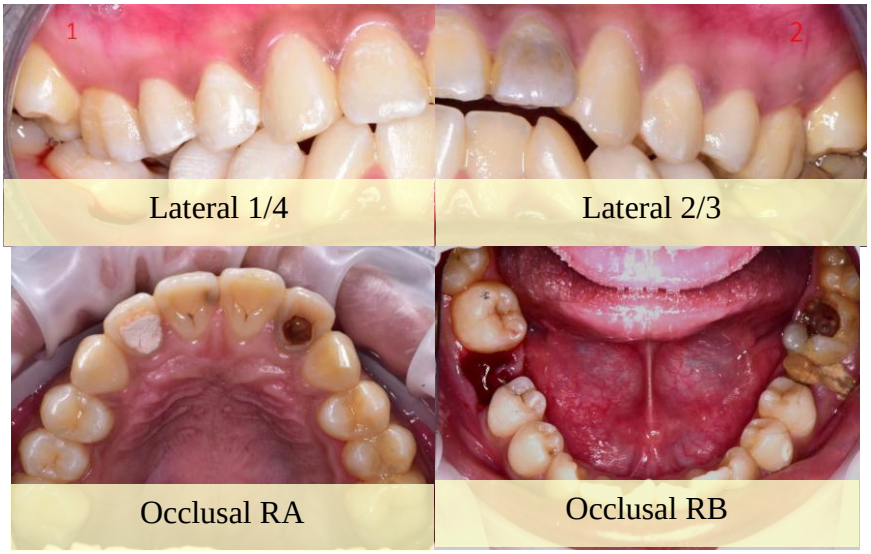

Figure 1. Intraoral Macroscopic Appearance.

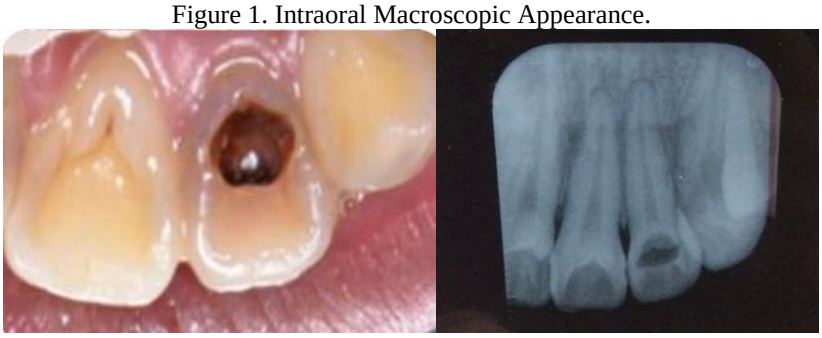

Figure 2.Clinical features of tooth 22 showed caries in cingulum which reached pulp and Periapical radiograph of tooth 22.

The diagnosis was determined according to tooth severity, namely Element 22: D6, site 1 size 3 with pulp necrosis and normal apical tissue.

Management of this patient start with Dental Health Education which includes education brushing teeth at least 2 times a day (morning after breakfast and at night before going to bed), improving oral hygiene and changing behavior with motivation in maintaining oral health. Followed by diet modification, namely reducing sweet foods consumption, choosing healthy snacks such as fruits and vegetables, chewing xylitol gum and drinking water regularly (increasing lubrication and self-cleaning). Recommended for regular dentist check-ups every 3 months. CPP-ACP was applied for remineralization and prevent caries.

The invasive treatment plan for tooth 22 with PSA Non vital, bleaching and direct restoration, prognosis of this patient is categorized as good (favorable).

At first visit, following procedures were performed: scaling then anesthesia (Scandonest 2%) infiltration, work area Isolation with Rubberdam, Open access with endoacsess bur, Orifice determination by gide path with K-file # 10, Determination working length with apex locator and radiographic confirmation (24 mm), Preparation with reciproc #25, Irrigation after file out, Irrigation with 5.25% NaOCl (Endodontic Irrigation), ultrasonic activation 30 seconds, saline, EDTA 17% (Smear Off) for 1 minute, saline, dry the root canal with paper point, MAC with radiographic confirmation, obturation, RMGIC (Ionoseal) application and temporary restoration.

Figure 3. Rubber dam isolation, access opening and IAF determination.

Figure 4. MAC determination and RMGIC application as orifice barrier.

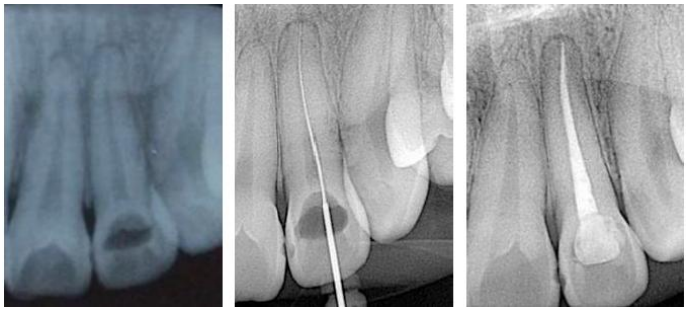

Figure 5. Pre-op, IAF and post-op X-rays.

At second visit after 1 week, obturation was controlled and found asymptomatic appearance, application of rubber dam, tooth color shade removal, opened a temporary restoration, application of intracoronal bleaching agent hydrogen peroxide, temporary restoration.

Figure 6. Rubber dam installation, shade taking and application of bleach material.

Two days later, it was found that color change was in accordance with desired color, then rubber dam was installed, opened a temporary restoration, irrigated the cavity from remaining bleaching material using saline, dried, applied Ca(OH)2 and closed temporary restoration.

Figure 7.Application of $Ca(OH)_2$ and post-bleaching clinical picture.

After a week, re-examined teeth condition. temporary restoration was removed, applied a rubber dam, cleaned Ca(OH)2 using saline, then dried, etched, washed and dried, bonded with light cure.

Figure 8.Bonding application and final restoration appearance.

Figure 9. Final appearance after complete management.

Then applied composite restoration layer by layer, contouring according to tooth anatomical shape, finishing and polishing, occlusion evaluation, post op radiography and periodic control.

III. DISCUSSION

Extrinsic causes of tooth discoloration are always associated with extrinsic direct stimuli such as tea, coffee, cigarettes, plaque, and poor oral hygiene. Teeth can also be indirectly stained, eg, by chlorhexidine. All of these agents concern only erupted teeth. However, both erupted and non-erupted teeth can be affected by intrinsic causes of discoloration such as traumatic shocks, which provoke pulp hemorrhaging and root resorption, as well as iatrogenic causes such as fluorosis and tetracyclines. Internal causes of discoloration are changes in normal tooth shade caused by dentinal caries and dental restorations, especially metallic ones.[1]

Intrinsic stains occur much deeper in the tooth. Sometimes they occur when the tooth is forming, by incorporating dark pigmented molecules into the crystal structure of the tooth. It can be caused from multiple factors like: enamel crack or tooth decay can allow extrinsic stain penetrating the enamel causing intrinsic stain, using tetracycline antibiotics may cause intrinsic grey color, pulp hemorrhage, or infection alter the teeth color; high percentage of fluoride can cause dental fluorosis which appears as white patches on the teeth; genetics may play a role in teeth discoloration, alkaptonuria, congenital erythropoietic porphyria, congenital hyperbilirubinemia, amelogenesis imperfect, and dentinogenesis imperfect.[5]After the eruption of teeth, the main cause of discoloration is the pulp necrosis, the deposition of the blood component to the dentine tubules after trauma or pulpectomy, and secondary dentine deposition due to aging or iatrogenic.[3]

Dental bleaching is a minimally invasive conservative solution for aesthetic problems, without any destruction of tooth structure. There are many protocols for bleaching non vital tooth such as internal and external bleaching. Internal bleaching as known as intrinsic bleaching, is the procedure used to position bleaching agents within the dental pulp in close contact with dentin. Internal bleaching is a treatment option that can be given in cases with discoloration of teeth that have been done endodontic treatment.[2]

When the bleaching agent is applied inside the pulp chamber and sealed, the bleaching occurs between dental appointments via the walking bleach technique. This technique traditionally has been used to treat discolored non-vital teeth. The other bleaching options involve the thermocatalytic technique and in-office external bleaching technique using high concentrated hydrogen peroxide and carbamide peroxide gel.[6]

Walking bleach technique is chosen because it takes a shorter time, safer and more comfortable for the patient. Internal bleaching indications on the teeth that have been treated endodontically are: discoloration in the pulp chamber, dentine discoloration, discoloration which can not be lost with extracoronal bleaching. Internal bleaching contraindications: superficial discoloration, enamel formation with defects, severe dentine loss.[3]

Walking bleach technique depends on making a mixture of sodium perborate with water into the pulp chamber of the discolored root filled tooth. Repeat this technique several times until the removal of discoloration. The technique can be modified using a combination of sodium perborate and 30% hydrogen peroxide which is applied for 1 week into the pulp chamber. Mixing sodium perborate with hydrogen peroxide increases its effectiveness. If there is any doubt about the endodontic filling status of the tooth, preoperative X-ray should be taken to make sure the quality of the filling.[7]

The size of the existing tooth structure, the accuracy of root canal treatment and the condition of the periodontal tissues should be noted by the operator, then they can choose the material and procedure of bleaching treatment. All the required criteria for the indication of internal bleaching, whichis good quality of endodontic treatment, a significant amount of tooth structure and intact root internal walls.Root filling or gutta percha should be lowered by 1-2 mm under the cement enamel junction (CEJ). Pulp chamber must be washed of the debris and traces of the substance of endodontic products or pollutants since the effectiveness of the bleaching agent can be adversely affected.[2]

The most mentioned problems relate to the need for significant removal of the tooth structure during conventional access opening and to the difficulty in locating the root canal, which can be overcome with several safe and feasible clinical strategies, such as Cone Beam Computed Tomography (CBCT) scans, magnification with microscopy and ultrasonic tips. When conservative attempts to locate the canal are unsuccessful, two other treatment options have been advocated in the literature: RCT with guided access and endodontic (root end) surgery.[8]

One of the main concerns regarding the bleaching of endodontically treated teeth is pH level and the high permeability of bleaching agents. When these agents reach the periodontal tissues through the dentinal tubules, they can alter the cementoenamel junction. This can trigger an inflammatory reaction caused by the denaturation of dentin. Said dentin can be considered a different tissue and thus be detected as a foreign body. This can lead to external cervical resorption. This resorption is asymptomatic and is usually diagnosed through routine radiography or clinical examination that reveals swollen papilla and a positive response to percussion.Therefore, it is essential to create a barrier in the cervical region, at the cementoenamel junction, between the obturating material (gutta-percha) and the pulp chamber space. This prevents the penetration of bacteria and the extrusion of the bleaching agent towards the apical periodontium, which could cause cervical resorption. Glass ionomer cement is the most widely used material to make this barrier because it is more cost-effective, among other advantages.[5]

The chemical process in bleaching occurs when the whitening material is applied to the teeth, usually using oxidizing materials such as hydrogen peroxide, chlorine or sodium hypochlorite. Although the bleaching process is a complex chemical process, the basic principle of the majority of bleaching processes is the step-by-step oxidation of the dye with decomposition. Bleaching material is oxidizing, reacting to the organic structure of a hard tooth tissue, pigments which have long chains slowly degraded into simple molecules such as carbon dioxide, oxygen and water which have a brighter colour, inorganic molecules are not broken down, the reduction-oxidation reaction which occurs in the bleaching process is known as redox reaction.[3]

In-office bleaching is most commonly carried out with hydrogen peroxide ranging from 15 - 38%. Hydrogen peroxide (H_2O_2) is able to penetrate dentinal tubules due its reduced molecular weight. It has the ability to release oxygen-free radicals capable of permeating through enamel and dentinal structures and eventually oxidizing organic pigments and chromogenic compounds.[11]The whitening effect of 35% hydrogen peroxide was greater than that of sodium perborate. The bleaching effect of 35% hydrogen peroxide exceeded the perceptibility threshold from the 4th day of the evaluation and increased over time. The highest bleaching effect was noticed on the 12th day.[4]

The use of lower concentration H2O2 minimises the risk of root resorption that exists with walking and power bleaching techniques. Inside/outside bleaching provides a less destructive and cost-effective alternative to veneers and their subsequent replacement. Although increased patient co-operation and commitment is required, results are more rapid and reliable than the walking bleach technique.[10]On average, the desired or maximum bleaching effect for this "walking bleach" technique required 3–4 appointments and 26 days.[9]

Internal bleaching requires a stable and tough temporary restoration to avoid the diffusion of the bleaching agent into the mouth as well as prevent the recontamination of the pulp chamber by bacteria or staining agents.[1] Patricia et al, said that the bleaching agents improved the pH of the external medium at 7 days and the calcium hydroxide could increase the external medium pH and was useful for pH alkalinization after intracoronal bleaching.[2]The remaining peroxide of the bleaching material, especially hydrogen peroxide can affect the strength of composite bonding, so it is advisable to wait several days after bleaching before the composite restoration is performed. The placement of calcium hydroxide in the pulp chamber for several days is useful for buffering acidity caused by bleaching material.[3]

Tooth color affects smile esthetics, which is among the first facial characteristics observed in a social interaction.[9] Dental Prophylaxis or Scaling is generally the term used by dentists for cleaning the teeth. The procedure for Dental Scaling of teeth is now routinely recommended by dentists nowadays as the best way to maintain good dental health and removal of extrinsic stains, which can be done using either sonic or ultrasonic scaler.Obtaining healthy and clean teeth helps in enhancing life. Healthy, clean white teeth increase self-confidence and decrease complain.[7]

IV. Conclusion

Internal bleaching is treatment of choice for non-vital teeth discolorization. The placement of calcium hydroxide in the pulp chamber for several days is useful for buffering acidity caused by bleaching material, and increase bonding strength of dental compositesto treated cavities.

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