

## The dangers of chlorine dioxide tooth bleaching

### Linda Greenwall clarifies the situation and dispels the myths on teeth bleaching techniques

#### Introduction

There have been numerous reports in the UK press and media about Chlorine Dioxide Tooth Whitening. This has come about due to the legislation surrounding bleaching in the UK and ways of seeking a means to bypass the legislation and offer alternative to whitening. These whitening treatments have been offered by non dentists namely beauty therapists and hair dressers as a means of by passing the legislation using hydrogen peroxide tooth bleaching. It has been postulated that this is a 'safer and more gentle method for whitening teeth' as it does not use harsh hydrogen peroxide and in fact the reverse is true. Many UK dentists are now seeing patients who have experienced the damaging effects of chlorine dioxide tooth bleaching. There are not many established protocols in how to deal with the resulting damage and how to repair this damage. It is the aim of this article to discuss the dangers of this material as a bleaching treatment and the harmful resultant effects that have been seen on teeth. Guidance on repairing the damage will be also discussed.

UK legislation and historical background In the UK the bleaching materials have been classified as cosmetics according to the ruling of the Law Lords in 2001. The House of Lords Judgement in June 2001 confirmed that tooth whitening agents are covered by European Council Directive on Cosmetic Products 76/768/EEC, which allows the supply and use of tooth whitening products provided they

contain no more than 0.1% hydrogen peroxide present or released. This limit is statutory in this country under the UK Cosmetic Products (Safety) Regulations 1996.

In March 2005 the European Commission's Scientific Committee for Consumer Products (SCCP) issued an 'Opinion' that tooth whitening products containing up to 6% hydrogen peroxide present or released would be safe. In the light of this recommendation at the time the Government issued a directive to all Trading Standards Officers in the UK to adopt a 'laissez faire' attitude to enforcement; what they termed a 'flexible policy'.

In the 18 months that followed, the debate continued to rage as more manufacturers and importers sold equipment to dentists and, increasingly, to beauty therapists. Was it legal to supply products containing more than 0.1% hydrogen peroxide? Most of the products that have proven effectiveness and safety studies (Haywood and Heymann 1989) contain a minimum of 3% hydrogen peroxide

A new report published by the SCCNFP, Scientific committee in Europe in January 2008 recommends the use of up to 6% HP being a safe limit to use. The committee has however not recommended the use of over the counter products being sold direct to consumers. They recommend that these products are only prescribed and administered by dentists. As a result of this statement it is expected that eventually this recommendation will be ratified by the European Council and this will eventually be ratified by the UK government. The time scale on this is not clear. This present situation effectively means that UK dentists by supplying the home bleaching materials containing from 3% HP which is equivalent to 10% carbamide peroxide are supplying these products illegally to their patients.

The General Dental Council issued a statement in June 2007 that only registered dentists may undertake tooth whitening. As such they will prosecute any non dentist for undertaking such whitening treatment no matter which bleaching agent they use. This has led to numerous reports to the General Dental Council (GDC) which they are at present dealing with. At this present stage this means that the Department of Trading Standards can send trading standards officers into a dental prac-

tice without warning and ask to inspect the bleaching products which a dentist supplies. Some dentists have been issued with warning notices from trading standards officers in the regions of Yorkshire and Lincolnshire. This is causing worry to these dentists so they are discontinuing offering whitening treatments to patients.

#### The Introduction of chlorine dioxide tooth whitening gel

These gels have been introduced as a means of bypassing the whitening legislation. Many of these materials have been sold directly to beauty therapists and other non dental practitioners, such as health spas and beauty spas on cruise liners. Many of these companies supplying these Chlorine dioxide agents are supplying cruise liners in the hope that these beauty products will thus be under maritime legislation as the treatments are not officially conducted in the UK soil.

These products are causing harm to teeth. These products are thus subject to the Consume Safety Act of 1987 and Product safety legislation of 2005 that states that no product should cause harm to the consumer. There are no published studies on the safety and effectiveness of chlorine dioxide as a whitening treatment on the pubmed website which keeps records of all published medical and dental research in peer reviewed journals. The beauty therapists are advised to check their product safety assessment.

#### History of chlorine dioxide as a whitening agent

As early as 1848, nonvital tooth bleaching with chloride of lime was practiced Dwinelle (1850). Truman is often credited with introducing, well before 1864, the most effective technique for bleaching nonvital teeth, which used chlorine from a solution of calcium hydrochlorite and acetic acid (Haywood 1992) chlorine was also inserted into non-vital teeth in attempts to lighten them in the late 1880s. Many of these allergy attempts resulted in regression and some of the dental colleagues at the time advised that it was not worth the effort to whiten these teeth. The most effective technique for bleaching nonvital teeth, which used chlorine from a solution of cal-



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Today magazine and has written a book called 'Bleaching Techniques in Restorative Dentistry an Illustrated Guide' which was awarded Best New Dental Book of the Year 2001. Linda lectures all over the world on all aspects of combining Bleaching with Aesthetic and Restorative Dentistry. She is also the President of the British Bleaching Society.

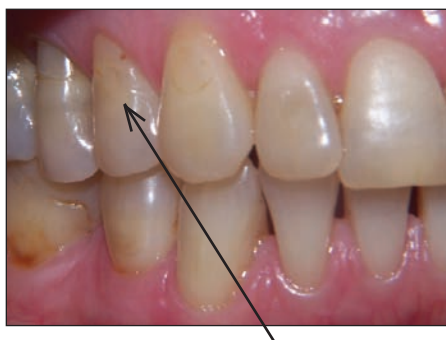


Figure 1a and b: Lateral views of the teeth - the arrows shows the difference between the teeth were not whitened were shiny and had not lost their lustre

cium hydrochlorite and acetic acid (Fasanara 1992). The commercial derivative of this, later known as Labarraque's solution, was a liquid chloride of soda Kirk (1889).

Chlorine dioxide is a green-yellow gas which oxidise rapidly. Chlorine dioxide has also been used as a germ killer, pesticide, reduction of oral malodour for breathe neutralisation. It is often used in the paper and pulp industries for whitening purposes.

In relatively low concentrations of chlorine dioxide, when contained in or released by tooth whitening compositions it may be effective and useful in whitening teeth. The chlorine dioxide contained in or released by tooth whitening compositions, when placed in contact with the tooth surface, is observed to rapidly oxidise tooth stains, rendering the treated tooth surface relatively whiter after the contact (Montgomery 1999).

### Chlorine dioxide and the beauty therapists

It appears that the majority of non-dental practitioners who are using these treatments are the beauty therapists. The UK Beauty therapists website BABTAC.co.uk advises their members 'that you could well have a claim against the person who sold you the equipment and consumables under The Sale Of Goods Act 1979 (the equipment not being 'fit for the purpose') or the Supply of Goods to Consumers Regulations 2002 - and the Misrepresentation Act 1967 might get you

out of any lease agreements on the hardware. BABTAC has already helped one member secure their position in this way'.

### The current chlorine dioxide whitening treatments

The current whitening treatments are sold as a chairside procedure in the beauty spa. The material consists of two products which are mixed together. One is a sodium chlorite and the other one portion contains a chlorine dioxide precursor (CDP), such as sodium chlorite, and another portion contains an acidulant (ACD) containing 2.0% anhydrous citric acid. The composition formed from an admixture of the two portions may be placed in contact with a stained tooth surface to effect whitening.

A low concentration of chlorine dioxide gel is applied directly to the teeth. This material is then left in place for a period of about twenty minutes to forty minutes. The process is enhanced with an LED light. Usually three applications are applied to the teeth. The client (patient) is then given a take home kit which either contains further chlorine dioxide gels or other carbamide peroxide gel to continue the whitening effect for a period of time. This take home kit is often a brush on applicator which is used to enhance the whitening. It is stated in some of the websites that the product is completely safe because it is a food additive and the effects will last permanently as long as the home brush on kit is used twice a week on



Figure 2: Intraoral view of teeth following whitening

a long-term basis. If eating is undertaken then the brush on applicator should be used half an hour before and half an hour after.

### Problems arising

Many of the chlorine dioxide gels are acidic. The pH range is from 1-3. As a result of the acid effect directly on the teeth, the resultant effect is that of etching the tooth permanently. At the end of the treatment the teeth appear white and this may be due to the dehydration effects as with other power whitening chairside techniques. The tooth loses its tooth lustre or shine and this can be a permanent effect. This loss of tooth lustre also makes the tooth feel rougher. Many of the clients have reported that the teeth seem to pick up further staining and become even more discoloured than before the treatment. The resulting discolouration is yellow to brown. Many patients report increased tooth sensitivity which is difficult to manage and not easy to desensitise.

### Further problems

These chlorine dioxide treatments are advertised as safe for teeth. It is certainly not the case. They also contain further instructions for the consumer which often gives misleading advice 'when asked will it lighten my crowns and veneers it states that it will only return to the original colour'. Research has shown that the process of whitening does not affect porcelain crowns. Clients are then advised to use the 'white teeth diet' which is to drink their

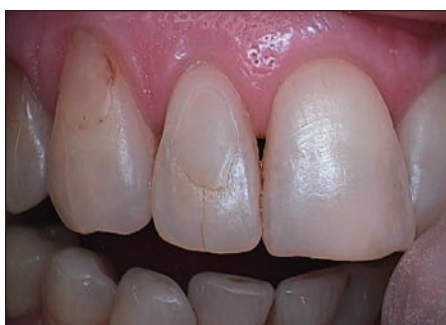


Figure 3: Intraoral view showing etched appearance



Figure 4: Close up detail of the central incisor



Figure 5: Results of whitening with chlorine dioxide from another patient. Final shade of teeth is C4 and teeth appear etched

Table 1

The damaging effect of chlorine dioxide whitening treatment on teeth:

- Etching of teeth
- Loss of tooth lustre
- Teeth appearing more discoloured
- Teeth absorbing more stains than before
- Teeth feeling rough
- Teeth more sensitive
- Teeth permanently sensitive.

Table 2

Reported systemic effects of the toxic problems associated with chlorine dioxide whitening treatments for teeth.

- Inhalation and other breathing difficulties
- Exacerbation of patients asthmatic condition
- Increased heart rate and palpitations
- Heart Irregularities
- Eyes watering
- Admission into the casualty and the emergency room

coffee through a straw and to drink white wine instead of red wine and to refrain from drinking cranberry juice and to rather drink grapefruit juice. This is misleading information as the grapefruit juice has a very low pH and drunk in excessive amounts can cause erosion onto the surfaces of the teeth.

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## References

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Table 3:

Options/ suggestions for treatment post chlorine dioxide whitening treatment

### Dealing with sensitivity:

- Desensitising the teeth with the normal desensitising agents
- Making a home tray for the patient in which to apply the desensitising agents for longer lasting effect.
- The application of amorphous calcium phosphate directly onto the surfaces of the teeth or into the whitening tray to return the calcium and phosphate back into the tooth.

### Dealing with the discolouration:

- Rewhitening the teeth using normal home bleaching agents such as 10% carbamide peroxide particularly those which have added desensitisers to reduce likelihood of further sensitivity
- These teeth may require prolonged whitening as it may take time to eradicate the brown discolouration from the tooth.

### Dealing with the loss of tooth lustre:

- Applying bonding agents directly to the affected teeth
- Applying enamel glazes effects to restore the lustre to the teeth

### Dealing with the permanent effect of enamel damage

- If all the above simple measures are not effective, it may be necessary to place porcelain veneers over all the affected teeth
- However etching the teeth to place the veneers may be difficult.

Linda Greenwall will be speaking, along with Edward Lynch and Sia Mirfendereski at The business of bleaching 2008 on Monday 3 November 2008 at the Holiday Inn Bloomsbury, London. This seminar will bring discuss the essential update associated with bleaching and the recent changes that have been made, which will bring you up to date on the very latest legal issues in bleaching. Linda will also be hosting a full-day hands-on bleaching session on Saturday 8 November which will incorporate both home bleaching and power bleaching. For further information and to book your places please call Independent Seminars on 0800 371652 or visit [www.independentseminars.com](http://www.independentseminars.com)

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