Raheel Malik

# Dental Bleaching: An Update

**Abstract:** Bleaching is a commonly sought aesthetic treatment. In recent years there have been changes to the legal aspects of dental bleaching. This article provides an overview of dental bleaching, the changes that have occurred and how they may affect the provision of this treatment. The article also discusses tray design, sensitivity and adhesive bonding, and summarizes the most common bleaching protocols currently used.

**CPD/Clinical Relevance:** Clinicians should be aware of dental bleaching legalities and the methods and techniques used to treat discoloured teeth.

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A subjective perception of tooth discoloration, or of having an unattractive natural tooth colour, can entice a patient to seek aesthetic enhancing procedures such as tooth bleaching. This safe[1] treatment was popularized by Haywood and Heymann in 1989.[2] They published a protocol on placing carbamide peroxide in custom-fabricated trays to lighten teeth.[2] Today, the basic principles remain the same, although there have been many modifications to the procedure. The active ingredient in bleach is hydrogen peroxide ($H_2O_2$), either contained or released. There are several products available on the market and these differ in flavour, stabilizers, anti-sensitive agents, delivery, storage and marketing of the product. Regardless of who supplies the $H_2O_2$, if it is kept on the teeth for long enough whilst also adhering to a safe protocol, most teeth will bleach.

Methods available for bleaching teeth include the following.

***1. Vital bleaching techniques:***

- Nightguard vital bleaching;
- Day-time vital bleaching.
- Assisted bleaching.

***2. Non-vital bleaching techniques***

- Inside/outside bleaching

**Raheel Malik**, BDS(Lond), BSc(Hons), General Dental Practitioner, Private Practice, Notting Hill. Programme Director, Clinical Tutor and Lecturer, Aspire Dental Academy.

## Legality in the UK

In the UK, tooth bleaching has been associated with controversy, mainly in terms of its alleged legality, treatment provider and the concentrations of bleach that can be used.

In the case of *Optident Limited and Ultradent Productions Inc vs. The Secretary of State for Trade and Industry and The Secretary of State for Health* (June 2001), the House of Lords deemed tooth bleaching to be covered by the EU Cosmetics Directive (implemented in the UK via the cosmetic products safety regulations) and not the Medical Devices Directive. At the end of a tortuous series of judgments, the House of Lords concluded that bleaching of teeth was mainly used for aesthetic enhancement and not the cure of disease. This in turn meant that the EU Directive set in 1976, which stated that cosmetic products could not contain more then 0.1% hydrogen peroxide, was still applicable.[3] This led to several problems. Companies were not allowed to supply bleaching products containing more than 0.1% hydrogen peroxide and, if caught doing so, could, in theory, be prosecuted by UK Trading Standards officers. Much to the bemusement and frustration of the profession, a dentist caught using more than 0.1% could theoretically face a GDC fitness to practise hearing for using a safe, evidence-based clinical procedure and, equally, clearly acting in the best interests of his/her patient, as recommended by the GDC to do so.[4] Fortunately, no such prosecution occurred. Additionally, the ruling also opened the way for non-dentists to offer tooth bleaching treatment, leading to the emergence of salon- and shopping centre-based treatments, and ultimately resulting in confusion about whether tooth bleaching was the practice of dentistry. In May 2013, following a high profile case, the UK High Court ruled '*that teeth whitening treatment comes within the practice of dentistry as identified in section 37 of the Dentists Act 1984.*' This made it illegal for anyone other than registered dentists, hygienists, or therapists under the supervision of a dentist, to practice bleaching.[5]

It was evident that the heart of the problem lay within the 1976 EU Council Directive on cosmetic products (76/768/EEC). Many groups and individuals had lobbied for an amendment for many years, which was finally published in September 2011 (2011/84/EU). This amendment merely added to the legal confusions that had marred bleaching for many years but meant that the law regarding UK cosmetic product safety had to change, which it did on October 2012. The new Cosmetics Products Directive listed a number of requirements that needed to be fulfilled

before bleaching could be lawfully satisfied in the UK.

The Directive states that 'over-the-counter' bleaching products, such as mouthrinses, toothpastes or dedicated tooth bleaching products cannot contain more then 0.1% hydrogen peroxide.[6] This concentration is too low to cause any significant colour change, but it does not stop manufacturers claiming that it does, or stop consumers buying the product in the belief that it will bleach their teeth.

Products containing between 0.1% and 6% hydrogen peroxide can only be supplied to a dentist and therefore only available to a consumer via the dentist. However, a number of conditions must be satisfied first.

***'An appropriate clinical examination is carried out'.*** A thorough clinical examination must initially be conducted, to ensure that the patient is free of any dental pathology, and to identify any risk factors that might affect the bleaching process. A thorough medical history is required. Though there are few contra-indications to the process, bleaching should probably not be undertaken in pregnant and lactating women. Although there is no evidence to suggest harm to a mother, foetus or newborn/infant, a study to establish this would be absurd. Anecdotally, it may be preferred to wait until the child is born, or, for breastfeeding mothers, until breastfeeding has discontinued. Patients diagnosed with Glucose 6-Phosphate dehydrogenase deficiency and Acatalasemia, which are rare inherited conditions, and affect the metabolism of $H_2O_2$, should avoid bleaching; or if bleaching is requested by such a patient, and use is deemed in his/her best interests for identifiable reasons, then a very mild form of peroxide should be used.[7]

***'Exposure to bleaching products is limited so as to ensure that the products are used only as intended in terms of frequency and duration of application.'*** To prevent misuse, the dentist must ensure that the patient can apply the product safely and is aware of the consequences of over-use. Verbal instructions, a detailed instruction sheet, and a chairside demonstration would aid in satisfying this criterion. This will also satisfy another condition of the Directive which states, ***'For each cycle of use, the first use should be limited to dental practitioners, or under their direct supervision, if an equivalent level of safety is ensured.'*** Essentially, for the first use, the dentist must ensure that the tray is fit for purpose, place bleach in the tray and show the patient how to place the tray and remove any excess. This is also true for patients who are to undergo another cycle of bleaching. The dentist must ensure that the patient attends for an appropriate clinical examination prior to commencement of bleaching, at which point the existing trays must be assessed and passed fit for continued use before bleach is supplied. Receptionists can no longer just supply the bleach. As mentioned above, the Directive stated '*under direct supervision*'; this means that a suitably trained hygienist or therapist can provide bleaching, even for the first cycle of use, but only as long as it is prescribed by the dentist and safety can be ensured. Some indemnity providers advise that a dentist is on the premises when the first cycle is administered by the hygienist or therapist.

***'The bleaching process should not be done in patients under the age of 18.'*** The Directive only allows the bleaching process for those aged 18 or over. Under-18s who seek bleaching for purely aesthetic reasons can therefore only be treated with the wholly ineffective concentration of 0.1% of $H_2O_2$. If a patient under 18 has his/her teeth bleached, the operating dentist could potentially face a prison sentence not exceeding 6 months, a £5,000 fine or – in the worst-case-scenario – both,[8] and a fitness to practise hearing at the GDC. This can pose an ethical dilemma for the dentist when presented with a discoloured anterior tooth or, more pertinently, multiple discoloured teeth, in a teenager who may be affected socio-psychologically as a result. Is the dentist still not to treat the problem teeth? Should we not act in a patient's best interest, as ordered by the GDC? Fortunately, in May 2014, the GDC clarified their stance, stating that dentists can bleach under 18s without fear of prosecution, providing it is carried out for treating or preventing disease and not for elective cosmetic reasons.[9] However, it is still advised that dentists seek the opinion of their indemnity provider before providing such treatment in under 18s. It is still somewhat perplexing that one can legally provide destructive elective treatments, such as ceramic veneers, crowns or even extractions for this group, but the scientifically proven-to-be-safe and non-destructive dental bleaching is precluded by UK law.

***'An appropriate labelling regarding the concentration in hydrogen peroxide of the tooth whitening or bleaching products containing more than 0.1 %.'*** Manufacturers should ensure correct labelling of all bleaching products supplied.

It is good practice when undertaking any tooth bleaching procedure that a consent form is utilized. It may help to ensure that patients understand the treatment and associated benefits and risks. Contemporaneous notes should be recorded and previous bleaching episodes enquired about.

The Directive states a concentration of greater than 6% hydrogen peroxide cannot be used. This limits the use to 6% $H_2O_2$ and 10% and 16% carbamide peroxide. 10% carbamide peroxide breaks down to 3.33%, $H_2O_2$ and 16% breaks down to 5 to 6%.[10] However, a quick internet search provides a plethora of shops that will distribute bleaching products, sometimes in excess of 30% to any consumer, regardless of age. Patient education is important in preventing this much more dangerous concentration of bleach being directly purchased by the consumer.

If the above law is breached, then criminal prosecutions are not undertaken by the GDC but by Trading Standards. The GDC will deal with fitness to practise associated with any breach by a dentist.

## Tray design

Tray fit may be crucial to the success of bleaching. Though this is an update on dental bleaching, tray design has not changed much over the years. A good fit prevents ingress of saliva into the tray. Saliva can reduce the efficacy of bleach by diluting it and salivary enzymes can inactivate the peroxide. A good fit also prevents leaching of gel on to the periodontal tissues.[11] Therefore, the dentist must ensure that the tray fits well before commencing.

The following decisions regarding tray design need to be made:

1. Scalloped (short tray) or non-scalloped (extended tray);
2. Reservoirs or no reservoirs.

Several limited studies have concluded that there are no clinically significant differences between tray designs in terms of the apparent degradation of bleach, efficacy, experience of sensitivity and,

**Figure 1.** A scalloped dental bleaching tray.

**Figure 2.** A non-scalloped dental bleaching tray.

ultimately, success of bleaching.[12] Generally, the design chosen is based on operator preference. A scalloped (Figure 1) tray may prevent gingival irritation by allowing easy removal of excess bleach. However, there is a higher risk of saliva leaching into the cervical area,[13] often leaving it darker than the remaining tooth. A non-scalloped tray (Figure 2) allows the cervical area to bleach more readily but makes removal of excess bleach more difficult, increasing the likelihood of gingival irritation. However, if the patient can be taught to apply the correct amount of bleach to each tooth, then this should be of little concern and any gingival irritation is reversible. Theoretically, reservoirs allow prolonged contact of bleach with the teeth. However, the results of several small studies have shown no clinically significant difference in the final shade achieved and the time in which it is achieved, whether reservoirs are used or not.[14]

## Sensitivity

A frequent adverse effect of bleaching is transient sensitivity. This varies from patient to patient but 15 to 65% of patients report it.[15] It is more common in the first few days of treatment and subsides as treatment progresses, completely disappearing after treatment is complete.[16] Advising the twice-daily use of an anti-sensitive toothpaste from the date of impressions to completion of the bleaching process may help. This may be aided further by using the same toothpaste in the trays for the first two nights of whitening. Alternatively, products containing amorphous calcium phosphate, such as MI paste (GC), both prior to and after the bleaching episode, are thought to reduce sensitivity.

Sensitivity is reportedly more severe with increased frequency of application[17] and a report has demonstrated increased sensitivity with higher concentration of bleach.[18] Higher concentrations do not bleach teeth more profoundly than lower concentrations, however, the length of treatment time may be reduced as the higher concentrations bleach teeth faster,[19] with the possible consequence of increased sensitivity. Therefore 16% carbamide peroxide is likely to bleach teeth more quickly than a 10% peroxide, but carries with it an increased risk of sensitivity. In the hope that teeth become whiter, some patients want to continue bleaching even after a desirable shade has been achieved. It is important to stress from the outset that teeth often reach 'optimum bleaching capacity' after which there will be no more change in colour, but if bleaching persists sensitivity could increase.

## Bonding of composites

Several laboratory studies have concluded that the bonding of composites immediately after bleaching of dental tissue results in significantly reduced bond strengths.[20] Bond strength is reduced for a number of different reasons. The tooth contains oxygen from the breakdown of peroxide, which prevents adequate curing of resin and prevents resin from infiltrating into the tubules. It is also thought that there are morphological changes to the structure of the enamel crystals and changes to the organic matrix of enamel and dentine, resulting in a reduction of bond strengths.[21] To increase the bond strengths following bleaching, different techniques have been promulgated. Several authors have suggested delaying the placement of the composite. Some suggest a delay of 1 week,[22] others a delay of 3 weeks,[23] with the assumption that this gives enough time for the oxygen to leave the tooth.[24] It is worth noting that a delay of 3 weeks in bonding also allows the colour of the teeth to stabilize prior to shade selection and is advised. Others have commented on the use of anti-oxidant solutions, such as sodium ascorbate, to be applied prior to bonding. Laboratory studies have shown sodium ascorbate to reverse compromised bond strengths to near normal. Currently, however, this is clinically impractical as it requires long contact time with the tooth to be effective[25] and no such product is yet available for commercial dental use. Studies have also assessed the bond strengths produced by different bonding agents on post-bleached teeth. Laboratory studies have concluded that the primer used in the bond can have an effect, with alcohol-based primers producing better bond strengths than acetone-based primers.[26]

## Summary of treatment steps

**Nightguard vital bleaching**

1. Patient assessment, expectations and diagnosis;
2. Identify and discuss any tooth-coloured restorations in the aesthetic zone as these will not bleach;
3. Identify any white spot lesions in the anterior zone and let patient know;
4. Gain informed consent;
5. Take pre-operative photographs and record pre-operative shade;
6. Take impressions, being careful to avoid air blows;
7. If appropriate, patient begins using anti-sensitive toothpaste;
8. Lab prescription – dictate teeth to be bleached, tray design, scalloped or not, reservoirs or not;
9. Fit trays;

**Figure 3.** Pre-operative view: inside/outside bleaching.

**Figure 4.** Post-operative view: 3 days of inside/outside bleaching.

10. Administer and demonstrate loading of the tray with 10%/16% carbamide peroxide. Provide written instructions;
11. Patient wears the trays at night, loading a small amount of bleach in each tooth space to be bleached;
12. Wear overnight for minimum 6–8 hours;
13. Review in 2 weeks, assess shade, soft tissue and gingival irritation and give remaining 2 weeks of bleaching gels;
14. Patient continues until final desired shade achieved;
15. Post-operative photographs.

#### Day-time vital bleaching

As above, but patient wears trays for 1 hour a day using 6% hydrogen peroxide.

#### Inside/outside bleaching

A technique used to treat non-vital discoloured teeth, commonly an anterior incisor. When treating a discoloured tooth, the least destructive option should be utilized. The preferred treatment for discoloration is bleaching and not an indirect restoration. Although restorations may be required to treat other aspects of the tooth, the colour should be corrected first.

1. Patient assessment, expectations and diagnosis;
2. Take pre-operative photographs and record pre-operative shade (Figure 3);
3. Gain informed consent;
4. Take impressions, being careful to avoid air blows;
5. Lab prescription – dictate tooth to be bleached;
6. On day of fit:
   -Remove restoration from access cavity, ensure it is fully removed as will hinder effectiveness of bleach;
   -Selective etching may help to ensure restoration is completely removed;
   -Remove 2–3 mm of coronal gutta-percha to below CEJ, otherwise cervical area does not bleach;
   -Possibly place barrier over the GP such as glass ionomer cement (GIC) or zinc phosphate. This is controversial, as the barrier material can stop bleaching at the neck of the tooth.
7. Patient instructions:
   -Place 10% CP into access cavity using syringe, the syringe can be marked with a black marker pen to ensure patient is in the correct position;
   -Load small amount of bleach in the tray, only on the tooth to be bleached;
   -Insert tray and remove excess;
   -Change bleach every 2 hours;
   -Leave tray in overnight with bleach.
8. Patient should stop when happy with the colour. It usually takes 2–3 days to reach the desired shade, at which point patient should be reviewed. Patient should be instructed to stop if he/she feels that the tooth is becoming over bleached in comparison to the adjacent teeth;
9. Access cavity sealed temporarily with, eg GIC;
10. Remove GIC 2–3 weeks later and restore with composite, ideally with a contrasting dentine shade;
11. Take post-operative photograph (Figure 4).

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