International Journal of Contemporary Dental Research (IJCDR)
Vol. 01, Issue. 1, Jan 2023, pp. 6~13
ISSN –2584-0274 DOI: https//doi.org/10.62175/apdch2302

Current Status and Future Prospects In Managing Discoloured Teeth – A Review And Case Report

Jayanthi Govindarajan[1], SujithRajmohan[2], Poorani Durai[3], Bharath Naga Reddy[4], Sowmiya Tamil[5], Ohm Nijandhan Kumar[6]
[1]Senior Lecturer, Vivekanandha Dental College For Women, Elayampalyam, Tamil Nadu, India
[2,3,5,6] Senior Lecturer, Adhiparasakthi Dental College And Hospital, Melmaruvathur, Tamil Nadu, India
[4]Professor, Adhiparasakthi Dental College And Hospital, Melmaruvathur, Tamil Nadu, India

Article Info

Article history:

Received:11/15/2022
Revised: 12/19/2022
Accepted: 01/10/2023

Keywords:

Tooth discolouration
Non-vital bleaching
External cervical root resorption

ABSTRACT

Tooth discoloration involves a wide range of treatment protocols for clinicians and patients in order to achieve an aesthetic result. Management of tooth discoloration may be interdisciplinary and involves both vital and nonvital teeth. Prosthodontic treatments are more invasive and involve loss of tooth structure as well as a life cycle of further treatment in the future.Vital teeth can be easily treated with low-concentration hydrogen peroxide products safely and effectively using an external approach and trays. For endodontically treated teeth, the walking bleach technique with hydrogen-releasing peroxide products is widespread. However, there is an association between external cervical root resorption with higher concentrations of hydrogen peroxide of 30%–35%. In this article, a brief reviewof managing tooth discoloration and a case report of nonvital bleaching will be discussed.

1. INTRODUCTION

Discolored teeth are known to impact the patient'squality-of-life.Various materials and techniques have evolved to restore the normal color of the tooth, amongst which bleaching is one of the most effective and conservative procedures (TABLE 1). The aetiology of the discoloration along with the underlying infection should be considered as there are different approaches for vital teeth when compared to endodontically treated teeth. It can involve either external or internal approaches to the tooth. While this review will consider the topic broadly, the focus will primarily be concerned with endodontically treated teeth as trauma is a major etiology of tooth discoloration [1].Tooth discoloration can be caused by intrinsic (staining) or extrinsic factors due to endodontic procedures and the materials used in root-filling the tooth (TABLE 2). Therefore,careful application of endodontic materials is needed when there are aesthetic considerations [2,3].

Table 1. History of bleaching

YEAR	NAME	MATERIALS USED
1860	Truman	Chloride and acetic acid for non vital teeth
1884	Harlan	Hydrogen peroxide for bleaching pulpless teeth
1918	Abbott	Superoxol (30% hydrogen peroxide) in combination with electric light rays
1924	Prinz	Heated solutions of sodium perborate and Superoxol in the pulp space
1961	Spasser	Walking bleach technique was developed using sodium perborate and water placed into the pulp chamber which was sealed into the root canal space
1963	Nutting and Poe	Improved the whitening efficacy by replacing the water with 30%–35% hydrogen peroxide.
1991	Haywood	Orthodontist observed whiter teeth when 10% carbamide peroxide was used in a tray for the treatment of gingivitis

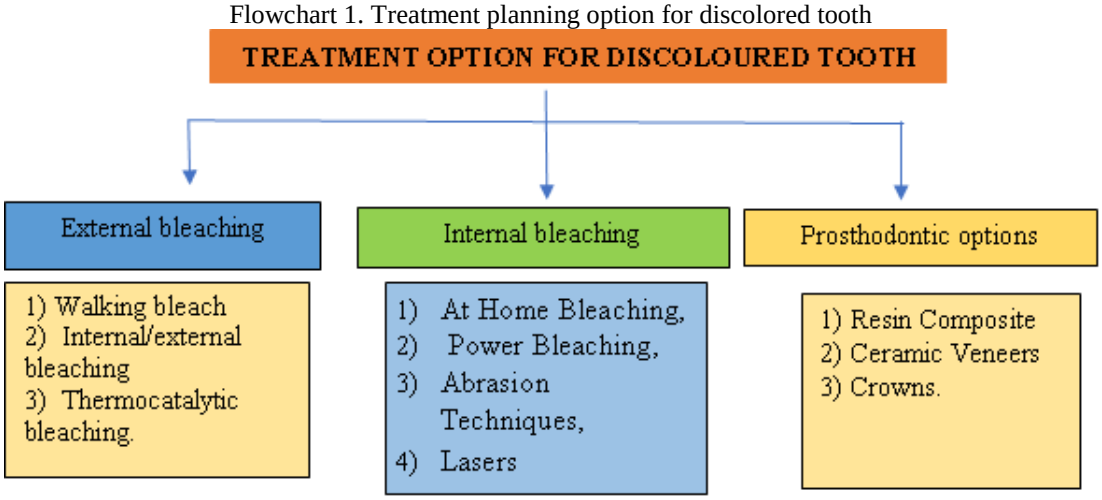
Table 2. Aetiology of tooth discolouration

Intrinsic cause	Extrinsic cause
Systemic causes a) Drug-related, e.g. tetracycline, minocycline used in RET b) Metabolic, e.g. congenital erythropoietic porphyria, cystic fibrosis of the pancreas, hyperbilirubinemia, thalassemia, amelogenesisimperfecta, dentinogenesisimperfecta Local causes a) Pulp necrosis, e.g. trauma Intrapulpalhemorrhage b) Calcification of the canal following trauma c) Remaining pulp tissue remnants following the endodontic treatment d) Root canal irrigants e) Root canal sealers f) Repair materials and secondary effects involving interactions with NaOCl and/or blood. g) Endodontic materials such as amalgam, coronal leakage or MTA (Mineral Trioxide Aggregate) and triple or double antibiotic pastes used in REPs (Regenerative Endodontic Protocols) h) Coronal filling materials including temporary restorations, e.g. IRM i) Root resorption j) Aging k) Fluorosis l) Caries Resorptions. Invasive cervical – pinkish colour	Dietary: Wine, coffee, tea, carrots, oranges, liquorice, chocolate, betel nut Tobacco Mouth rinses, e.g. Chlorhexidine Plaque, e.g. Chromogenic bacteria

Treatment planning options:

The discolored tooth/teeth can be a great challenge to obtain pleasing aesthetic outcomes affecting the 'smile zone'. The vitality of the pulp, prior endodontic treatment, and signs, and symptoms of infection will determine whether external or internal bleaching is advised. The color of the root, the thickness of the gingiva, and the tooth form are also important determinants of treatment choice presented in [FLOWCHART 1]. Periodontal considerations such as root color, tooth shape, and form should be considered in the treatment planning.

Flowchart 1. Treatment planning option for discolored tooth



2. EXTERNAL BLEACHING – AT HOME EXTERNAL BLEACHING, POWER BLEACHING, ABRASION TECHNIQUES, LASERS:

Vital tooth bleaching is a technically easy and low-cost method to improve tooth color. Nightguard vital bleaching is a safe procedure with satisfactory retention of shade with only mild and transient side effects which will disappear within a few days of treatment completion [4]. There are increasing demands from patients to improve the color of natural teeth [5]. Whitening toothpasteis also popular[6].

There are three approaches generally used that include

- In-office and professionally administered
- At home and professionally administered
- Commercially available and self-administered procedures that use products based on hydrogen peroxide or carbamide peroxide [7].

The in-office approach allows for professional application to avoid soft-tissue damage and potentially provide more rapid aesthetic outcomes [8]. Power bleaching approaches activate the catalytic decomposition of the peroxide products by heat or light to enhance the release of oxygen-based free radicals [9]. Light activation sources have included light-emitting diodes, plasma arc lamps, halogen lamps, and lasers [10]. The use of trays and peroxide bleaching is safe to enamel surfaces [11]. In a recent review, new whitening products and technologies including nano-additives and different carrier systems may maximize the bleaching process and minimize structural enamel damage [12].Micro-abrasion uses peroxide products for shallow intrinsic stains and superficial irregularities in the enamel [13].

3. INTERNAL BLEACHING – WALKING BLEACH, INTERNAL/ EXTERNAL BLEACHING, THERMOCATALYTIC BLEACHING

Bleaching agents for whitening of root-filled teeth:

Bleaching agentsutilize hydrogen peroxide as the active agent in an oxidative process that degrades larger discolored compounds and stains. **Hydrogen peroxide** can be applied directly or from products derived from a chemical reaction from sodium perborate or carbamide peroxide [14]. Hydrogen peroxide releases free radicals [15], reactive oxygen molecules, and hydrogen peroxide anions [16]. The reactive molecules break down the long-chained, dark-colored chromophore molecules and split the double bonds into smaller, less colored, and more diffusible molecules [17]. The change in pigment configuration and size alters the wavelength of the reflected light. The stainappears lighter in colorwhich is seen as whitening [18]. Hydrogen peroxide-releasing bleaching agents are chemically unstable and should be stored in a dark, cool place or refrigerator [19]. Hydrogen peroxide released from sodium perborate reaches peak concentration within 72 hrs and plateaus at 3 days.[20] It is considered safer than hydrogen peroxide for intracoronal bleaching[21]. **Carbamide peroxide** (CH6N2O3) breaks down into carbamide and hydrogen peroxide in an aqueous solution. It also produces urea which has a high pH that enhances the bleaching effect. Carbamide peroxide crystals and powder contain H2O2 in an approximate concentration of 35%. Carbamide peroxide in contact with dentine releases oxygen products for 40–90 min when compared with hydrogen peroxide where the release is more instantaneous [22]. **Sodium perborate** (NaBO3) is commercially available as a stable dry powder or gel in monohydrate, trihydrate, and tetrahydrate forms that have varying oxygen contents. The bleaching efficacy is dependent on the oxygen content [23].

Thermocatalytic technique:

The thermocatalytic technique is considered the best approach because of the increased reactivity of the technique with the application of heat by either special lamps or hot instruments[24].

Walking bleach technique:

Sodium perborate mixed with water is the most used technique for internal bleaching of root-filled teeth.

Steps in walking bleaching: (Adapted from Dahl et al., 2019)

1. **Patient discussion**:(Informed consent, Discussion of options and risks)
2. **Clinical and radiographic assessment:**(Examination of defective restorations and/or caries. Adequate root filling. Photographs prior to bleaching)
3. **Access cavity:** (Removal of all restorative materials and root filling materials)
4. **Coronal seal of the root filling**:(Root filling should be covered with a barrier of glass–ionomer cement (e.g. Vitrebond), or 2 mm of Cavit or IRM).
5. **Refinement and finishing of the access cavity**(smear layer removal)
6. **Bleaching material placement**:(thick mix of sodium perborate and water)
7. **Provisional restoration**:(2–3 mm layer of Cavit or IRM cement)
8. **Bleaching time:** (recall visit within 3–7 days)
9. **Final restoration:**(composite restoration placed 1–3 weeks after the last bleaching appointment, Post bleaching photograph and periapical radiograph).

Inside–outside closed bleaching:

It is the combination of the walking bleach technique along with a single-tooth external tray bleach to speed up the bleaching process [25].

Inside–outside open bleaching:

This approach allows the bleaching agent to be externally as well as inside the pulp chamber simultaneously[26]and involves leaving the access cavity open and protecting the root filling with a base. The patient regularly applies the bleaching agent (10% carbamide peroxide) with a syringe into a tray provided which included a reservoir on the labial surface of the tooth to be treated and holes in the labial surfaces of adjacent teeth 4–6 h daily, with the patient reviewed after 2–3 days to assess the change in discolouration[27]. This technique has the disadvantage of leaving the access cavity open which may lead to accumulation of food debris. The patient is instructed to rinse the access cavity and to place a fresh cotton pellet after each meal to limit food debris accumulation. Over bleaching and external cervical resorption is a major concern with this technique. Designing the tray that avoids accidental diffusion of bleaching agent to adjacent tooth will overcome the drawback.

Novel techniques – Lasers:

The use of lasers enhances the bleaching process in the walking bleach technique when sodium perborate and an Nd:YAG laser irradiation is used [28].

Novel techniques – Cold atmospheric plasma:

Application of cold atmospheric plasma into the access cavity of a root-filled tooth without the use of conventional hydrogen peroxide bleaching agents [29].

CONTRAINDICATIONS TO BLEACHING OF ENDODONTICALLY TREATED TEETH:

Teeth with extensive restorations may not respond as well to bleaching[30]. Intracoronal bleaching is not indicated unless pulp pathosis is evident [31].

COMPLICATIONS AND RISKS:

Tooth bleaching can have adverse risks on hard and soft dental tissues including external cervical resorption, adverse effects on adhesive bonding systems, and dental material solubility [32].

TABLE 3: Adverse effects of bleaching agent.

BLEACHING AGENT	COMPLICATION
Hydrogen peroxide	• 25%–50% of patients in clinical trials experience gingival irritation with the use of custom-made trays [33]. • Hydrogen peroxide penetrates enamel and dentine to enter the pulp space [34].
Carbamide peroxide	Tooth sensitivity is usually mild to moderate and transient lasting only a few days [35]. • Longer-term discomfort has been reported [36].

External cervical root resorption:

External cervical root resorption is a serious complication of bleaching with peroxide compounds that can result in tooth loss. External cervical resorption has been reported in 6%–8% of cases that used 35% hydrogen peroxide and 18%–25% if the hydrogen peroxide was heat-activated[37]. Predisposing factors include cementum deficiency exposing dentine, a periodontal ligament injury, and prior trauma [38].

Enamel and dentine damage:

It has been proposed that peroxide components alter the ratio of organic to inorganic hard tissue compounds[39].

Gingival irritation:

It is a greater concern for external bleaching. However, the protection of the oral tissues with a rubber dam is advised [40]. The use of wedges and block-out materials such as Orabase or Opal Dam to properly seal the rubber dam to protect the gingival tissues is also advocated [41].

4. PROSTHODONTIC OPTIONS – RESIN COMPOSITE AND CERAMIC VENEERS, CROWNS:

Direct composite resin veneers are more affordable, less invasive, and easier to repair than indirect porcelain veneers but are more likely to sustain a colorloss over time.

In terms of survival rate Ceramic veneers had better outcomes than indirect composite veneers.[41]Failures associated with feldspathic porcelain and glass–ceramic laminate veneers include debonding, fracture/chipping, secondary caries, and severe marginal discoloration[42].

Masking the discolored tooth with zirconium copings can present technical issues and a higher incidence of chipping of feldspathic porcelain.

CASE REPORT

A 20-year-oldfemale patient reported to the department of conservative dentistry and endodontics with a chief complaint of a discolored tooth in the upper front tooth region for the past 6 months.The patient gave a history of H/o trauma before one year.

The clinical examination revealed a discoloured tooth in 21(**Fig.1**) and a negative response to the pulp vitality test.

The radiographic examination revealed no periapical pathology. Considering the clinical and radiographic examination the patient was diagnosed with Non-vital tooth #21Patient was advisednon-surgicalroot canal treatment in #21 followed by non-vital bleaching.

After obtaining informed consent from the patient, the access cavity preparation #21was done under rubber dam isolation. The working length was determined using an electronic apex locator and was confirmed with a periapical radiograph in 21

The Cleaning and shaping were done using hand files, apical preparation was done upto # 50 K Fileand step back was done up to#70 K File in # 21. The canals were irrigated using 2ml of 5.25% sodium hypochlorite solution with a double-side vented 27 gauge needle for 1 minute, 17% EDTA solutionwas usedas a final rinse to remove the smear layer and with normal saline to finally flush the root canals. The calcium hydroxide intracanal medicament was placed and a closed dressing was given with zinc oxide eugenol in #21.

In the second visit, the master cone x-raywas taken with 50-sizegutta-percha, obturation was done with 50-sizegutta-percha along with accessory cones by lateral condensation technique with a bioceramic sealer (**Fig.2**),and the patient was kept under observation.

After one week, gutta-percha was removed from the root canal orifice up to 2-3mm and a GIC barrier was used as coronal root-end filling. The refinement and finishing of the access cavity was done. The pulp space was filled with a thick mix of sodium perborate and water followed by thermocatalytic bleaching done with carbamide peroxide. (**Fig.3,4**) A 2–3 mm layer of Cavit was placed. The patient was recalled after 7 days.

The permanent restoration was done with an acid-etch composite restoration placed after two weeks follow-ups (**Fig.5**).

Fig 1. Pre-operative clinical picture and IOPA X-ray of 21

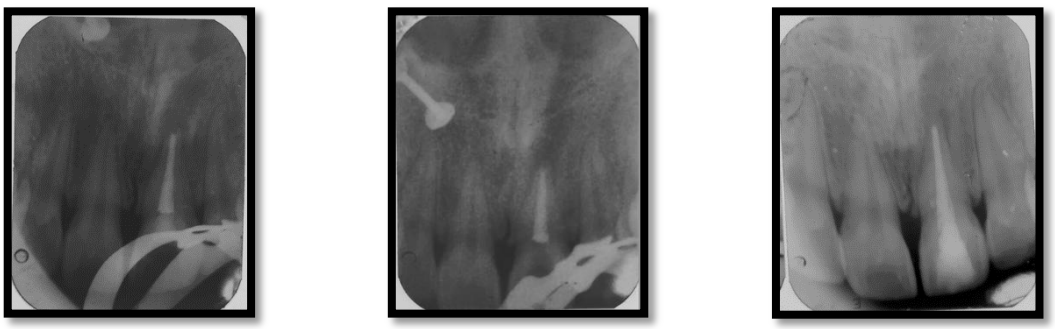


Fig 2. Post-Obturation IOPA -21,GP Removal {2MM} below CEJ &GIC Barrier placement

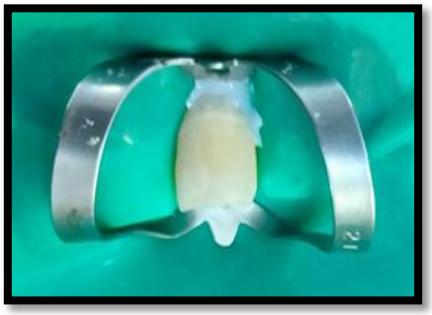


Fig 3. Thermocatalytic and Walking Bleaching done in -21

Fig 4. Immediate post-op Fig.5 Post-opafter 2 weeks follow up

5. DISCUSSION:

Internal bleaching is considered aconservative, simple, effective, and low-cost procedure for treating non-vital tooth discolorations. The cervical barrier should be used as a standard of care. The shape of the barrier was kept as bobsled tunnel to block all the dentinal tubules.[43]In traumatized teeth, bleaching techniques that uses less causticsubstances (hydrogen peroxide at low concentrations, or evenwater associated with sodium perborate) should be used, instead ofusing 35% hydrogen peroxide associated with heat. The material in this case (sodium perborate withhydrogen peroxide 20%) has a lower concentration of hydrogenperoxide, and therefore it is less aggressive.[44]The combined technique should be used instead of the walking-bleach technique due to the similarity in the aesthetic results obtained using the two techniques, the concentrations used for both, and the fact that the biocompatibility of the bleaching agent was more important than its efficiency or speed in producing results[45]. So, in this case, a combined technique was used and satisfactory results were obtained.

6. CONCLUSION

Discoloured teeth management involvesthorough knowledge, a clear understanding, diagnosis and aetiology of the discolouration followed by proper interdisciplinary management approach. Bleaching endodontically treated teeth can be considered as safe, conservative and effective protocol. The risk of external cervical root resorption may be lower with the use of sodium perborate when compared with hydrogen peroxide.

References:

[1] Hattab et al., (1999) Dental discoloration: an overview. Journal of Esthetic Dentistry, 11, 291–310.
[2] Ahmed, H.M.A. & Abbott, P.V. (2012) Discolouration potential of endodontic procedures and materials: a review. International Endodontic Journal, 45, 883–897.
[3] Krastl, G., Allgayer, N., Lenherr, P., Filippi, A., Taneja, P. &Weiger, R. (2013) Tooth discolouration induced by endodontic materials: a literature review. Dental Traumatology, 29, 2–7
[4] Leonard, R.H. (2000) Nightguard vital bleaching: dark stains and long-term results. Compendium, 21, S18–S49.
[5] Maran, B.M., Burey, A., de Paris, M.T., Loguercio, A.D. & Reis, A.(2018) In-office dental bleaching with light vs. without light: a systematic review and meta-analysis.Journal of Dentistry, 70, 1–13
[6] Alkahtani, R., Stone, S., German, M. & Waterhouse, P. (2020) A review on dental whitening. Journal of Dentistry, 100, 103423.
[7] Dahl, J.E. &Pallesen, U. (2003) Tooth bleaching–a critical review of the biological aspects. Critical Reviews Oral Biology &

Medicine, 14, 292–304.
[8] Alomari, Q. & Daraa, E.I. (2010) A randomized clinical trial of inoffice dental bleaching with or without light activation. Journal of Contemporary Dental Practice, 11, E17–E24.
[9] Kashima-Tanaka, M., Tsujimoto, Y., Kawamoto, K., Senda, N., Ito, K. & Yamazaki, M. (2003) Generation of free radicals and/or active oxygen by light or laser irradiation of hydrogen peroxide or sodium hypochlorite. Journal of Endodontics, 29, 141–143
[10] Ontiveros, J.C. (2011) In-office vital bleaching with adjunct light. Dental Clinics of North America, 55, 241–253.
[11] Mielczarek, A., Klukowska, M., Ganowicz, M., Kwiatkowska, A. &Kwaśny, M. (2008) The effect of strip, tray and office peroxide bleaching systems on enamel surfaces in vitro. Dental Materials, 24, 1495–1500.
[12] Alkahtani, R., Stone, S., German, M. & Waterhouse, P. (2020) A review on dental whitening. Journal of Den
[13] Gupta, A., Dhingra, R., Chaudhuri, P. & Gupta, A. (2017) A comparison of various minimally invasive techniquesfor the removal of dental fluorosis stains in children. Journal of the Indian Society of Pedodontic Preventive Dentistry, 35, 260–268
[14] Budavari, S., O'Neil, M.J., Smith, A. &Heckelman, P.E. (1989) The Merk index. An encyclopedia of chemicals, drugs, and biologicals. Rahway, NJ: Merk and Co., Inc.
[15] Gregus, Z. &Klaassen, C.D. (1995) Mechanisms of toxicity. In: Klaassen, C.D. (Ed.) Cassarett and Doull's toxicology, the basic science of poisons. New York, NY: McGraw-Hill Companies Inc., pp. 34–74
[16] Cotton, F.A. & Wilkinson, G. (1972) Oxygen. In: Cotton, F.A. & Wilkinson, G. (Eds.) Advances in inorganic chemistry. A comprehensive text. New York, NY: Interscience Publisher, pp. 403–420.
[17] Frysh, H., Bowles, W.H., Baker, F., Rivera-Hidalgo, F. & Guillen, G. (1995) Effect of pH on hydrogen peroxide bleaching agents. Journal of Esthetic Dentistry, 7, 130–133.
[18] Plotino, G., Buono, L., Grande, N.M., Pameijer, C.H. &Somma, F. (2008) Nonvital tooth bleaching: a review of the literature and clinical procedures. Journal of Endodontics, 34, 394–407
[19] Abramson, I.L., Norris, J.P. & Sachs, W.J. (1966) Atlas of Endodontic Technique. A Clinical Guide. St Louis: C.V. Mosby
[20] Tran, L., Orth, R., Parashos, P., Tao, Y., Tee, C.W.J., Thomas, V.T. et al. (2017) Depletion rate of hydrogen peroxide from sodium perborate bleaching agent. Journal of Endodontics, 43
[21] Setzer, F. (2020) Bleaching procedures. In: Berman, L.H. & Hargreaves, K.M. (Eds.) Pathways of the pulp, 12th edition. St Louis, MI: Elsevier, pp. e2–e22.
[22] Nathoo, S.A. (1997) The chemistry and mechanisms of extrinsic and intrinsic discoloration. Journal of the American Dental Association, 128, S6–S10.
[23] Weiger, R., Kuhn, A. &Löst, C. (1994a) In vitro comparison of various types of sodium perborate used for intracoronal bleaching of discolored teeth. Journal of Endodontics, 20, 338–341
[24] Haywood, V.B. &DiAngelis, A.J. (2010) Bleaching the single dark tooth. Inside Dentistry, 6, 42–52.
[25] Liebenberg, W.H. (1997) Intracanal lightening of discoloured pulpless teeth: a modified walking bleach technique. Quintessence International, 28, 771–777.
[26] Greenwall-Cohen, J. &Greenwall, L.H. (2019) The single discoloured tooth: vital and non-vital bleaching techniques. British Dental Journal, 226, 839–849.
[27] Sağlam, B.C., Koçak, M.M., Koçak, S., Türker, S.A. &Arslan, D. (2015) Comparison of Nd:YAG and diode laser irradiation during intracoronal bleaching with sodium perborate: color and Raman spectroscopy analysis. Photomedicine and Laser Surgery, 33, 77–81
[28] Pavelić, B., Švarc, M.Z., Šegović, S. & Bago, I. (2020) Cold atmospheric plasma for bleaching endodontically treated tooth: a new clinical approach. Quintessence International, 51, 36471.
[29] Glockner, K., Hulla, H., Ebeleseder, K. &Städtler, P. (1999) Five-year follow-up of internal bleaching. Brazilian Dental Journal, 10, 105–110.
[30] Rotstein, I. (2019) Tooth discoloration and bleaching of non-vital teeth. In: Rotstein, I. & Ingle, J.I. (Eds.) Ingles endodontics 7. Raleigh, NC: PMPH USA, Ltd, pp. 1203–1214.
[31] Anderson, D.G., Chiego, D.J., Glickman, G.N. & McCauley, L.K. (1999) A clinical assessment of the effects of 10% carbamide peroxide gel on human pulp tissue. Journal of Endodontics, 25, 247–250.
[32] Bruzell, E.M., Palleson, U., Thoresen, N.R., Wallmaan, C. & Dahl, J.E. (2013) Side effects of external tooth bleaching: a multicentre practice-based prospective study. British Dental Journal, 215, E17
[33] Thitinanthapan, W., Satamanont, P. &Vongsavan, N. (1999) In vitro penetration of the pulp chamber by three brands of carbamide peroxide. Journal of Esthetic Dentistry, 11, 259–264.
[34] Jorgensen, M.G. & Carroll, W.B. (2002) Incidence of tooth sensitivity after home whitening treatment. Journal of the American Dental Association, 133, 1076–1082
[35] Tam, L. (1999) Clinical trial of three 10% carbamide peroxide bleaching products. Journal of the Canadian Dental Association, 65, 201–205.
[36] Cvek, M. &Lindvall, A.M. (1985) External root resorption following bleaching of pulpless teeth with oxygen peroxide. Endodontics and Dental Traumatology, 1, 56–60.
[37] Baratieri, L.N., Ritter, A.W., Monteiro, S. Jr, Caldeira de Andrada, M.A. & Cardoso Vieira, L.C. (1995) Non-vital tooth bleaching: guidelines for the clinician. Quintessence International, 26, 597–598
[38] Heling, I., Parson, A. &Rotstein, I. (1995) Effect of bleaching agents on dentin permeability to Streptococcus faecalis. Journal of Endodontics, 21, 540–542.
[39] Heithersay, G.S., Dahlstrom, S.W. & Marin, P.D. (1994) Incidence of invasive cervical resorption in bleached root-filled teeth. Australian Dental Journal, 39, 82–87.
[40] Rotstein, I. (2019) Tooth discoloration and bleaching of non-vital teeth. In: Rotstein, I. & Ingle, J.I. (Eds.) Ingles endodontics 7. Raleigh, NC: PMPH USA, Ltd, pp. 1203–1214.
[41] Gresnigt, M.M.M., Cune, M.S., Jansen, K., van der Made, S.A.M. &Özcan, M. (2019) Randomized clinical trial on indirect resin composite and ceramic laminate veneers: Up to 10-year findings. Journal of Dentistry, 86, 102–109
[42] Morimoto, S., Albanesi, R.B., Sesma, N., Agra, C.M. & Braga, M.M. (2016) Main clinical outcomes of feldspathic porcelain and glass-ceramic laminate veneers: a systematic review and meta-analysis of survival and complication rates. International Journal of Prosthodontics, 29, 38–49.
[43] Pandey SH, Patni PM, Jain P, Chaturvedi A. (2018) Management of intrinsic discoloration using walking bleach technique in maxillary central incisors. Clujul Med.;91(2):229-233. doi: 10.15386/cjmed-852.

[44] Izidoro ACSA, Martins GC, Higashi C, Zander-Grande C, Tay LY, et al. (2015) Combined Technique for Bleaching Non-Vital Teeth with 6-Month Clinical Follow-Up:Case Report. Int J Oral Dent Health 1:009
[45] Bersezio, C.; Martin, J.; Pena, F.; Rubio, M.; Estay, J.; Vernal, R.; Junior, O.O.; Fernandez, E. Effectiveness and Impact of the Walking Bleach Technique on Esthetic Self-perception and Psychosocial Factors: A Randomized Double-blind Clinical Trial. Oper. Dent. 2017, 42, 596–605.