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Case Study

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MINOCYCLINE INDUCED DISCOLOURATION OF PERMANENT TEETH AND ITS MANAGEMENT BY WALKING BLEACH TECHNIQUE

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ABSTRACT

Treating tooth discolouration is an important part of cosmetic dentistry. Non-vital anterior teeth discoloration can be quite concerning aesthetically and needs to be treated effectively. Dental discoloration may be extrinsic, intrinsic, or a combination of the two, depending on the cause, degree, location, and appearance. The semi-synthetic, broad-spectrum antibiotic minocycline has been linked to teeth discolorations that are still developing. It is commonly used to treat a variety of common illnesses in both adults and children. Walking bleach involves the use of chemical substances like hydrogen peroxide or sodium perborate which in contact with the tooth release oxidizing agents that diffuse through the enamel and dentin and oxidize the pigments responsible for discoloration. This article aims at presenting a case report on the walking bleach method performed on discoloured endodontically treated teeth associated with superior esthetic outcomes.

KEYWORDS: Tooth discolouration, minocycline, walking bleach, hydrogen peroxide.

INTRODUCTION

Aesthetics and colour of the teeth reflect the health of the system. There are numerous extrinsic and intrinsic factors that might affect the tooth colour.[1] In addition to known local and systemic factors, trauma, loss of vitality, endodontic treatment, restorative procedures and medications containing tetracycline and iodine, as well as intracanal medications, which was seen in this case by triple antibiotic paste can all result in intrinsic tooth discoloration.[2] Minocycline is a broad-spectrum, semi-synthetic antibiotic that may be used in the treatment of many common infections in children and adults. It has been shown to cause pigmentation of a variety of tissues, including skin, thyroid, nails, sclera, teeth, conjunctiva, and bone.[3] In contrast, extrinsic tooth stains can be caused by smoking, using excessive amounts of mouthwash containing chlorhexidine, eating foods high in tannin, brushing poorly, and/or consuming metal salts.

Tooth bleaching, veneering or placement of a full coverage crown are treatment options for the discoloured tooth.[1]

As an alternative to invasive procedures like porcelain veneers, crowns, or other dental work, tooth bleaching provides a conservative and aesthetic solution. Two primary categories of bleaching exists: vital bleaching, which is applied to teeth that are vital, and nonvital bleaching, which is applied to teeth that have undergone root canal therapy.[2]

Bleaching discoloured nonvital teeth that have had endodontic treatment is a crucial step in cosmetic dentistry, particularly in the anterior region where there is a significant aesthetic problem. Bleaching is regarded as an outpatient procedure for teeth whitening that uses high doses of hydrogen peroxide or carbamide peroxide. When these compounds come in contact with the tooth, they release active metabolites that diffuse in the enamel and dentin and oxidize the pigments, which are responsible for discolouration.[2]

Non-vital teeth that are extensively discoloured are highly receptive for bleaching techniques. In order to prevent unfavourable post-operative consequences, it is imperative to properly place the cervical barrier and create an apical seal to stop bleaching agents from

penetrating into the periradicular tissues. If apical seal is not proper, a retreatment should be considered before proceeding ahead with the non-vital bleaching technique.[1]

In 1961, Spasser introduced the use of sodium perborate and water in the pulp chamber of teeth that had undergone root canal therapy to bleach the discoloured nonvital teeth.[4] Nutting and Poe modified this method in 1963. They replaced water by 30% hydrogen peroxide, which is called the "walking" bleach technique.[5] In 1980, Howell reported that acid etching of the dentin internally would "open" the dentinal tubules facilitating better penetration of the bleaching agent.[6] According to a 2017 assessment by Tran et al., the concentration of H_2O_2 quickly peaked in 27 hours and reached the plateau in 75 hours. Low levels of H_2O_2 were also visible after 3 days and for at least 28 days.[7]

The bleaching agent is a 2:1 (g/ml) solution of sodium perborate and water. Sodium perborate comes in white crystalline form and is stable. It contains nearly 95% of perborate which corresponds to 9.9% of the available oxygen. It exists in several forms as sodium perborate monohydrate, sodium perborate trihydrate, and sodium perborate tetrahydrate. In dentistry, hydrogen peroxide is utilized as whitening agents at concentrations ranging from 5% to 35%. It is classified into organic and inorganic. They are potent oxidizers that break down the double bonds of inorganic and organic compounds. Due to its low molecular weight, it can readily penetrate the dentin and release O2 inside the tubules.[2,8]

Walking bleach technique is a bleaching method by placing the active ingredient in the pulp chamber, followed by closing the tooth cavities. The etiology of the discolouration will determine the results, and bleaching can be applied two or four times for an acceptable outcome.[9]

The purpose of this case report is to illustrate the effectiveness of non-vital bleaching on a discoloured tooth following endodontic treatment, which was carried out using walking bleach technique which had a favourable prognosis and no adverse effects.

CASE REPORT

A 13-year-old male patient reported to the department of paediatric dentistry with the chief complaint of broken teeth in the upper front region since 2 years.

Patient had a history of trauma 2 years back. On general examination, patient had no significant dental and medical history. Extra oral examination showed symmetrical face, no abnormalities of the lips, the left and right mandibular salivary glands were unaffected and painless. Intra-oral examination showed that crown of teeth 11 and 21 were broken from the incisal edge (Figure 1). Hygiene of the oral cavity was good. Tenderness to percussion was negative. Electric pulp testing was done irt 11,12, 21, and 22 which confirmed that #21 was non-vital.

Figure 1: Intraoral photograph.

Radiographic examination was done which revealed no periradicular changes with the concerned teeth (Figure 2).

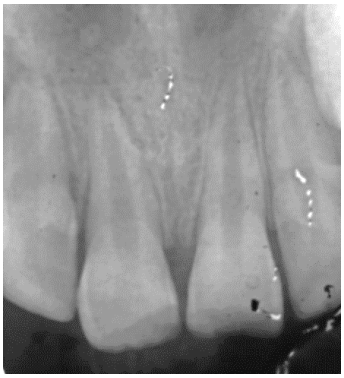

Figure 2: Preoperative Radiograph.

Based on clinical and radiographic findings, a provisional diagnosis of Ellis class IV fracture was made wrt 21.

Patient was explained about the root canal therapy for the tooth. Access cavity preparation was done, working length was determined (Figure 3), apical preparation till #40 k file was done in the first visit along with proper irrigation with sodium hypochlorite and normal saline.

Figure 3: Working Length Determination.

An intracanal medicament Triple Antibiotic Paste (metronidazole, ciprofloxacin, and minocycline, in a definite proportion of 1:1:1 to produce effective results) was place inside the canal and the cavity was temporarily restored with Cavit. After two weeks, during the second visit, patient returned with a discolouration of the tooth

21 (Figure 4). The tooth colour was matched using Vitapan classical shade guide which was found to be C3 with some patches of discolouration on 21.

Figure 4: Discolouration of crown 21 after the first visit.

Biomechanical preparation was completed in the second visit. Then, Calcium hydroxide paste was placed inside the canal as an intracanal medicament. In the third visit, complete obtuaration was done (Figure 5).

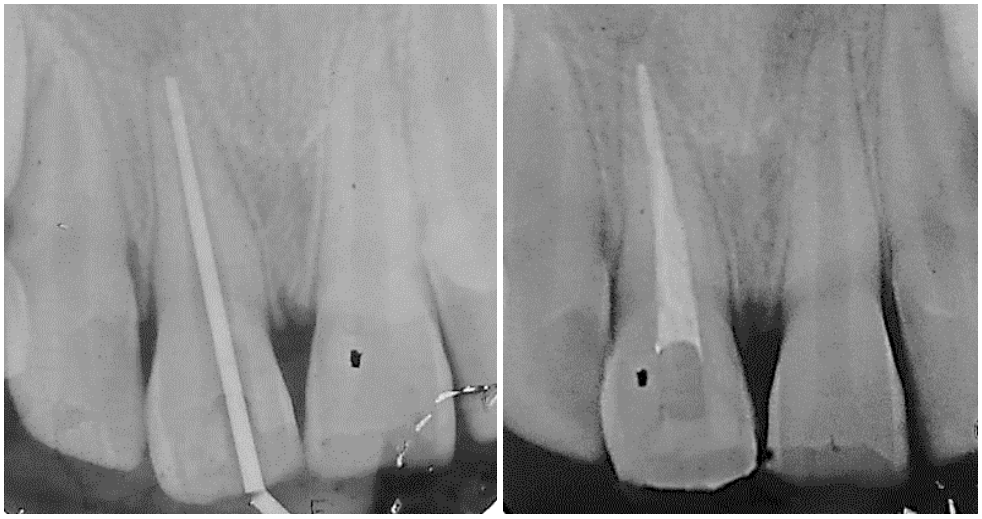

Figure 5: Master cone radiograph and Obturation done.

Now, for treating the discolouration, patient was explained about the intracoronal bleaching and informed consent was taken. The preparation in the pulp chamber for bleaching was done by removing 2 mm of gutta-percha near orifice (Figure 6) and 1 to 2 mm glass ionomer cement (GIC) was placed over it to create a mechanical barrier in the root canal at the level of cemento- enamel junction (Figure 7).

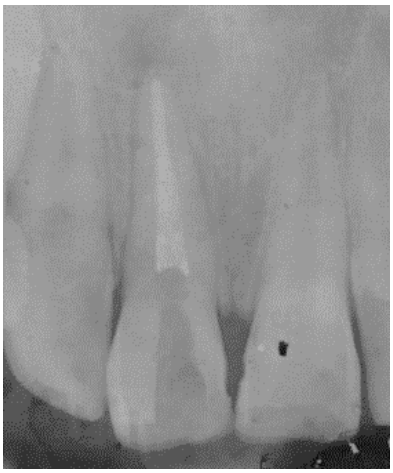

Figure 6: 2mm Gutta Percha removed

Figure 7: 2mm GIC placed at the level of CEJ

Then the pulp chamber was etched with 30% phosphoric acid for 30 sec. and dried. Then Sodium tetrahydrate perborate and 30% Hydrogen peroxide were mixed in relation 2 g to 1 ml in a creamy paste consistency. Using the amalgam carrier, the material was applied in the pulp chamber and then covered with cotton pellets. The tooth

was coronally sealed with the temporary cement. The same procedure was repeated weekly in three-time intervals. After 1st week and 2nd week, there was change in shade (Figure 8). After the 3rd week, the desired result was achieved with the change in shade from C3 to A3 (Figure 9) and the tooth was permanently restored with composite (Figure 10).

Figure 8: Follow up after 1st and 2nd week.

Figure 9: Follow up after 3 weeks.

Figure 10: Post operative photograph.

DISCUSSION

The causes of tooth discolouration are numerous and intricate, but they are generally classified into three categories: intrinsic, extrinsic, and internalized. Intrinsic discoloration occurs due to entrapment of chromogenic content within enamel or dentin, either during tooth formation or after eruption, whereas extrinsic discolorations occurs on the surface.[10] Internalized stains result from external stains getting into the dentine through surface cracks in the teeth.[3]

The most common causes for intrinsic tooth discoloration are intrapulpal hemorrhage, pulp necrosis, obturation materials and sealers, and metallic restorations placed in the coronal access such as AH 26, endomethasone, iodoform cement, and medications containing tetracycline and iodine, as well as intracanal medications, which was seen in this case by triple antibiotic paste.[2,11] Frequently, discoloration can also be caused by metal ions that are liberated from amalgam and silver points.[2,12]

Blood components such as hematoidin, hematoporphyrin, hemin, hemosiderin, and others release iron ions during their breakdown. These iron ions combine with hydrogen sulfite to form iron sulfide, which is black in appearance and causes discoloration of the crown. Additionally, the protein degradation of necrotic pulp results in crown discolouration. During the proteolytic process, amino acid molecules are released, which leads to more degradation and the invasion of new microorganisms.[1,2]

The triple-antibiotic paste is the most widely prescribed medication and is known for its potent disinfectant properties. Nevertheless, the main drawback of using it is the discolouration of the crown brought on by minocycline. As a result, care was taken in this case to maintain the paste one millimeter below the tooth's CEJ. Despite the precautionary measure, there was blue-grayish discoloration of the crown after 2 weeks during the second visit.

Therefore, to reduce the discoloration, it is advised to apply a bonding agent to the pulp chamber walls before applying the triple antibiotic paste. However, it has been shown that it can only reduce the change in darkness of the teeth but cannot prevent it.[13]

Here are three possible ways by which minocycline can stain: the first is the intrinsic theory, which is based on the fact that the high concentration of minocycline excreted in the gingival fluid causes it to etch into the enamel where it becomes oxidized (i.e., turns black in color) due to exposure to oxygen or bacterial activity. The second is the extrinsic theory, which is based on the fact that the minocycline molecule becomes highly protein bound upon absorption and then preferentially binds to higher collagen-containing tissue (tooth and bone) resulting in discolouration. Third, an insoluble compound is formed inside the teeth by the chelation of haemosiderin, a breakdown product of minocycline, with iron ions. The onset of staining can vary from one month to many years after the start of therapy. The unique incidence of "black bones," "black or green roots," and a blue-gray to gray colour darkening the crowns of permanent teeth are specific to minocycline. The prevalence of minocycline staining has been reported to be 3–6 per cent.[3]

Developing a suitable treatment strategy and making an accurate diagnosis require a comprehensive and definitive understanding of the etiology of tooth discolouration.

Numerous options are available for the treatment of discoloured endodontically treated anterior teeth: full

veneers, laminates, crowns, and non-invasive procedure such as bleaching.

The use of lime chloride for the whitening of discoloured non-vital teeth was first documented in the mid 19th century. Prior to the discovery of H_2O_2's bleaching properties in 1884, a number of bleaching agents, including oxalic acid and aluminum chloride, had been identified.[10]

The advancement of cosmetic dentistry has led to the creation of numerous bleaching techniques that are effectively used in the treatment of single tooth discoloration.

Walking bleach technique is one of the method which was first reported by Spasser. This method uses sodium perborate (SP) mixed with distilled water.[1] Sodium perborate serves as an oxidizing agent containing 95% perborate that exists in the form of mono, tri ($NaBO_2$ • H_2O_2 • $3H_2O$) or tetra hydrate. H_2O_2 is released when sodium perborate and water are mixed. Later Nutting and Poe modified this method by replacing H_2O with 30% H_2O_2 to improve the effect.[10]

The use of a bleaching agent with a high concentration of H_2O_2 when combined with heating tends to encourage resorption of the cervical root.[14] An inflammatory response is triggered by the bleaching agent leaking via dentinal tubules. Within the pulp chamber, sodium perborate produces active oxygen radicals, which diffuses into the dentinal tubules. Iron sulfide and other pigments found in the dentinal tubules get bleached and oxidized when get exposed to oxygen. Free radicals also cause oxidative effects on lipids, proteins, and nucleic acids.[15]

When doing nonvital tooth bleaching, resorption of the cervical root is a serious concern.[10] According to a study by Lado et al, he concluded that internal bleaching procedure can lead to denaturation of dentin in the cervical region and this denatured dentin induces a foreign body reaction.[16] Research has indicated that there is minimal chance of cervical resorption when using a mixture of sodium perborate and water. Glass ionomer cement was used as a sealant barrier to prevent leaching of a bleaching agent.[17] In addition, this also prevents the hydrogen peroxide from diffusing into the extra-radicular environment. The amount of hydrogen peroxide diffusion is substantially lower when sodium perborate-tetrahydrate and water are used together as compared to 30% hydrogen peroxide combined with different sodium perborates.[10]

The chemical molecule carbamide peroxide ($CH_4N_2O{\cdot}H_2O_2$) is made up of urea products and H_2O_2. 10% carbamide peroxide releases 3.5% hydrogen on decomposition.[18] Additional proof comes from in vitro research, indicating that 10% carbamide peroxide, 3% and 30% of H_2O_2, and SP in water are all effective agents for internally bleaching nonvital teeth.[10,19] A study on the effect of different concentration of carbamide peroxide was done by Yui in 2008 where he concluded that sodium perborate associated with both 10% and 35% carbamide peroxide was more effective than when associated with distilled water.[20]

Bleaching of a tooth provides a conservative and esthetic solution rather than an intrusive restorative option. Follow-up is essential for external cervical resorption and possible discoloration from the bleaching procedure, so clinical and radiological examinations should be performed to confirm the condition through periodic follow-ups.[16]

In this case report, the walking bleach method was performed by applying a creamy paste of sodium perborate mixed with 30%H_2O_2 in the pulp chamber and the patient was recalled periodically for evaluation. The whole procedure was repeated till the desired result was obtained.

CONCLUSION

The present case report demonstrates the effectiveness of the nonvital bleaching approach, which achieves successful and reliable cosmetic outcomes by combining sodium perborate with 30% H_2O_2. At follow-up, neither cervical root resorption nor discolouration showed any indications of a recurrence. Henceforth, it can be summarized that walking bleach method can be considered as a potential treatment of choice for discoloured nonvital endodontically treated teeth.

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