

What's new for the clinician – summaries of recently published papers (March 2023)

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1. Bleaching efficacy and quality of life of different bleaching techniques

In a world of increasing emphasis on aesthetics and beauty, the tooth form, colour and appearance has taken on significant importance in the overall makeover that many patients seek as part of their quest for beauty and youthfulness. Common concerns among many patients relate to the appearance and colour of their teeth. This dissatisfaction has led to an increased desire for treatments that improve dental aesthetics, including tooth bleaching, which is a conservative and viable option for attaining a patient's desired smile when tooth integrity is acceptable.¹

Tooth bleaching can be performed at home or in the dental office by a wide range of techniques.¹ At-home bleaching has become increasingly popular since the introduction of the nightguard vital bleaching, which is the most prescribed technique among dentists, mainly due to its high efficacy and safety profile¹. Although the described protocol for at-home bleaching is the overnight use of a custom tray with a 10% carbamide peroxide (CP) gel (which requires medical prescription), nowadays, several modifications and formulations can be found among manufacturers, with application times ranging between 1 and 8 hours a day.¹

As an alternative to at-home bleaching, dentists can perform in-office techniques which are viable options typically associated with higher hydrogen peroxide (HP) concentrations. Most of the products have 35% to 40% HP and are available in the form of a base and catalyst gel, either ready-mixed or supplied as a powder/liquid combination to be freshly mixed at the dental office¹. The rationale for those higher HP concentrations lies in obtaining faster results, thus being indicated for situations when immediate whitening is required. However, HP's oxidative properties prompted manufacturers and clinicians to search for in-office techniques with lower HP concentrations to prevent hazardous effects on biological tissues. As a result, a wide range of bleaching products with lower peroxide concentrations have been developed over the years, and even an at-home paint-on varnish technique (VivaStyle Paint On Plus, Ivoclar) was proposed for in-office use due to its fast-bleaching rate suggested by a fast HP release in approximately 10 min.¹

Currently, tooth bleaching is known to potentially influence oral health related quality of life (OHRQoL) by affecting the patient's self-esteem and social behaviours, such as smiling, laughing, or showing teeth without embarrassment.¹ Therefore, the long-term effects of tooth bleaching are not only related to tooth colour stability but may also impact the patient's everyday life.

Pereira and colleagues (2022)¹ reported on a study that sought to compare the bleaching efficacy and oral health

related quality of life (OHRQoL) of three different bleaching systems with a similar HP concentration of 6% or its carbamide peroxide (CP) equivalent while assessing the outcomes for up to six months. The following null hypotheses were established: (1) there were no differences in bleaching efficacy between the three tested bleaching systems; (2) there were no differences in tooth colour stability, at the six-month follow-up, between the three tested bleaching systems; (3) there were no differences in OHRQoL, at the end of treatment, between the three tested bleaching systems; (4) there were no differences in OHRQoL, at the six-month follow-up, between the three tested bleaching systems.

Materials and methods

This randomised clinical trial had three parallel groups (30 per group; 90 patients in total) corresponding to different products and techniques: group A, in-office paint-on varnish 6% HP (VivaStyle Paint On Plus); group B, at-home 6% HP with a prefilled disposable tray (Opalescence GO); group C, at-home 16% CP with a customised tray (Opalescence PF 16% CP).

Participants attending the faculty clinic were screened according to the following inclusion criteria and consecutively recruited: being at least 18 years of age, having the upper canines darker than A3.5 in VITA Classical (VC) shade guide (assessed by spectrophotometry), accepting to interrupt smoking habits during the full duration of the study, and signing an informed consent form. The exclusion criteria were the presence of fixed orthodontic appliances, decayed teeth, pregnancy, poor oral hygiene, anterior teeth (16 anterior teeth, from the second premolar to the second premolar) with dental restorations, endodontic treatment, and severe anomalies of the dental structure or intrinsic stain.

Each bleaching system was coded from A to C using a randomisation software. A third party (blinded to the allocation results) analysed the data in an SPSS worksheet where each bleaching system was referred to as groups A to C.

Participant and clinical operator blinding was not possible due to the three whitening systems' different formulations. However, the tooth colour examiners were blinded, and spectrophotometric analysis was recorded as per machine output, thus reducing the potential bias.

Examiners were calibrated, and during the study, if disagreements occurred, the examiners reached a consensus. To standardise lighting conditions, the Smile Lite device (Smile Line) with LED lights at 5500 K and a polarisation filter was used.

An independent and blinded examiner performed objective tooth colour measurements with a spectrophotometer (SpectroShade micro (SS)).

The validated Portuguese version of the Oral Health Impact Profile 14 (OHIP-14) was applied at baseline, at the end of treatment (after bleaching), and after six months (six-month follow-up). The questionnaire consisted of 14 questions with seven domains (two questions per domain): functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. The answers were scored according to a Likert scale from 0 to 4 (never=0, rarely=1, sometimes=2, repeatedly=3, always=4), with higher scores representing a worse OHRQoL (OHIP-14 total score ranged from 0 to 56 and each domain score from 0 to 8). Effect size (ES) and standardised response mean (SRM; calculated by dividing the mean score change by the standard deviation of the change) were calculated and ES and SRM were described as small <0.3, moderate 0.3–0.8, or large ≥ 0.8 effect). A minimal important difference (MID) of five in the total OHIP-14 score change was also considered.

For the clinical procedures, In the first appointment, each patient was screened at the first appointment according to the inclusion/exclusion criteria and submitted to professional dental prophylaxis with interproximal radiographs for diagnosis purposes. The professional dental prophylaxis was performed using an ultrasonic scaler and a nylon brush with prophylaxis paste in a low-rotation contra-angle handpiece by a dentist. Each patient was assigned to one group, according to the randomisation process. One week after, the clinical bleaching protocol was performed according to the technique's description which was done according to manufacture's recommendations.

To assess tooth sensitivity that could lead to treatment interruption, all patients were instructed to fill a daily visual analogic scale (VAS) form during the treatment (15 days), numbered from 0 (no pain) to 10 (maximum extreme pain), while notifying medication intake and oral lesions occurrences. Additionally, instruction forms were delivered with information regarding at-home bleaching procedures, food intake (to avoid acidic and potential staining foods), and oral hygiene. Patients were instructed to use their regular toothpaste during the whole study to avoid any potential change in tooth sensitivity unless it was a whitening toothpaste, in which case they were instructed to change to a non-whitening 1450-ppm fluoride-containing toothpaste.

Tooth colour measurements were performed at baseline, after bleaching treatment, and at the six-month follow-up. The colour of the upper central incisors and canines' buccal surfaces was assessed with the VC and VB shade guides with the patient seated on the dental chair while the calibrated examiner used the Smile Lite device with LED lights at 5500 K and a polarisation filter for standard lighting conditions. The shade tabs received a number to categorise each colour: VC tabs were numbered from 1 to 16 according to the colour's value order from the highest (B1) to lowest (C4), and VB tabs were also numbered according to the colour's value order from 1 to 15 (highest: 0M1; lowest: 5M3). The total tooth colour difference (ΔE_{00}) and tooth whiteness index (WID), with the corresponding difference (ΔWID), both based on the CIE $L^*a^*b^*$ colour notation system, were calculated to evaluate bleaching efficacy at the end of treatment and colour relapse at the six-month follow-up.

Results

Ninety participants were included in the study after the recruitment procedures: 56 females and 24 males, aged between 18 and 40 years old with a mean of 23.0 [22.8:23.4] years. A total of 80 bleaching treatments were completed (group A: 27; group B: 26; group C: 27) with an overall 11.1% attrition rate bias due to COVID-19 quarantine measures, leading to an overall 32.2% attrition bias at the six-month follow-up (group A: 20; group B: 20; group C: 21). Baseline CIE $L^*a^*b^*$, WID, and shade guide unit (SGU) values and did not show significant ($P > 0.05$) differences between groups, resulting in tooth-colour and whiteness homogeneity before bleaching treatment.

Bleaching efficacy analysis detected that the perceptibility thresholds in all techniques were surpassed in at least 98% of cases and attained 100% in the upper canines (98% for acceptability thresholds). Thus, all techniques showed bleaching efficacy even though the $\Delta E_{00}/\Delta WID/\Delta SGU$ were significantly higher ($P < 0.05$) in group C after bleaching. The L^* colour coordinate presented significantly ($P < 0.05$) higher mean values while a^* and b^* were lower when compared to baseline, indicating a lighter and less yellow tooth colour post-treatment. The WID mean values were significantly ($P < 0.05$) higher after bleaching in all groups, thus indicating increased levels of whiteness in tooth colour. The SGUVC and SGUVB mean values were significantly ($P < 0.05$) lower after bleaching, indicating that the examiners detected higher value colour tabs.

At the six-month follow-up, an inverse response was detected in all variables, with values becoming closer to the respective baseline. All techniques showed colour stability even though tooth colour relapse cases were higher in group C (83.3% cases).

There were no reports of treatment interruption due to tooth hypersensitivity or presence of oral lesions, with the overall VAS mean values between the three groups similar, without significant ($P > 0.05$) differences.

There was a noticeable improvement in OHRQoL after tooth bleaching, represented by significantly lower ($P < 0.05$) OHIP-14 total score values when all treatments were considered. However, no significant differences ($P > 0.05$) in OHIP-14 scores were detected within or between groups, indicating that changes in OHRQoL are not related to the bleaching technique.

Conclusions

The researchers concluded that all techniques presented bleaching efficacy, colour stability, and improvements in OHRQoL up to six months post-treatment.

Implications for practice

Clinicians may consider both at-home and in-office bleaching techniques with 6% HP to attain long-lasting satisfactory clinical results while producing positive changes in OHRQoL.

REFERENCE

1. Pereira R, Silveira J, Dias S, Cardoso A, Mata A, Marques D. Bleaching efficacy and quality of life of different bleaching techniques—randomized controlled trial. *Clinical Oral Investigations*. 2022 Aug 17:1-1.

1. Do different placement techniques for composite resins affect clinical success in Class II cavities?

Composite resin fillings are routinely used in posterior restorations and have almost completely replaced amalgam fillings as the material of choice. In many clinical cases, polymerisation shrinkage and the limited polymerisation depth of most conventional composites are prevented with the use of thinner composite layers.¹ Traditionally, the resin composites are placed in increments of 2 mm (maximum) that are cured separately (incremental technique)¹. This incremental technique provides sufficient light penetration and monomer conversion. However, it has disadvantages such as the risk of blood or saliva contamination between layers, bonding failures, and time-consuming protocols, and it is difficult to apply in large cavities. There are various benefits to bulk-filling of the cavities: it is more time-efficient and can avoid technical errors such as voids and contamination between layers.

Polymerisation shrinkage is one of the major disadvantages of conventional resin composite restorations. It has been associated with marginal insufficiencies, cracked cusps, cuspal movement, and enamel fractures, which may result in microleakage, postoperative sensitivity, and secondary caries¹. Shrinkage stress is influenced by tooth-related variables such as cavity size and configuration factors (C-factor). Cavities with a high C-factor will cause greater stresses owing to a greater number of bonded surfaces.¹

The most important factors that affect it are volumetric shrinkage of the restorative material and elastic modulus. In resin composites with a lower modulus of elasticity or a slower curing rate, lower polymerisation stress may occur.¹ However, these properties are often inversely proportional to each other and largely depend on the amount, size and shape, monomer structure, or chemistry of filler particles. Another important parameter for resin composite restoration is the depth of cure. Resin composite contains a photo-initiator that is triggered by blue visible light to activate the polymerisation.

Many resin composites contain camphorquinone as a primary photo-initiator and a tertiary amine as a co-initiator¹. In addition, photo-initiators such as trimethyl benzoyl diphenylphosphine oxide (TPO) and dibenzoylgermanium (Ivocerin) derivatives have also been used.¹ Various strategies have been developed by manufacturers to increase the depth of cure. In particular, extensive efforts have been made with new monomers, initiator systems, and filler technology; translucency was also increased for better light penetration and polymerisation. Based on these, manufacturers have presented to the market “bulk-fill composites” that can be polymerised in a single layer up to 4–5 mm thick. A material that is presented to the dental market is primarily evaluated in vitro conditions that simulate the oral environment. Nonetheless, clinical trials are needed to clearly determine the clinical properties of the materials. Kılınc & Demirbuga (2022)¹ reported on a trial that sought to evaluate the clinical success of bulk-fill resin composite positioned through different placement techniques (bulk-filling and incremental techniques) in Class II carious lesions using the criteria of the World Dental Federation (FDI) and the United States Public Health Service (USPHS). The tested null hypothesis was that “Placement techniques do not have a significant effect on the clinical success of bulk-fill resin composites.”

Materials and methods

This was a randomised, double-blind, and split-mouth clinical study. A total of 158 volunteers aged 18–22 years (the mean age of the participants was 19.2 years) with similar oral hygiene (none of the patients had gingivitis and periodontitis in the gingival health assessment), and similar oral hygiene habits (they had all brushed their teeth at least twice a day), and were inspected by two pre-calibrated dentists. Evaluations were made under reflector light using a mouth mirror, explorer, and periodontal probe. Using the inclusion–exclusion criteria and radiographic findings, 20 participants (12 females, 8 males) were included in the study. Patients were included if they had least, 4 Class-II caries lesions in first and second molar teeth (MO or DO); Good health systemically; An acceptable level of oral hygiene; Teeth with occlusal and proximal contact and were 18–20 years old. Those that had deep caries lesions reaching the pulp, bruxism, periodontal disease or secondary caries were excluded.

Four restorations (two bulk-fill resin composites that had different placement techniques (bulk-filling and incremental technique)) were placed randomly. In the present study, two different bulk-fill resin restorative composites (X-tra fil and Filtek Bulk) were used in the bulk-filling and incremental technique. The bulk-fill resin composites were used in both the bulk-filling and incremental techniques for the same participant. The study consists of 4 groups and 20 restorations in each group (80 restorations in total).

Cavities were prepared by a single dentist using a standardised protocol that included the use of rubber dam and did not exceed a depth of 4mm. A one-step universal adhesive system (Clearfil Universal) was used for the self-etch mode following the manufacturer’s instructions. After bonding procedures, the groups were created as follows.

1. X-tra fil (bulk-filling) (X-traB)
2. X-tra fil (incremental) (X-tral)
3. Filtek Bulk (bulk-filling) (FBB)
4. Filtek Bulk (incremental) (FBI)

For the incremental technique, the cavities were filled horizontally in two pieces with a 2mm thickness of each layer. For the bulk technique, one layer (approximately 4mm) was applied in bulk. An LED light device (Valo, 1000 mW/cm²) was used for the cure of the restorations according to the manufacturer’s recommendations (10s for X-tra fil, 20s for Filtek Bulk Fill). Diamond burs and sanding paper were used to finish and polish restoration.

Clinical evaluations of the restorations were done baseline, sixth-month, second-year, and fourth-year using FDI and USPHS criteria, by two calibrated scorers. The scorers were blind to the group assignment because they were not involved in the restoration procedures. In a double-blind randomized clinical trial design, subjects were likewise kept in the dark regarding their group assignment. In case of inconsistencies between scorers, the restorations were re-evaluated by two examiners and a final consensus was reached. The resulting data were recorded in the standardised case report form.

Evaluations of postoperative sensitivity were made seven days after restorative procedures by asking the patient about the effect of occlusal force (chewing) and cold/hot

stimuli. To detect secondary caries after four-year, bite-wing radiographs were taken. On the scales employed in the study, each criterion was assessed independently. It describes the characteristics of a clinically acceptable restoration on both scales. For each criterion, there are three scores ("alpha" for an ideal clinical condition, "bravo" for clinically acceptable condition, and "charlie" for clinically unacceptable condition.) in the USPHS and five ("clinically very good", "clinically good," "clinically sufficient/satisfactory," "clinically unsatisfactory," "clinically poor") in the FDI. In the USPHS criteria, regardless of the severity of postoperative sensitivity, when postoperative sensitivity was determined, it was evaluated as "charlie," and in the absence of postoperative sensitivity, it was evaluated as "alpha." Secondary caries was scored in the same way.

Results

All restoration was evaluated at baseline, six-month, two-year, and four-year recall. According to both criteria used in the current study, all 80 restorations of the 20 participants were evaluated without any loss.

Eight restorations (three restorations in the FBB group, four restorations in the FBI group, and one restoration in the X-tral group) were broken at the end of year four. There was no loss of any retention after four years. At the end

of four years, the groups showed no statistical difference between the baseline and the four-year findings ($P > 0.05$). When the groups were evaluated among themselves, there were no statistically significant differences in the four-year recall ($P > 0.05$). Postoperative sensitivity was not detected in any restoration after year four. The difference between the groups was not statistically significant at the baseline evaluation ($P > 0.05$). For all of the variables assessed: Marginal adaptation, Marginal discoloration, Secondary caries, Anatomical form and Colour match/ staining surface, there was no significant differences between the groups at the four-year recall.

Conclusions

The researchers concluded that there were no differences observed between the bulk-filling and incremental techniques at the end of four years.

Implications for practice

The longer term (four years) clinical success bulk-fill composites is not dependent on the placement technique used.

Reference:

1. Çakır Kılıç NN, Demirbuga S. The influence of different placement techniques on the clinical success of bulk-fill resin composites placed in Class II cavities: a 4-year randomized controlled clinical study. *Clinical Oral Investigations*. 2022 Oct 12:1-7.

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