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Review Article

Effectiveness and satisfaction of home-based external bleaching

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ABSTRACT

Hydrogen peroxide is the main ingredient in bleaching products (BP), and based on the settings of the reaction, can produce (per-)hydroxyl anions, superoxide anions, and other radicals. The radical-related oxidative mechanism can trigger the breakage of molecular bonds in enameller and dentinal stains, while the exact process is not entirely grasped. Products as a consequence look less colorful. The amount of the active bleaching component, the likelihood of BP interaction with discolorations, and the contact duration all affect the effectiveness of the bleaching treatment. Effectiveness also depends on a number of variables, including the individual's age, the type of staining, and the number of bleaching treatments. A significant number of local adverse effects have been recorded with over-the-counter items due to poorly fitted tray, adjuvants such as binders, preservatives, and flavors as well as a low pH, coexisting gingivitis, abrasion, and erosion. In cases of the coupled utilization of tobacco and excessive alcohol intake because tobacco users demonstrate lower levels of hypersensitivity to the BP and may be heavily influenced by the positive cosmetic effects, they must particularly be counseled against getting bleaching done as the combination has been found to pose elevated oral carcinoma risk. Overall, current literature has found a positive relation between procedure efficacy and patient satisfaction.

Keywords: Tooth bleaching, Over the counter hydrogen peroxide, Carbamide peroxide, Esthetic dentistry, Cosmetic dentistry

INTRODUCTION

Hydrogen peroxide is the main ingredient in BP, and based on the settings of the reaction, can produce (per-)hydroxyl anions, superoxide anions, and other radicals. According to their lifespan and the environment in which they react, both hydrogen peroxide and free radicals can permeate different depths into tooth material. The radical-related oxidative mechanism can trigger the breakage of molecular bonds in enameller and dentinal stains, while the exact process is not entirely grasped. Products as a consequence look less colorful.[1] Carbamide peroxide, a chemical that makes bleaching agents more stable, is an ingredient in many over the counter and patient-administered at-home BP. Carbamide peroxide breaks down into 36% hydrogen peroxide and 65% urea when exposed to water in the mouth. As urea disintegrates into ammonia and carbon dioxide, hydrogen peroxide further breaks down into water and oxygen. Ammonia may contribute to an advantageous basic solution that can enhance the radical forming reaction rate.[1] There has not been much investigation on the performance of over-the-counter solutions among the many tooth whitening techniques. The techniques, treatments, active bleaching chemicals, concentrations, additions, and pH of these products can all vary greatly. The normal concentration of carbamide peroxide in over-the-counter BP that use

prefabricated trays is from 16% to 35%.[2] By soaking the tray in hot water to soften it and applying it on the teeth prior to the actual product thermosets, the tray is fitted to the teeth. Because the tray rim's height cannot be adjusted, there is a greater chance of overfilling and friction with the gingival tissues. In contrast, dental practitioner-supervised at-home bleaching uses carbamide peroxide concentrations of 10% to 16% carbamide peroxide and is applied once or twice each day or at night for roughly two weeks.[2] Customized trays are used. The effectiveness of 10% carbamide peroxide BP used at home under professional supervision has been thoroughly examined. Yet, despite the fact that treatments made of up to 35% carbamide peroxide are offered on the global market, there is little study on the effectiveness of and negative effects brought on by carbamide peroxide levels of 20% or more. Only BP with less than 6% hydrogen peroxide may be applied by patients, and users below the age of 18 are not allowed to use BP at all, in accordance with the European Union (EU)- regulation on cosmetic products enacted in Scandinavia on November 1st, 2012.[3] The products can only be marketed to and utilized by dentistry experts after an adequate clinical evaluation is completed. It is well acknowledged that the amount of the active bleaching component, the likelihood of BP interaction with discolorations, and the contact duration all affect the effectiveness of the bleaching treatment (BT).[4] Additionally, effectiveness depends on a number of variables, including the individual's age, the type of staining, and the number of BT.[5] The tooth whitening product selected must be capable of producing a shade that is at least two steps lighter (VITA chart), in accordance with efficacy and safety recommendations.[4] Numerous local adverse effects of dental whitening have been documented, involving tooth sensitivity, sore or irritated gingiva or throat, and dental pain.[6] The first two occurrences are the most common.[1,7-11] Such outcomes may rely on the BP strength, exposure duration, insufficient, gingiva, pre-existing factors like dental sensitivity, eroded or abraded tooth structure, or gingival inflammation, cervical decay, and the number of restorations, in addition to user and/or care-related factors.[4,7,10,11]

LITERATURE SEARCH

This study is based on a comprehensive literature search conducted on November 16, 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about the effectiveness and satisfaction of home-based external bleaching. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

Efficacy

The VITA Classic shade chart is frequently used in bleaching efficacy research and in operation because it allegedly identifies shade variations with good precision that are therapeutically meaningful and that the user may notice.[12,13] Visual examination is a qualitative technique with subjectivity and may be affected by the inspector's assumptions, making it less reliable than more quantitative means like spectrophotometric methods. Nonetheless, there are a few drawbacks to using a spectroscopy, including the fact that readings cannot be made on tilted or misaligned teeth but only on the anterior teeth; Color information can only be detected in one way, not all wavelengths are read, translucency is not constant across the teeth, and curved dental surfaces may have a detrimental effect on the homogeneous reflection of light to the spectrophotometer.[14] Even just a comparatively short treatment period, as opposed to the more common two weeks when 10% carbamide peroxide night therapy is utilized, resulted in a sizable tooth shade lightening.[15] The tiny concentration difference (5.7% vs. 7.9% hydrogen peroxide) and the limited sample sizes are probably to blame for the identical bleaching efficacy results among the groups in investigations. The quantity may vary by 20%, according to the product details provided by different BP companies. No other oral carbamide peroxide-containing products that might have accelerated the bleaching process in any of the individuals did not appear to have been mentioned by the researchers in the literature that was studied. Studies done so far have not shown any evidence of a variation in the extent of tooth lightening following bleaching with equal doses.[2] Numerous studies have shown that bleaching with 10% carbamide peroxide for 3-5 hours, once or twice daily for 5-6 days results in a similar rise in tooth shade reduction.[4] According to Matis et al lesser dosages administered over longer times yield the same outcomes overall with fewer side effects.[16] Extended follow-up investigations with a bigger patient population would be ideal because, more than two weeks after BT was stopped, no improvement in lightening had been noticed and the individual variances remained significant.

Side effects

In other investigations, between 15% to 78% of patients receiving 10% carbamide peroxide admitted experiencing more sensitive teeth.[1,8] In one investigation, 64% (n=24) of the respondents stated tooth sensitivity in a comparison of three various preparations containing 10% carbamide peroxide, and 4% of the patients discontinued the intervention due to discomfort.[9] According to a different study, tooth sensitivity was so bad that 14% of the patients stopped the BT (10% carbamide peroxide).[17] Research have documented prevalence/incidence rates of increased tooth hypersensitivity ranging from 0 to 100%.[8] However, the majority of research reports prevalence of

15 to 80%.[1] Most of the time, tooth hypersensitivity goes away a few days after the BT, while reports have been made of prolonged periods of up to 39 days and later.[8,10.11,15,17] The following factors may account for the significant number of local adverse effects documented in a few research findings: First, these investigations use over-the-counter items with prepared trays. In one investigation in particular, it was found that the trays were poorly fitted when 11 and 17 patients, correspondingly, experienced gingival redness or irritation up to "the last day of treatment" visit ($p>0.05$; information not shown). Second, because the studies were conducted in academic environments, participants may have been more cognizant of negative effects. Third, adjuvants such as binders, preservatives, and flavors as well as a low pH (2-3) of the BP may have led to local negative impacts.[18] Gingivitis, abrasion, and aberration-pre-treatment symptoms that might have affected the start of adverse effects-were not evaluated or noted.[11] Lastly, a placebo-controlled category was omitted from certain research. Use of over-the-counter medications without patient assessment and follow-up is probably going to result in an even greater number and more severe adverse effects. Research revealing that a larger amount is more likely to induce higher dental hypersensitivity contradicted the lack of discernible variations in adverse reactions among the products.[5] Actual variations in modest impact parameters among small samples, nevertheless, cannot be anticipated, and this is especially true if therapeutic agent levels are possibly overlapping. It's also possible that the bleaching time was too little to identify any significant differences among the items. One analysis revealed that 68 (n=37) of the individuals experienced side symptoms that disappeared after two to three days. It is always possible, though, that the survey's design led to underreporting of adverse reactions. The shorter exposure times may help adverse influences cease prior to the scheduled conclusion of therapy. It has been shown in certain research that each study group tends to report more side effects during the second bleaching session than during the first, even if this difference is not statistically meaningful. The amount of bleach administrations that were finished during the two bleaching sessions is probably connected to this fact. There haven't been any unforeseen or quantitatively serious negative impacts documented in the research. According to observations, the bleaching tray may overlay soft tissue, resulting in burning, inflammation, and gingival bleaching through exposure to the bleaching gel.[1] In this investigation using prefabricated trays, more participants (63%) experienced sore or irritated gingiva than in a clinical trial using 10% carbamide peroxide in customized trays, which affected up to 34% of the participants.[8,9] It's possible that a few patients in the current trial didn't fit the tray correctly, which raised the risk of gingival irritation. The likelihood of improperly fitted trays will often increase with the usage of over-the-counter products. The patients' experiences with side effects revealed significant individual differences. Some patients stopped their trials early because they were uncomfortable. Approximately 14% and 20% of patients receiving 10% carbamide peroxide (dentist-supervised at-home treatment) stopped receiving it, while 14% halted receiving different carbamide peroxide levels.[11,15,18]

Visual analogue scale measurement

Visual analogue scale (VAS) is a quantification approach that assigns a set of ratings to traits or attitudes along a gradation of values that are difficult to quantify explicitly, like the degree of acuity of an incident. The technique is frequently used in combination with bleaching to pain assessment. The words used to describe the most extreme (such as "traumatic," "intense," "intolerable," etc.) and lowest intensity (such as "zero pain," "totally no pain," "tolerable pain," etc.) perception will have an impact on how the responses are graded.[19] As a result, it is challenging to correlate VAS results across research. In one investigation, 38 individuals (66%, n=38) experienced dental hypersensitivity at some point throughout the investigation, with values ranging from 1 to 7. The average VAS grade was similar to those discovered following both therapy with 10% carbamide peroxide in a specially designed tray (3.38±1.66) and over-the-counter BP with 5.3% hydrogen peroxide bleaching strips (2.62±1.46) seven days after the therapy.[20] Other investigations have noted dental sensitivity with a mean VAS score of around 4, including 24 hours following therapy with 28% hydrogen peroxide mixed with light (worst: "unendurable sensitivity") and post-bleaching with 35–38% hydrogen peroxide paired with light (worst: "extreme discomfort").[21,22] In the later trial, the equivalent average VAS grade for gingival sensitivity was 1.11±0.9.

Tobacco use

Both cigarette smokers and "snus" consumers participated in experiments that used tobacco; it is unknown how each tobacco product may have an impact on the effectiveness of bleaching. In many investigations, the proportion of users of each tobacco product was not stated. Additionally, the participants weren't questioned as to whether they persisted to smoke during the bleaching procedure. Contrary to the statistically insignificant link between tobacco use and hypersensitivity in the at-home bleaching study population (n=143), it was discovered in one investigation that tobacco consumers experienced considerably less hypersensitivity than non-users (days 1-3). The aforementioned findings highlight the need for confirmation of significant results in small study groups. There is considerable controversy regarding the impact of "snus" use on dental and overall health because research with long-term follow-up is insufficient. Studies indicating an elevated risk of oral cancer brought on by "snus" consumption outnumber those indicating no risk significantly.[23] Regarding the coupled utilization of tobacco, excessive alcohol intake, and bleaching's higher likelihood of causing cancer, tobacco users must particularly be counseled against getting bleaching done

because they might be influenced by the procedure's ostensibly positive cosmetic effects and, as this study's findings show, lower levels of hypersensitivity in the initial bleaching days.[1]

Patient satisfaction

Most researchers found a link between user contentment with the procedure and procedure efficacy.[24] The practitioner may not be able to estimate the level of contentment because it may depend on personal needs and desires.

CONCLUSION

There are limitations to the current studies on how effective and satisfying at-home external bleaching is. Notwithstanding the brief bleaching period, almost all subjects stated the adverse impacts they felt they had experienced, without regard for their kind or degree. Users are expected to gain from the regulations indicated in the EU directive for cosmetic items, even though level of satisfaction with bleaching results and commodity convenience factor were high for over-the-counter treatments. Prior undergoing bleaching, users must be made aware of the possibility of adverse impacts as well as significant individual variations in the kinds and severity of side effects. It is hard to accurately predict if a patient will be satisfied with the BT outcomes.

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