

VITAL AND NON-VITAL TOOTH BLEACHING PROCEDURES: A SURVEY AMONG DENTISTS FROM ROMANIA

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Abstract

Changes in tooth form, texture and shade inevitably accompany the aging of the people. The desire of improving smile appearance leads to an increase in the request of esthetic dental procedures. Bleaching is now the most common and non-invasive esthetic dental treatment. Even if it is considered a cosmetic dental treatment, the dentist always should establish a diagnosis and treatment plan before initiate the procedure. This study aims to evaluate the Romanian dentists approach to vital and non-vital bleaching procedures and to assess if there are correlations between their options and the time of clinical practice or the postgraduate training. The cross-sectional study was undertaken using a closed questionnaire addressed to dentists by online method. The twenty questions focused on the following topics: time of clinical practice, self-perception on safety of the treatment, self-confidence in providing bleaching, postgraduate training, the main technique for vital and non-vital tooth bleaching therapies, first choice material, the use of light activation, the need for desensitizing agents and the attitude towards restorations.

Introduction

Dental bleaching is a worldwide elective dental treatment with a predictive improvement of smile aesthetics. It is the most common procedure used in dentistry to restore the natural tooth shade or even for obtain a more lighter color (1). The teeth aesthetics is of great

importance for patients nowadays, together with the dental color, the alignment and the caries. Therefore, the literature suggests that when planning treatment, dentists should consider patient’s aesthetic objectives in addition to the function and long-term stability (2).

The improvement of tooth color can be achieved in various ways: vital “home” (night-guard bleaching) (3) or “in office” (power bleaching), treatment with over-the-counter products (strips, paint-on gels, brush on adhesive liquids) or non-vital bleaching (4).

The most frequently used peroxide compounds as active ingredient in extra coronal tooth-whitening products, regardless of the in-office or at-home technique used, are carbamide peroxide and hydrogen peroxide (5).

Hydrogen peroxide breaks down into water and oxygen that penetrate the tooth and liberate the pigment molecule, causing the tooth whitening (6).

Carbamide peroxide is available in the concentration range of 3 to 45%, and is chemically composed of approximately 3.5 parts of hydrogen peroxide and 6.5 parts of urea which means that the true active ingredient for tooth bleaching is hydrogen peroxide (7).

Sodium perborate is primary used for intra coronal bleaching procedures and its stability depends on the dryness of the environment. In the presence of acid, warm air, or water it decomposes in sodium metaborate, hydrogen peroxide, and nascent oxygen which determine its whitening efficacy. The monohydrate and tetrahydrate forms are used in intra coronal bleaching procedures, containing 34% and 22% hydrogen peroxide, respectively, the true active ingredient (8-9).

Patients knowledge and perception regarding tooth bleaching has been assessed in the literature, (9–11) but there are few articles investigating dentists’ clinical options, knowledge and awareness about whitening procedures.

Materials and methods

The cross-sectional study was performed online within the duration of a 2-month period in Romania. The evaluating items were divided into two sections comprising: time since practicing dentistry to quantify personal experience and knowledge about bleaching procedures. The experience of dentists was registered and assigned in four groups: 0-5 years, 5-10 years, 10-15 years, and more than 15 years. The questions about preferred bleaching procedures were focused on: safety of vital and non-vital procedures, the confidence in providing vital and non-vital bleaching, the attending on postgraduate courses about whitening protocols, the most common vital technique and concentration used, the use of activating agents on bleaching compounds, the attitude towards restorations and postoperative sensitivity, the techniques and materials used in non-vital bleaching treatment.

The data collected were submitted to Excel Office 2019 in order to obtain a statistical assessment of the answers and to highlight the possible link between vital and non-vital bleaching and the two variables selected by the operators: experience of dentists and the attending on postgraduate courses. Since the collected data were interpreted as categorical, the chi-square statistic was applied for hypothesis testing. Fisher's exact test was used when the chi-square usage conditions were not met.

Results

While it was open for answers, the questionnaire received a total number of 145 responses. The descriptive analysis showed that dentists with experience of 0-5 years were the most common (53,7%), followed by 5-10 years (18,6 %), more than 15 years (15,8%) and 10-

15 years (11,7%). The questioned dentists participated on postgraduate trainings regarding bleaching in 47,6% of cases.

The dentist’s opinion on the safety of the vital and non-vital bleaching procedures was assessed: score 1- strongly agree, score 2-

agree, score 3- neutral, score 4- disagree and score 5 strongly disagree. Their confidence in providing whitening procedures was categorized as follows: score 1- very confident, score 2- confident, score 3- quite confident 4- unconfident 5-very unconfident (**Table I**).

Opinion on: “Vital tooth bleaching is safe”.	N (%)	Opinion on: “Non-vital tooth bleaching is safe”.	N (%)	Self-confidence in providing vital bleaching.	N (%)	Self-confidence in providing non-vital bleaching.	N (%)
Score 1	18 (12.4%)	Score 1	12 (8.3%)	Score 1	41 (28.3%)	Score 1	27 (18.6%)
Score 2	62 (42.8%)	Score 2	54 (37.2%)	Score 2	28 (19.3%)	Score 2	33 (22.8%)
Score 3	44 (30.3%)	Score 3	50 (34.5%)	Score 3	41 (28.3%)	Score 3	52 (35.9%)
Score 4	19 (13.1%)	Score 4	28 (19.3%)	Score 4	26 (17.9%)	Score 4	26 (17.9%)
Score 5	2 (1.4%)	Score 5	1 (0.7%)	Score 5	9 (6.2%)	Score 5	7 (4.8%)

Table I. Descriptive analysis of the variables “opinion of the dentists on safety” and “self-confidence in providing” vital and non-vital dental bleaching (N=145)

Our study concluded that 55.2% (12.4% + 42.8%) agree with the statement: "Vital tooth bleaching is safe", and 45.5% (8.3% + 37.2%) agree with the statement: "Non-vital tooth bleaching is safe". Consequently, 75.9% (28.3% + 19.3% + 28.3%) are confident enough to perform vital bleaching procedures to patients, and 77.3% (18.6% + 22.8% +35.9%) are confident enough to perform non-vital bleaching procedures to their patients.

Regarding the most used vital bleaching technique, the respondents choose “in office” bleaching (83.7%), while “at home” bleaching is less used (16.3%). Corroborating these preferences with the practice experience of the dentists, it seems like even though power bleaching is more frequently used, there is a tendency to increase the use of “at home bleaching” directly proportional with the age of the dentist (**Figure 1**).

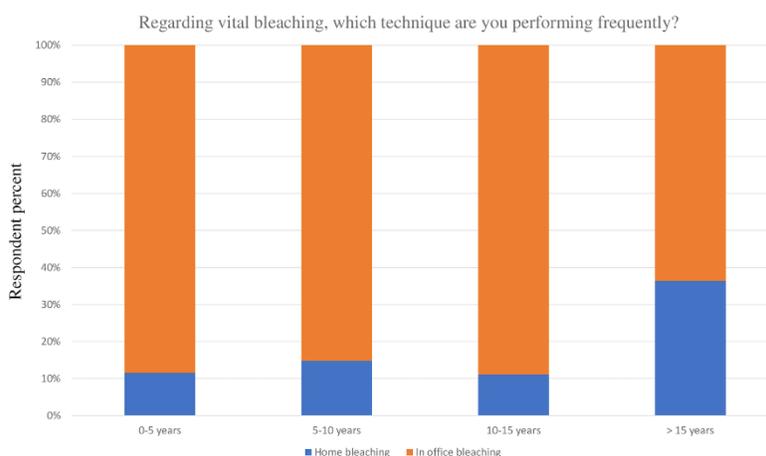


Figure 1. Preferred technique for vital bleaching

Moreover, the attending on postgraduate training does not influence the options regarding the use of night guard vital bleaching as a method of bleaching vital teeth with less

concentrated agents (16.6% of the dentist who did not had a postgraduate course, uses night guard bleaching and 17.3% from those who took the course are using it) (**Figure 2**).

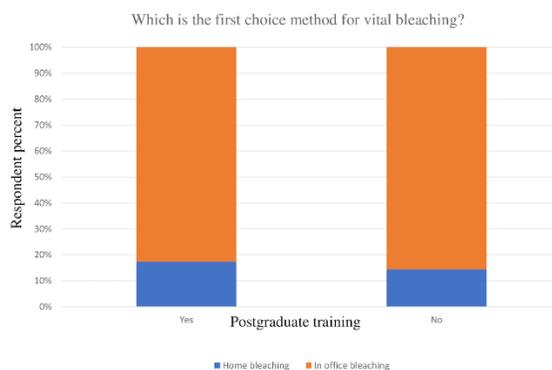


Figure 2. First choice method for vital bleaching

The chi-square statistic is 0.2307. The p-value is 0.631024. The result is not significant at $p < 0.05$. The first-choice material

for vital bleaching respondents seem to use the most (60 % of respondents) is the hydrogen peroxide 35% (**Figure 3**).

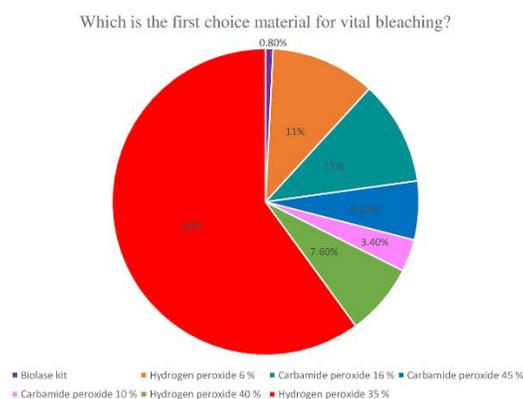


Figure 3. The first-choice material for vital bleaching

Asked about the means for activating the power bleaching gels, the respondents are using preponderant LED light activation (44.8%), followed by laser activation (15.2%) and halogen light activation (11.7%).

Regarding non-vital bleaching, the most selected method was „walking bleaching” with high concentration of hydrogen peroxide 35% (50.3%), followed by combined techniques of bleaching non-vital teeth (37.2%) (**Figure 4**).

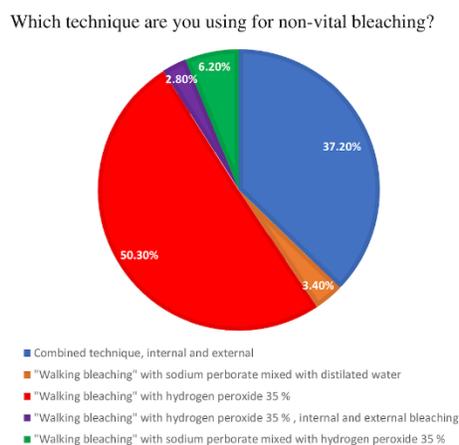


Figure 4. Preferred technique for non-vital bleaching

We found no correlations between experience of the dentists or postgraduate courses in the choice of non-vital bleaching

treatment method. Fisher's exact test p-value is 0.39367. The result is not significant at $p < 0.05$.

Regarding the “walking bleaching technique”, within the materials used by the respondents for the cervical barrier we assessed that flowable composites were mostly used (51%), followed by conventional glass ionomer cements (25.5%) (**Figure 5**).

Which material are you using for the cervical barrier in “walking bleaching” non-vital technique?

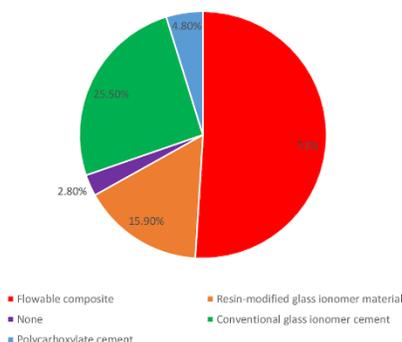


Figure 5. The first-choice material for cervical barrier

When the respondents were asked about the use of “jump start” technique followed by at “home bleaching” they stated that: 77.9% are not using it, 15.9% are using it sporadically and only 6.2% of the respondents are using this method when they feel it is necessary. We found

no correlation between the experience of the respondents and the knowledge of this technique. However, there is a link between the attending on postgraduate training and the ability to select the cases that need this approach (**Figure 6**).

Have you ever used “the jump start” technique followed by “at home bleaching”?

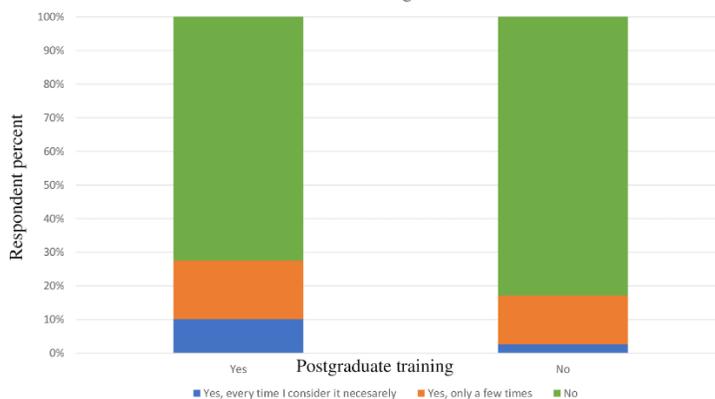


Figure 6. The knowledge of "jump start" technique

In order to assess the awareness of the dentists about post-bleaching sensitivity, the questionnaire contained the following question: “Do you usually apply desensitizing agents before bleaching in order to prevent tooth sensitivity?”- 44.8% are not using this method to prevent post-bleaching sensitivity, 16.6% are always applying desensitizing agents before the treatment and 38.6 % use the method when they

consider it is necessary. Regarding the need of applying desensitizing agents after the whitening, we record it as follows: 1-very frequently, 2-frequently, 3-often, 4-rare, 5-very rare. The data collected are: 41.4% choose the score 3, 14.5% the score 2 and 9.7% the score 1, indicating a high rate of application of desensitizing agents after bleaching (**Table II**).

Desensitizing agents before bleaching	N (%)
No	65 (44.8%)
Yes, always	24 (16.6%)
Yes, when I consider it necessary	56 (38.6%)
Desensitizing agents after bleaching	N (%)
Score 1	14 (9.7%)
Score 2	21 (14.5%)
Score 3	60 (41.4%)
Score 4	27 (18.6%)
Score 5	23 (15.9%)

Table II. Descriptive analysis of the variable “desensitizing agents” among responders (N=145)

The attitude towards restorations was assessed in terms of the main reasons for replacing an old restoration after bleaching (aesthetics, the decrease in bond strength, changing in the marginal sealing, or alterations of the physical properties) and the right time to do this. Regarding the reasons for replacing the

old restoration, the dentists chose the aesthetics in 93% of the cases, 4% considered the decrease in bond strength, while 3% went for changing in the marginal sealing or alterations of the physical properties like increase in roughness or decrease of micro-hardness (**Figure 7**).

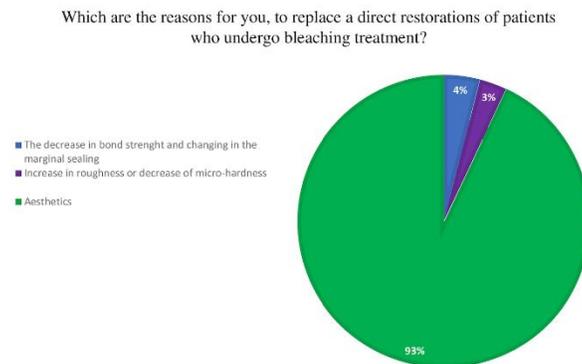


Figure 7. The main reason to replace a direct restoration

Asked about the time when they replace the old adhesive restoration the majority (88.3%) is waiting 14 days to perform the adhesive protocol, 4.8% are replacing immediately after bleaching and 3.4% immediately after bleaching but with the use of an antioxidant agent.

Discussion

Our study concluded that 55.2% of the respondents agree with the statement: "Vital tooth bleaching is safe", while 45.5% chose the opposite. A similar study undertaken in UK on 662 dentists defined that the most frequent side effects experienced with vital bleaching by the respondents were: soft tissue inflammation and sensitivity (12). On the other hand, the most feared side effect of non-vital bleaching is root resorption. The occurrence of root resorption stated in the literature is a range between 1%-13% (13).

This study shows that the most used vital bleaching technique in Romania is "in office" bleaching (83.7%) whereas the "at home" bleaching is by far less used (16.3%). A similar survey was conducted in Brazil on 276

respondents. The preferred vital bleaching technique was home bleaching (78.1%), while the "in office" treatment is used merely by 21.9% of respondents, (14) a totally reversed situation compared to our study.

Starting from the fact that the "in office" bleaching is the preferred protocol, 60% of the respondents stated that the first-choice material for vital bleaching is hydrogen peroxide 35%. This high concentration of peroxide was studied by the literature and compared with decreased concentrations as well: 6% or 17.5%, showing that the color changes, hence the efficiency of low concentrations is similar with high concentration outcomes, but it leads to less micro hardness loss, decrease in roughness and surface damage on enamel (15–19).

Asked about the means for activating the power bleaching gels, the respondents are using preponderant LED light activation (44.8%), followed by laser activation (15.2%) and halogen light activation (11.7%). The literature has controversial results regarding both the efficacy of activation methods and the risk-benefit ratio. Some studies claim that light activation increases whitening efficacy in terms

of color change, (20) whereas others suggest that there is no significant difference between light activated bleaching and conventional bleaching (21-22). On the other side, recent studies prove the effectiveness of KTP and CO₂ laser activated techniques (23), while others show that the use of laser-activating systems does not improve the efficacy of whitening (24).

Regarding non-vital bleaching, the literature shows that „walking bleach” is the most used method (14) and our study results consistently supports this fact.

The cervical barrier prevents leakage of bleaching agents reducing therefore the osteoclastic activity on the root surface. The preferred materials for “cervical barrier” in this study were flowable composites 51%, followed by conventional glass ionomer cements 25.5%. Many sealing materials prove their effectiveness: glass ionomer cements (GI) as the common used material, mineral trioxide aggregate as a new alternative on GI (25), resin-modified glass ionomer cement liners, restorative resin-modified glass ionomer cements, eugenol-free zinc oxide cements. But, there are studies concluding that because of the high infiltration rate, resin composite and zinc phosphate cement should be avoided (26).

Tooth sensitivity is a well-known side effect of bleaching treatment. Several changes in bleaching protocols had been made in order to diminish this side effect: lowering the concentration of active ingredients, decreasing the time of application or application of desensitizing agents. Potassium nitrate and sodium fluoride are the most used desensitizing agents. They can be applied before treatment, incorporated in bleaching gels or delivered after bleaching. Studies assessing the application of 10% potassium nitrate before “in office”

bleaching show that tooth sensitivity is not decreased in terms of incidence or intensity (27). Other studies show that the same desensitizing agents delivered after bleaching procedure reduce tooth sensitivity instead (28). Furthermore, there is a link between baseline color and tooth sensitivity. Darker teeth have more organic material, this organic structure retains hydrogen peroxide in the hard tissues of the tooth and prevent it to travel in the pulp tissue. Conversely, the age of the patient is not involved in the prediction of tooth sensitivity, even if it could be thought that a thicker layer of dentine in old patients could impede the advancing of peroxide towards the pulp chamber (29).

Starting from the observation that we have to change the restorations after bleaching, the literature shows that direct restoration materials (resin composite) determine a reduction in surface gloss (30) and no significant or perceptible color change (31). Thus, the difference from the tooth color after bleaching is leading to the need of replacement of resin restorations. Furthermore, the literature shows not only that the aesthetic reasons for replacement exist, but also that the bleaching procedures lead to superficial cracks in composites, increased porosity and separation of resin matrix from the fillers (32). The increased surface roughness of composite restorations after bleaching is concentration dependent and is in favor of bacterial adhesion and plaque accumulation (33). Also, preexisting composite restorations are affected by whitening treatment in terms of shear bond strength especially by prolonging bleaching protocols (34).

Regarding the bonding of dentine after intracoronal bleaching, the literature states that sodium perborate mixed with distilled water

make up the best bleaching agent (35). Hydrogen peroxide (35) as well as carbamide peroxide should be avoided for walking bleach procedures because of the adversely effects on bond strength (36). Regarding bonding on bleached enamel, it is known that oxygen, hydroxyl and perhydroxyl ions remain on the tooth structure after bleaching, interfering with the adhesive protocol. Therefore, a waiting period of 24 hours to four weeks is recommended in order to allow the buffering effect of saliva onto residual peroxides. The literature shows that antioxidants like 10% sodium ascorbate are capable of restoring the bonding to enamel at a level comparable to unbleached enamel (37,38).

The clinical cases selected for the dental bleaching procedure should exclude occlusal trauma which can lead to loss of dental tissue, hypersensitivity, morphological changes of the dental pulp and marginal periodontitis (39,40).

Conclusions

The results of this study show that the “in office” bleaching technique was broadly

preferred over the “at home” procedures for vital bleaching. The first-choice material for the procedure is 35% hydrogen peroxide and most respondents use LED light activation in their protocol.

There is a tendency to increase the use of “home bleaching” in more experienced respondents, but the rate in the use of this procedure still remains low.

Regarding non-vital techniques, the “walking bleach” with high concentration of hydrogen peroxide is preferred.

The level of confidence in providing vital and non-vital bleaching procedures is rather high, but Romanian dentists are keen on active improvement. Thus, they are following postgraduate training in a rate of 47,6%. The attendance to courses did not show a significant influence in the options of the materials or protocols in this study.

Most dentists know the side effects of teeth whitening, such as post-bleaching sensitivity and the need to replace restorations affected by whitening. They mostly apply an appropriate protocol to each clinical situation.

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Availability of data and materials

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Ethics approval and consent to participate

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethical Committee of the University of Medicine and Pharmacy of Craiova, Romania (approval no. 98/10.09.2019).

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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