Prolonged Effects of Dental Trauma Managed by Conservative Means and Their Medico-legal Implications: A Case Report

Palipana PD[1*], Adikari AAAS[2]

[1]Department of Restorative Dentistry, Faculty of Dental Sciences, University of Sri Jayewardenepura, Sri Lanka
[2]Postgraduate Institute of Medicine, Colombo, Sri Lanka

Abstract
Dental injuries are frequently associated with multiple complications. An array of problems may present at different times, from immediate to ones that appear after decades. Careful assessment is mandatory to predict the possible complications, determine the damage, possible rehabilitation options, cost to be incurred, and the medico-legal implications. The case described here is trauma to multiple teeth which have presented with late complications. It describes the importance of regular review, conservative management options, and the medico-legal aspects. This also describes how the clinician can contribute to preventing the transformation of an injury to the grievous category.

Keywords: Dental Injuries, bleaching, discoloration of teeth

Received: 03 June 2022, **Revised version accepted:** 26 Nov 2022, **Published**: 31 Dec 2022. ***Corresponding author:**
Palipana PD, Email: priyakepalipana@sjp.ac.lk https://orcid.org/0000-0002-5077-312X

Cite this article as: Palipana PD, Adikari AAAS. Prolonged Effects of Dental Trauma Managed by Conservative Means and Their Medico-legal Implications: A Case Report. Medico-Legal Journal of Sri Lanka, 2022;10(2):36-41. DOI: http://dx.doi.org/10.4038/mljsl.v10i2.7471

Introduction

Physical appearance is closely affiliated with self-esteem. Dental aesthetics deal with the dentition's color, form, symmetry, lines, unity, and harmony. Out of them, the alteration of tooth shade is the most perceived cosmetic problem.

The natural color of teeth is primarily determined by dentine and is influenced by the properties of enamel.[1] Dental trauma is a common cause of intrinsic discoloration, pulpal hemorrhagic products being the principal chromogen. Associated with acute trauma microscopic bleeding takes place in the dental pulp. The cells that escape the vessels are broken-down products of the haemolysed cells spreading along the dentinal tubules. Calcific degeneration of the pulp occurring as a pulpal reaction to dental trauma can also cause yellow-brown discoloration of the tooth.[2]

treatment outcome for discolored teeth depends on accurate diagnosis and selection of the appropriate treatment modality.

Pulpal complications are common following dentoalveolar trauma. In the absence of pain, disturbed aesthetics sometimes be the sole motivation to seek treatment. Therefore, careful assessment of the tooth concerned is essential in deciding the most appropriate management strategy.

The discoloration of teeth after trauma converts the category of the injury from non-grievous to grievous hurt under the 'limb f' (Disfiguration) of Section 311 of the Penal Code of Sri Lanka.[3] The following case describes the prevention of discolouration and management of discolored upper anterior teeth and other pulpal complications years after a traumatic dental injury.

Case report

A 52-year-old male presented to Restorative Unit B, Institute of Oral Health, Maharagama, requesting aesthetic improvement of discolored upper front teeth. He revealed a traumatic history following a road traffic accident around 25 years ago. He was originally treated at the Dental Institute, Colombo. He was followed up for one year and the Root Canal Treatment (RCT) of the affected teeth was initiated. Thereafter he has lost interest and not turned up for treatment. He has never experienced significant pain but recalled several episodes of pus discharge in relation to the affected teeth.

Past medical history was insignificant. On examination, the patient was generally healthy without any signs of systemic diseases. Many teeth in the upper arch were missing (Figure 1). Both upper central incisors (11 and 21) and right lateral incisors (12) were significantly discoloured, and the

shade was recorded to be darker than shade C4 in VITA classical A1 – D4 Shade Guide ® (Figure 5). The root canals of those teeth were prepared with root canal access cavities (Figure 1). 11 and 21, were tender to percussion.

Figure 01. Pre-operative intra-oral view of the upper arch showing previously prepared access cavities

Radiological investigations revealed peri-apical radiolucencies in relation to 12, 11, and 21 (Figure 2) A sensibility test was performed with an electric pulp tester, and teeth other than 11, 21, and 12 gave a positive response.

Figure 02. Pre-operative periapical view of 12, 11, and 21 shows a large peri-apical lesion in tooth number 11 (White arrow)

Following clinic and radiographic assessment, the patient was diagnosed to have discolored 11, 12, and 21 with periapical periodontitis, incomplete root canal treatment in them, and crown fracture in 12.

With the patient's participation, a comprehensive plan was drawn starting with preventive measures to complete remedying of the discoloured teeth. 12, 11 and 21 teeth were planned for completion of root canal treatment. As the final part of the treatment, it was decided to adopt the least invasive bleaching procedure for the discoloured teeth and build up the broken tooth (12).

Root canal treatments of 12, 11, and 21 were re-initiated. The access cavities were modified and cleaning and shaping of the already negotiated root canals were done. Permanent root filling was done in all 3 teeth. Radiographs were taken post-operatively (Figure 3).

Figure 03. Post-operative view of 12, 11, and 21 shows successful root canal treatment of all 3 teeth.

After a week bleaching of the discoloured teeth was started with a custom-made bleaching tray. Inside-outside bleaching procedure was performed using 10% Carbamide peroxide gel (Opalescence® 10% - Ultradent) was used for bleaching (Figure 4).

Figure 04. Bleaching material and the tray, the tray was constructed in the laboratory for the patient to wear it using the bleaching gel in the tube.

The patient was demonstrated and educated in doing the bleaching procedure. He was advised to wear it overnight but not during meals. He was recalled in 5 days to find a complete change of shade to match the remaining dentition (Figure 6). He was highly satisfied with the improved aesthetics of the incisors.

Figure 05. Pre-operative shade of the discoloured incisors

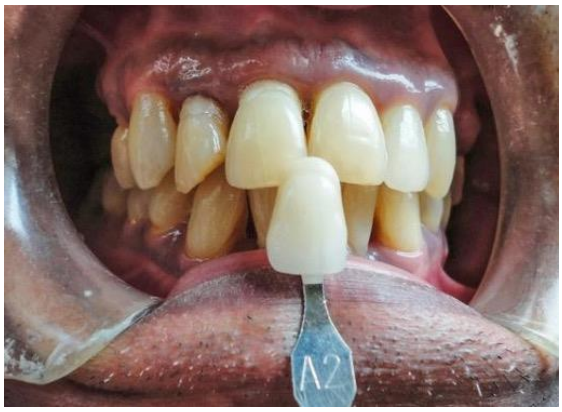

Figure 6. The shade of the incisors after bleaching, notes that there is no colour difference in tooth number 21 with the rest of the tooth.

Discussion

Teeth that have suffered dental trauma can present a spectrum of reactions, which range from no lasting effects to teeth that ultimately are not restorable. Common complications include pulp necrosis, inflammatory root resorption, replacement root resorption, and pulp canal obliteration. These may appear shortly after the trauma or even after years.[4] Guidelines have been set up by the International Association of Dental Traumatology (IADT).[5] Early diagnosis, timely treatment, long-term follow-up and proper monitoring lead to better control of post-traumatic complications and increased chances of conservation.

Dental trauma can be considered one of the common causes of tooth discoloration.[6] Necrosis of the pulpal tissue and its by-products penetrates the dentinal tubules and causes discoloration. The degree of discoloration is directly related to the duration that the pulp has been necrotic [6]. Initially, blood components flow into the dentinal tubules causing pink discoloration. Following hemolysis of the red blood cells, they release Haem which combines with putrefying pulpal tissue to form black iron sulfide which can cause grey discoloration.[2] Sometimes, dentine hyper-calcification may result following trauma. It can lead to yellow-brown discoloration despite being vital.[1] If a tooth gets discoloured following trauma, that will fall into the category of grievous injury under disfiguration (Limb f) of section 311 of the penal code.[3] Thus it is very important in clinical practice to monitor the injuries that may cause discolouration of teeth from a medico-legal point of view. Usually, teeth that give a negative response to sensibility testing are more liable to be discolored. Therefore, it is compulsory to stick to the recommended review protocols and have close monitoring with regard to this.

Other causes of intrinsic tooth discoloration should be excluded before a definitive diagnosis. They include developmental causes such as amelogenesis imperfecta and dentinogenesis imperfecta, iatrogenic causes such as tetracycline staining and endodontic materials, metabolic causes, aging, and root resorption.

Other than the above described, teeth can also get discolored due to staining of the external surface of the tooth, which refers to as extrinsic discoloration. The main causes are dietary sources such as tea and coffee, tobacco, medicines, mouth rinses, and the action of chromogenic bacteria. When the external stains are taken up to acquired defects such as dentinal caries, wear defects, and around restorative materials such as amalgam, it is called internalized discoloration.

As for any disease condition, the first step in the management of a discolored tooth should involve proper history, comprehensive clinical assessment along with investigations leading to accurate diagnosis and the identification of causative factors. A variety of treatment modalities are available. However, factors such as type/ etiology of discoloration, pulpal status of the affected teeth, age of the patient and patient's aesthetic expectations may govern the selection of the most appropriate treatment modality.

The traumatic injury may cause complete severance of the apical neurovascular bundle, which causes sterile necrosis of the pulp. The necrosed pulp gets infected leading to peri-apical periodontitis if unattended.[8] Discoloration of the tooth crown, tenderness to percussion and palpation over the apex, presence of a sinus tract along with peri-apical radiolucency, inflammatory root resorption, and absent response to pulp sensibility test are all indicative of pulpal necrosis. However, sound endodontic health is an important pre-requisite before aesthetic restorative treatment. Therefore, endodontic therapy is inevitable in managing discolored teeth with necrotic pulps. In our patients, 12, 11, and 21 were discolored with pulpal necrosis. Thus, proper endodontic treatment of the same teeth was planned before embarking upon any aesthetic

procedures. When the pulp is irreversibly damaged, the ultimate biological aim of endodontic therapy is either to prevent or cure apical periodontitis.[9]

In our patient, already prepared access cavities on 12, 11, and 21 had to be modified and all the tissue remnants removed before undertaking further treatment. The basic objectives of mechanical preparation of the root canal system are to facilitate irrigation and obturation of the canal system.[10] Studies have found that up to 53% of the canal wall remains unreached by the instruments following preparation.[11] Therefore solutions used to clean the root canals (irrigants) play a crucial role in destroying micro-organisms, neutralizing endotoxins, and removing organic tissue components.[12] Sodium hypochlorite is considered to be the gold standard of endodontic irrigants.[13] It is a broad-spectrum antimicrobial, fast acting, inexpensive, and capable of dissolving organic debris.[11]

Although the biological aim of endodontic treatment of necrotic teeth is to eliminate bacteria within the root canals, studies have demonstrated the persistence of bacteria in root canals after shaping and cleaning.[13] Performing RCT upon multiple visits with the use of inter-appointment dressings such as calcium hydroxide has been suggested to be an important step in chemo-mechanical root canal disinfection, in an attempt to eradicate residual bacteria.[14] Calcium hydroxide is considered to be the material of choice for dressing root canals. In this patient, all infected root canals were dressed with calcium hydroxide for a period of 1 month before GP obturation.

One of the objectives of RCT is to achieve a hermetic apical, coronal as well as a lateral seal to prevent re-infection. Gutta-percha is the most commonly used material for obturation. In the patient described, GP obturation of all the root canal-treated teeth was performed with cold lateral compaction.

Although 12 was fractured, the tooth retained more than 50% of the remaining natural tooth structure facilitating adequate retention of a direct adhesive filling/ restoration. However, the tooth was severely discolored before treatment. Therefore, the coronal restoration for 12 was postponed until the bleaching was completed.

Having considered the principal goal of any restorative treatment is, the preservation of the remaining tooth structure. It is important to adapt minimally invasive techniques and move to complex, invasive strategies only when the conservative means are deemed ineffective.

Non-vital bleaching is a conservative and minimally invasive technique available to treat discolored teeth. As opposed to direct and indirect veneers or full coverage crowns, this technique has the least or no damage to the tooth structure. Such alternative techniques are particularly indicated for teeth that are heavily restored, including with the use of endodontic posts.[15] However, the possibility of the ability to correct the discolouration of an already discoloured tooth does not prevent the hurt category from becoming grievous. Yet, it is important to adopt strategies in correcting discoloured teeth as the expenses can be regained as compensation through a District court.

The most commonly used bleaching materials are hydrogen peroxide, carbamide peroxide, and sodium perborate.[2] They contain hydrogen peroxide as the active ingredient and are strong oxidizing agents. Because of the low molecular weight, this substance penetrates dentin and releases oxygen that breaks the double bonds of the chromogenic organic and inorganic compounds, changing their appearance.[16] Hydrogen peroxide is used in different concentrations from 5%–35% as a bleaching agent.

Different techniques of non-vital bleaching are described in the literature. They include walking bleaching, inside-outside bleaching, in-office bleaching, photocatalytic bleaching, and power bleaching [5]. Each technique utilizes different bleaching materials with various concentrations, alone or in combination for various time intervals to achieve the desired outcome.

Settembrini in 1997 described a more predictable method of bleaching using 10-15% carbamide peroxide gel.[17] The method is called inside/outside bleaching where the endodontically treated tooth is bleached both internally and externally using a custom-made bleaching tray. This way, a greater surface area of the tooth can be bleached at a time. Careful patient selection, patient preparation, correct tray design, appropriate protocol, and patient instructions determine the successful outcome.

The root-filled tooth should be asymptomatic and satisfactorily obturated with no periapical pathology.[18] The pre-operative shade of the tooth should be recorded, and patent compliance should be ensured. In the case described, the patient presented with discolored 12, 11, and 21 with signs of periapical pathology. Bleaching was considered after 5 weeks following root canal treatment after settling the periapical infection. The patient was asymptomatic, and the bleaching was assumed.

The design of the tray is important to optimize treatment outcomes. Reservoirs allow a greater amount of bleaching material to contact the tooth surfaces, particularly with viscous bleaching materials and bulbous teeth.[6]

It is found that half the active ingredient of the gel is dissipated during the first 2 hours. Therefore, the patient should be ideally advised to refresh the gel at two hourly intervals during the day and to wear the bleaching tray overnight. Following each bleaching session, the patient is advised to irrigate the cavity with water in a syringe and place a cotton pellet to occlude the access cavity. This method is advantageous over the others in that it utilizes both internal and external bleaching leading to rapid results compared to other techniques.[6] Additionally, using a lower concentration of bleaching material lowers the risk of external resorption and there have been no reported cases of cervical root resorption associated with the inside/outside technique.[15] The main disadvantage of the technique is the compulsion of patient compliance and adequate manual dexterity. In our patient, 11, 12, and 21 were bleached using the above technique and remarkable improvement of shade of all the teeth could be observed within 5 days of bleaching. The treatment was the least invasive and cost-effective.

Therefore, considering the invasive nature of such restorations, 12 in the described patient which satisfactorily responded to bleaching was restored with a direct composite resin restoration of appropriate shade.

Medico-legal aspects

Dental injuries have a lot of Medico-legal implications.[19,20] It is obligatory to identify the type of trauma and time of presentation as they lead to various consequences both immediate and long-term.[19] When a tooth is discoloured after several years of dental trauma initiates a lot of medico-legal issues. Victims can claim for disfiguration under the 'limb f ' of section 311 of the penal code. However, when discolouring the teeth after 25 years of the trauma incident, the establishment of the cause-effect relationship between the trauma and the discolouration after 25 years is important.

Aesthetic effects have a huge impact on a patient's social and psychological well-being. However, the possibility of the ability to correct the discolouration of an already discoloured tooth does not prevent the hurt category from becoming grievous. Yet, it is important to adopt strategies in correcting discoloured teeth as the expenses can be regained as compensation through a District court.

The impact of trauma has to be identified at the time of the initial presentation. Usually, teeth that give a negative response to sensibility testing are more liable to be discolored. Therefore, it is compulsory to stick to the recommended review protocols and have close monitoring with regard to this.

The expenses spent for the correction of possible complications including discolouration should always be considered in determining the compensation.[21]

Conclusion

Dental trauma leads to lifelong effects on the individual. Tooth discoloration has a profound negative impact on social and psychological well-being and medico-legal aspects. Meticulous case selection, thorough analysis, and treatment planning are essential in the successful management of discoloration. Good quality endodontic treatment is an essential prerequisite if the discolored teeth are non-vital.

Assessing the medico-legal impact should be carefully done at the time of presentation as the consequences may even happen after decades of the initial trauma. Identification and adopting the minimally invasive techniques and advancing up the hierarchical order only upon failure of the more conservative therapies led to a conservative, but successful aesthetic and functional rehabilitation of the patient described.

From a medico-legal point of view, it is very important to make all possible measures in preventing discolouration of traumatized teeth as it may fall into the category of grievous injury.

Recommendation

Dento-alveolar trauma can cause a series of complications for the individual. Early intervention is always helpful in minimizing complications. It is the prime role of the clinician in taking steps to prevent an injury from turning into the grievous category as they lead to facial disfigurement.

Disclosure statement

Conflicts of interest: The author declares that she has no conflicts of interest.

Funding: None

References

1. Sulieman M. An overview of tooth discoloration: Extrinsic, intrinsic and internalized stains. Dent update. 2005;32(8):463-71
2. Plotino G, Buono L, Grande NM, Pameijer CH, Somma F. Nonvital tooth bleaching: A review of the literature and clinical procedures. J Endod. 2008;34(4):394-407
3. Penal code of Sri Lanka

4. Andreasen JO, Andreasen FM, Andersson L, eds. Textbook and Color Atlas of Traumatic Injuries to the Teeth, 4th Ed. Oxford: Blackwell, 2007
5. Andersson L, Andreasen JO, Day P, Heithersay G, Trope M, Diangelis AJ. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dent Traumatol. 2012;28(2):88–96
6. Sulieman M. An Overview of Bleaching techniques: 2 Nightguard vital bleaching and non-vital bleaching. Dent Update 2005; 32(1): 39-46
7. Barber A, King P. Management of the single discolored tooth. Part 1: Aetiology, prevention, and minimally invasive restorative options. Dent Update. 2014;41(2):98-110.
8. "Dental Trauma Guide". Dentaltraumaguide.org. N.p., 2016. Web. [Cited on 12 Oct. 2016]. Available from: http://www.iadt-dentaltrauma.org
9. Ørstavik D, Pitt Ford TR, editors: Essential endodontology: prevention and treatment of apical periodontitis. Oxford: Blackwell Science; 1998.
10. Darcey J, Taylor C, Roudsari RV, Jawad S, Hunter M. Modern Endodontic Principles Part 3: Preparation. Dent Update. 2015 Nov; 42(9): 810-22
11. Peters OA, Laib A, Gohring TN. Changes in root canal geometry after preparation assessed by high-resolution computed tomography. J Endod 2001;27(1):1−6.
12. Hubscher W, Barbakow F, Peters O. Root canal preparation with FlexMaster: canal shapes analyzed by micro-computed tomography. Int Endod J 2003;36(11):740-7
13. Sjögren U, Figdor D, Persson S et al.Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. Int Endod J 1997;30(5): 297−306
14. Ørstavik D, Kerekes K, Molven O. Effects of extensive apical reaming and calcium hydroxide dressing on bacterial infection during treatment of apical periodontitis: a pilot study. Int Endod J 1991;24(1):1−7.
15. Barber AJ, King PA. Management of the single discolored tooth. Part 2: Restorative options. Dent Update. 2014 Apr; 41(3):194-6, 198-200, 202-4.
16. Seghi RR, Denry I. Effect of external bleaching on indentation and abrasion characteristics of human enamel in vitro. J Dent Res 1992;71(6):1340–4.
17. Settembrini L, Gultz J, Kaim J, Scherer W. A technique for bleaching nonvital teeth: inside/outside bleaching. J Am Dent Assoc 1997; 128(9):1283-4.
18. Poyser NJ, Kelleher MG, Briggs PF. Managing discolored non-vital teeth: the inside/outside bleaching technique. Dent Update. 2004 May;31(4):204-10, 213-4.
19. Chanana A, Chanana S, Kalra S Dental traumatology-medicolegal aspects; I.J.S.N, 2014;5(1):177-82.
20. Kaushal A, Goel M, Chaudhary P. Medicolegal aspect of Traumatic Tooth injuries; I.J.S.R, 2020;9(7):44-5
21. Rovida, TAS, Dias, IA, Garbin, CAS, Garbin, AJI. Evaluation of injury cases for dental intervention described in legal dentistry reports. Int. J. Odontostomat.2015;9(3):533-9