

Internal Bleaching of Endodontically Treated Teeth: A Dental Practitioner's Perspective from Kingdom of Saudi Arabia

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ABSTRACT

Aim: To determine the knowledge and attitude of dental practitioners (DPs) for internal bleaching technique (IBT) in Kingdom of Saudi Arabia.

Materials and methods: A cross-sectional study was developed based on a convenient sampling of dental practitioners and specialists working in Kingdom of Saudi Arabia. DPs responded to a structured, self-administered questionnaire for evaluation of their knowledge and attitude toward IBT. The questionnaire had two components: (i) the characteristics of the study participants; and (ii) the items related to the internal bleaching technique (IBT). Data analysis was conducted using SPSS (version 25.0), with descriptive statistics and a bivariate analysis.

Results: A total of 532 dental practitioners (61.3% males and 38.7% females) participated in this study. The response rate of participation was estimated at 92.5%. Almost 37% participants considered the sodium perborate as the most commonly used dental material for internal bleaching. Almost 70% participants reported that superficial enamel discoloration was a contraindication for internal bleaching in endodontically treated teeth.

Conclusion: DPs have good knowledge and attitude on use of IBT for discolored teeth. In general, there is a need to improve knowledge and attitude of dental professionals about the IBT by attending continuing dental educational programs.

Clinical significance: Saving of the remaining tooth structure is a main principle of the different types of dental treatments. So the IBT should be known for all dental practitioners to use it before going to more aggressive dental treatment options such as full crowns.

Keywords: Carbamide peroxide, Discoloration, Hydrogen peroxide, Internal bleaching, Resorption, Sodium perborate.

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INTRODUCTION

The dental practice in today's time is a combination of treatment and maintenance of esthetics. People consider whiteness of teeth as an important component for achieving self-esteem and confidence; discolored teeth significantly impacts on physical, psychological, and social aspects of individuals' quality of life.

Discoloration is the change in the hue, color, or translucency of a tooth. Tooth discolorations could be due to hereditary or environmental factors, age, or any underlying disease. It may also be trauma-induced or iatrogenic as a result of dental and medical treatment. Discoloration of the teeth could be extrinsic or intrinsic. The intrinsic discolorations is worrisome, owing to its integration into the tooth structure, while extrinsic discolorations are incorporated superficially on the tooth surface. Bleaching of the teeth is a popular technique used for the treatment of discoloration.

Bleaching is a procedure that lightens the tooth color by oxidizing the organic discoloration in the tooth. It restores the physiological color and the hue of a tooth, and removes the stain with an effective oxidizing agent, also known as a bleaching agent.¹ The effectiveness and efficacy of bleaching of the teeth is dependent upon the underlying cause of the discoloration. The indication of bleaching procedure should be integrated into the final treatment plan.²

Bleaching of endodontic treated teeth impacts on the color of the teeth, increasing the cost of care for patients via a more aggressive expensive treatment of full crowns. The walking bleach technique (IBT) is to leave a bleaching material (mixture of sodium perborate) in the pulp chamber for several days, with the access cavity filled with provisional cement.^{3,4} The internal bleaching

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procedure consists of several steps, including: (i) diagnosing the etiology and origin of stain; (ii) assessment of the root canal treatment; (iii) coronal restoration investigation, (iv) clinical photography; (v) rubber dam isolation; (vi) preparation of access cavity for restorative filling materials, root-filling material; (vii) removal of sealer remnants and necrotic pulp tissues remnants; (viii) rinsing the cavity with sodium hypochlorite to reduce surface tension.⁵ Placement of protective layer over the root filling material

should be done, where sodium perborate is mixed with an inert liquid to achieve the consistency of wet sand. The rubber dam is removed and all tissues are inspected and the patient should be informed about the reaction of the stain to the bleaching agent and the expected time to achieve results.

MATERIALS AND METHODS

Study Design, Sampling Method, and Sample Size Calculation

A descriptive cross-sectional study was performed in a convenient sample of dental practitioners working in Kingdom of Saudi Arabia. The sample size was determined using the following formula:

$$n = \frac{z^2 p(1-P)}{d^2}$$

where n was the needed sample size, Z was statistic for a level of confidence, P was the expected knowledge of (14.7%, $P = 0.147$), and d was precision (in proportion of one; if 5%, $d = 0.05$). Z statistic (Z) was the level of confidence of 95% with a z value of 1.96. The sample size achieved in this study was 532 subjects.

Ethics Approval

This study was carried out in collaboration with the Alfarabi College for Dentistry and Nursing, Riyadh city, Kingdom of Saudi Arabia. The study duration was scheduled between December 2018 and May 2019. Ethics approval was obtained (ethical approve: Ref. 002342017).

Data Collection and Mailing of Questionnaires

The participants were provided a self-administered questionnaire. In the first section, the questionnaire included questions on the gender of the participant. The second section consisted of an 18-items questionnaire that was used to investigate the knowledge and practice amongst dental practitioners for IBT indication, diagnosis, technique, materials, and prognosis. After the construction of the questionnaire, it was evaluated by two DPs and six dental specialists (two pediatric dentists and four endodontists). Opinions provided by DPs and dental specialists were carefully assessed and incorporated within the final version of the questionnaire. Further, reliability of the questionnaire was established by distributing the questionnaire to the 15 DPs and 5 dental specialists. A Cronbach's alpha score was calculated as 0.79. The questionnaire responses were recorded as "yes", "no" and "I don't know" except for Item one.

A total of 576 questionnaires were administered either as a printed version or electronic version. The questionnaires were either posted or emailed to the DP in different parts of Kingdom of Saudi Arabia. Of the 576 questionnaires, 532 were filled and returned back. A response rate of 92.5% was obtained. Consequently, 532 of 576 questionnaires were utilized for conducting a statistical analysis.

Data Analysis

All the data were entered into the statistical analysis software SPSS (version 25.0; IBM Corp, USA). Descriptive statistics of frequency distribution and percentages were calculated for all questionnaire responses, and most appropriate answers were noted to assess the overall knowledge of IBT among the study participants.

RESULTS

A total of 532 DPs participated in the study. There were 326 male DPs (61.3%) and 206 female (38.7%) DPs who participated in this study (Table 1). When enquired among the study participants about the most common used material in internal bleaching, almost 37% of the DPs responded sodium perborate as the most commonly used bleaching material. Hydrogen peroxide (34.2%) and carbamide peroxide (27.8%) were the second and third most commonly used bleaching materials (Table 2). The responses of the other 17 items are illustrated in Table 3.

DISCUSSION

Internal bleaching is a conservative and economic dental procedure that does not change the shape or position of the tooth on the dental arch.⁶ In some cases, it is necessary to do an internal bleaching before placement of all ceramic restorations. It assists in maintaining the nature color of the tooth abutment by allowing passage of light through it, improving esthetic, physical, and social aspects of individuals' quality of life.⁷

Prior to performing IBT, DPs should know if the tooth to be bleached is treated endodontically with an adequate obturation, which is usually done using the suitable radiograph. A tooth may become nonvital because of trauma and may lose its original color without being endodontically treated anytime. In such cases, that root canal treatment should be the first step in the treatment. If the tooth is endodontically treated, we can proceed with the internal bleaching procedure. The highest percentage of responses in recent study reflected a good knowledge that sodium perborate was safer than concentrated hydrogen peroxide solutions and easily controlled.⁸⁻¹¹ Therefore, in most cases, it should be the material of choice for IBT and this information was suggested by 36.8% of the dental practitioners.

More than half of the participants' reported that discoloration of pulp chamber origin is an indication for IBT, whereas superficial enamel discolorations and defective enamel formation were reported as a contraindication for IBT because of the internal cause of the first staining and the external cause of the second.¹² The results of our survey gave an idea about realizing the importance of putting a protective layer of dental material of at least a 2-mm thickness over the root-filling material before the application of bleaching mixture in the pulp chamber. Without this layer,

Table 1: Participants' distribution according to "gender"

	Frequency	Percent
Female	206	38.7
Male	326	61.3
Total	532	100.0

Table 2: The most common used material in internal bleaching

	Frequency	Percent
Carbamide peroxide	148	27.8
H ₂ O ₂	182	34.2
Sodium perborate	196	36.8
I don't know	6	1.1
Total	532	100.0

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Table 3: Answers of the items from 2 to 18

	Frequency	Percent
Discolorations of pulp chamber origin is an indication of internal bleaching		
Yes	334	62.8
No	146	27.4
I do not know	52	9.8
Total	532	100.0
Superficial enamel discoloration is a contraindication of internal bleaching		
Yes	356	66.9
No	108	20.3
I do not know	68	12.8
Total	532	100.0
Defective enamel formation is a contraindication of internal bleaching		
Yes	352	66.2
No	154	28.9
I do not know	26	4.9
Total	532	100.0
Before starting internal bleaching we have to put a barrier between root canal filling and the bleaching material in thickness of 2 mm		
Yes	302	56.8
No	50	9.4
I do not know	180	33.8
Total	532	100.0
In case severe stains add 3% hydrogen peroxide to make a paste of sodium perborate		
Yes	210	39.5
No	72	13.5
I do not know	250	47
Total	532	100.0
We have to recall the patient after putting the mixture in pulp chamber in 7-14 days		
Yes	172	32.3
No	324	60.9
I do not know	36	6.8
Total	532	100.0
External root resorption is a complication of internal bleaching		
Yes	176	33.1
No	256	48.1
I do not know	100	18.8
Total	532	100.0
Sodium perborate is stable when dry, but in the presence of acid, warm air, or water, it decomposes to form sodium metaborate, hydrogen peroxide, and nascent oxygen		
Yes	168	31.6
No	132	24.8
I do not know	232	43.6
Total	532	100.0
Sodium perborate preparations are available: monohydrate, trihydrate, and tetrahydrate. They differ in oxygen content		
Yes	160	30.1

Contd...

Contd...

	Frequency	Percent
No	140	26.3
I do not know	232	43.6
Total	532	100.0
It is commonly thought that "overbleaching" after internal bleaching is desirable because of future recurrence of discoloration.		
Yes	118	22.2
No	166	31.2
I do not know	248	46.6
Total	532	100.0
Carbamide peroxide has been suggested for internal bleaching		
Yes	238	44.7
No	252	47.4
I do not know	42	7.9
Total	532	100.0
Carbamide peroxide is not probably superior to sodium perborate		
Yes	220	41.3
No	184	34.6
I do not know	128	24.1
Total	532	100.0
Residual peroxides of bleaching agents, mainly hydrogen peroxide and carbamide peroxide, may affect the bonding strength of composites to the tooth		
Yes	164	30.8
No	84	15.8
I do not know	284	53.4
Total	532	100.0
Sodium perborate mixed with water results in much less loss of bond strength than does concentrated hydrogen peroxide		
Yes	62	11.7
No	134	25.2
I do not know	336	63.2
Total	532	100.0
It is not recommended that the tooth be restored with composite immediately after bleaching but only after an interval of a few days		
Yes	188	35.3
No	244	45.9
I do not know	100	18.8
Total	532	100.0
After internal bleaching: packing calcium hydroxide paste in the chamber for a few weeks before the final restoration is placed would reverse the acidity caused by bleaching agents and prevent resorption		
Yes	138	25.9
No	92	17.3
I do not know	302	56.8
Total	532	100.0
Coronal fracture is one of internal bleaching complications		
Yes	242	45.5
No	224	42.1
I do not know	66	12.4
Total	532	100.0

bleaching materials may penetrate the root filling in to the apical foramen, causing irritation in the periapical region.^{2,13}

Only 39.5% of participants agreed that “in case of severe stains adding three percent hydrogen peroxide to make a paste of sodium perborate” is effective in cases of severe discoloration and it may be due to the danger of increasing the risk of subsequent root resorption. A walking bleach paste is strengthened by adding increased concentrations of hydrogen peroxide instead of water to sodium perborate.^{14,15}

Only 32.3% of all respondents knew when to recall the patients after the bleaching material has been placed in the pulp chamber. It is recommended that a patient should return after 3–10 days of bleaching for reassessment of the results and to replace/refresh the walking bleach if necessary.^{5,12}

Only 33.1% of DPs in Kingdom of Saudi Arabia had an idea about external root resorption being as a complication of IBT. This was explained by Anderson et al., in his clinical study.¹⁶ Only 31.6% of DPs believed in the chemical changes of sodium perborate according to the medium to be in as mentioned by Spasser et al., his study.⁴ Sodium perborate is stable if dry, but when it comes in touch with water, acid, or warm air, it will give sodium metaborate, hydrogen peroxide, and nascent oxygen, respectively.⁴

Weiger et al., declared that there are different types of sodium perborate, including monohydrate, trihydrate, and tetrahydrate. The oxygen content in these types of sodium perborates is different and it affects the bleaching efficacy.¹⁷ Of all dental practitioners in this study, 56.8% did not have any previous information about this fact. Also 46.6% of participants reported that they don't know if the over bleaching related to IBT is desirable or not. Howell et al. clarified the term “overbleaching” that it was accepted because of the expected recurrence of discoloration.¹⁸

The dentist should be aware that bleaching a tooth to a lighter shade comparing with a neighboring tooth is mostly carried out with care because the discoloration of the overbleached teeth may not occur again. Less than 50% of dentists reported that carbamide peroxide can be used as internal bleaching material and this is true according to the Vachon et al. study.¹⁹ Carbamide peroxide has poorer properties when compared to sodium perborate according to many studies.²⁰ The tooth restoration of bleached tooth is important for a long-term success, but an important point to be in mind is that the residual peroxides of bleaching agents may affect the bonding strength of composite restorative material to the tooth.^{21,22} This knowledge was found amongst 31% DPs.

A very poor percentage of dental practitioners participating in this study (11.7%) agreed that sodium perborate mixed with water resulted in much lesser loss of bond strength than did concentrated hydrogen peroxide.²³ An interval of a few days should be present between the day of bleaching and that of final composite restoration, which is similar to the results of our study.

Only 56.8% of participants did not have any information about placement of the calcium hydroxide paste in the pulp chamber for many weeks before placing the final restoration. This modified the acidic environment caused by bleaching agents and prevented future resorption as stated by Rotstein et al. that this procedure was ineffective and unnecessary.⁸ Approximately 50% of the DPs were familiar with the fact that the coronal fracture was one of the IBT complications and this problem was explained to be caused as a result of either desiccation or alterations to the physicochemical characteristics of the dentin and enamel.²⁴

CONCLUSION

Within the limitation of this study, it may be concluded that the knowledge of DPs in Kingdom of Saudi Arabia about IBT is poor. Hence, it is recommended that the DPs should attend the continuous education seminars and workshops on internal and external bleaching in the aim of improving their knowledge about this dental procedure and patient experience. A revision of curriculum is needed at the undergraduate level to address this problem.

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