

TOOTH WHITENING

Written by **Dr Linda Greenwall**



Linda Greenwall looks back over the history of tooth whitening

The introduction of contemporary tooth whitening techniques was launched with the key research paper called 'Nightguard Vital Bleaching', published in 1989 by Quintessence publishing. The authors, Van Haywood and Harald Heymann, described the use of a bleaching tray to use as a vehicle to place the whitening gel into the mouth for better retention and to give better long lasting and predictable results. Further research by the authors has showed the effectivity, efficacy, predictability, longevity and reduction in side effects. It is now 26 years since that this first paper was published and this article will review how in a quarter of a century tooth whitening has become a valued treatment service for patients. Millions of people around the world have benefitted from tooth whitening and its popularity continues to grow (Greenwall, 2001).

Although tooth whitening techniques were popular in the 1980s using strong concentrations of hydrogen peroxide and a bleaching lamp, the modern techniques now focus on the use of a bleaching tray and applying products in the tray at home. It was Bill Klausmier, an American orthodontist, who started using the technique in 1968 to help reduce gingivae swelling post orthodontic treatment. He advised his patients to use peroxy mouthwash in the retainer to reduce the gingival hyperplasia (Haywood 1991a). At his six-month recall he noted that not only was the gingivae significantly improved, but the teeth were whiter. This chance finding has allowed many patients to benefit from these techniques. He wrote a paper after 40 years of using this technique and reported that nobody needed a root canal treatment, broke a tooth or damaged a tooth following the use of peroxide in the tray. He advised his colleagues in the local study group to use this technique, which was passed onto Dr Van Haywood, who began research.

THE EARLY RESEARCH

The early research focussed on whether the whitening products were safe and effective. Professor Yiming Li from the university of Loma Linda has devoted the last 20 years of his research life investigating the safety of hydrogen peroxide and he has concluded that it was safe to use as a whitening agent in the oral cavity as long as the products used are dentist supervised and monitored by the dentist and the dental team (Li et al, 2013). There was extensive research conducted on the side effect of sensitivity, which occurs in up to 85% of patients. Research was conducted as to how and why the sensitivity occurred and how best to treat it. It was discovered that the whitening gel penetrates the tooth within five to 15 minutes of gel application. Therefore it is essential to assess that the

pulp of all the teeth are healthy prior to undertaking any whitening procedure. If whitening was to be undertaken in the presence of a non-vital area, the area will flare up and need a root canal treatment.

HOW HAVE THINGS CHANGES

Changes in the whitening legislation were introduced in 2011. The Cosmetic Products (Safety) Amendment Regulations 2012 (implementing Directive 2011/84 EU which amends Directive 76/768/EEC) come into force on 31 October 2012. The legislation specified that products containing or releasing between 0.1% and 6% hydrogen peroxide cannot be used on any person under 18 years of age, except where such use is intended wholly for the purpose of treating or preventing disease.

Products containing or releasing less than 0.1% of hydrogen peroxide, including mouth rinse, toothpaste and tooth whitening or bleaching products are safe and will continue to be freely available on the market. Tooth whitening or bleaching products containing or releasing between 0.1%-6% of hydrogen peroxide may be used provided an appropriate clinical examination is carried out in order to ensure that there are no risk factors and any other oral pathology is ruled out. Tooth whitening products containing or releasing between 0.1% and 6% hydrogen peroxide may only be sold to dental practitioners.

For each cycle of use, the first use must be carried out by a dental practitioner or under their direct supervision if an equivalent level of safety is ensured. After the first cycle of use, the product may be provided by the dental practitioner to the consumer to complete the cycle of use. The concentrations exceeding 6% of hydrogen peroxide remain prohibited unless wholly for the purpose of the treatment or prevention of disease.

WHITENING TECHNIQUES

There are two basic techniques for home



Figure 1: An advanced whitening case with a diagnosis of Fluorosis. This patient had direct composite bondings placed over the upper central incisor teeth to mask the discolouration which were removed prior to whitening. Home bleaching was undertaken with 10% carbamide peroxide in a bleaching tray and reviewed after two weeks



Figure 2: Result after whitening with carbamide peroxide for 8-10 weeks

bleaching depending on the products; either night-time use, using a carbamide peroxide material or a day-time use using a hydrogen peroxide only material.

The treatment options for both vital and non-vital teeth have changed over the last 25 years with the introduction of whitening techniques. These days a sectional whitening tray can be used to whiten the single dark tooth, whether vital or non vital. It is essential to whiten the dark tooth first in order to establish the whitening potential and possibility of the dark tooth first.

When the patient receives mild trauma to an anterior tooth, the tooth tries to repair and heal itself by laying down extra secondary and tertiary dentine in the pulp chamber. The trauma results in bleeding into the pulp chamber and pulp canal. The blood products reorganise and breaks down into iron. The discolouration is a result of the bleeding and the formation of secondary and tertiary dentine. This can be detected when the tooth is a different colour to its neighbour by about one or two shades only. In the past it was thought that these teeth which are diagnosed and having Calcific Metamorphosis (Haywood, 2010) need to have root canal treatments. This is not true and they need only be whitened.

The techniques for non-vital bleaching have also evolved with the banning of sodium perborate by the scientific committee in Europe. They are concerned about the feototoxic and cytotoxic effects. The standard technique, which was called the 'Walking Bleach' technique and first described by Nutting and Poe in 1965 (Nutting and Poe, 1967), was advocated by using sodium perborate mixed with 35% per cent hydrogen peroxide. The two products together act synergistically and create the equivalent of 50% hydrogen peroxide, which is too caustic for a root canal considering that it may be affected by trauma previously. High concentrations of hydrogen peroxide have been banned in Europe and it may only be possible to use 6% hydrogen peroxide sealed into a root canal. In addition the strong concentrations of hydrogen peroxide in combination with previous trauma to the tooth may result in cervical resorption (Cvek, 1985; Hierthersay, 1999) which has been extensively described in the literature.

There are now new modifications for this treatment which involved the use of a bleaching tray and a segmental bleaching tray. These day 16% carbamide peroxide is sealed into the root canal and the patient uses the bleaching tray to whiten the external surface of the tooth so the tooth is effectively whitening from the inside and the outside of the tooth at the same technique.

A modification was described by Dr Willie Liebenberg in 1997 where he advocated leaving the access cavity of the nonvital tooth open and the patient was to apply the whitening syringe directly into the access cavity every two hours, thereby whitening the tooth over the course of the weekend. The patient was to return at the end of the weekend and the access cavity was disinfected and cleaned and the pulp chamber restored with glass ionomer.



Figure 3: This patient had a basic inherent grey shade of his teeth



Figure 4: The result after whitening for six weeks with home bleaching trays using 10% carbamide peroxide whitening gel

PATIENT EXPECTATIONS

With the introduction of the whitening gels and treatment, patients are now demanding to have whiter teeth. Expectations need to be kept narrow and defined and the dentist should be able to explain to the patient exactly when undertaking whitening treatment exactly what they can expect and what will not happen in terms of expecting a uniform whiteness when some teeth do not bleach evenly. Darker and more difficult discolourations can be treated with home bleaching at 10% carbamide peroxide but the treatment times are extended to 8-10 weeks. Patient who have tetracycline stained teeth will be able to achieve whitening, but the treatment times are much longer.

There is no age restrictions for older age patients to be able to whiten their teeth (Kelleher et al 2011) and it is a factor of anatomy as to how quick the whitening gel can penetrate into the tooth. Older teeth are more heavily compacted with secondary dentine and so their teeth will take longer to whiten. Younger teeth will lighten quicker as enamel is young. Despite the fact that there are larger pulp canals and pulp chambers, young patients who undertake whitening do not demonstrate more sensitivity than older patients (Greenwall 2009).

Considering the 25 year time period, it is expected that patients may whiten four to five times in this time period. Maintenance is essential and this involves regular professional oral prophylaxis maintenance, the use of whitening toothpaste and sometimes a reduction in consumption of food and drink that cause staining. Over the past quarter century it has been possible to whiten the teeth beyond the normal original vita classic shade guides. New shade guides have been developed to match the new shades of white and porcelain and composite shades have been introduced onto the market. There are some patients that have developed a syndrome where they continually seek whiter and whiter teeth. This is also associated with body dysmorphophobia and low self esteem.

THE FUTURE

There are exciting new developments in tooth whitening products with the introduction of whitening varnish. The tooth is coated with a varnish which contains 6% hydrogen peroxide varnish. This hydrophilic (moisture-loving) varnish adheres well to the tooth, delivering the active agent directly into the enamel and dentine. A second layer, a sealant, dries onto the tooth and is supposed to lock the hydrogen peroxide layer in place. This varnish layer is hydrophobic and the two varnish layers are immiscible during application. The varnish is left on the teeth for 30 minutes per day and then it is brushed off with a toothbrush. (Philips Zoom QuickPro whitening varnish). The 6% hydrogen peroxide whitening varnish is followed by an innovative sealant layer that dries in seconds and locks the hydrogen peroxide layer into place.

There are also new developments with enzymatic bleaching where two products are mixed together to activate and speed up the process of whitening.

CONCLUSION

Over the last 20 years the explosion in dental research into tooth whitening techniques has demonstrated that the whitening products are safe, effective, predictable to use and have many benefits for patients. Side effects such as sensitivity can be managed well, as the newer generations of whitening products now contain extra soothers such as potassium nitrate, fluoride and amorphous calcium phosphate. Patients have benefitted from their new shade of white teeth and these treatments have improved smiles in a natural and non-invasive way.

Further clarification in the whitening legislation for under 18s (Kelleher 2014) is being investigated by the CED in Europe and these treatments may be able to be used for under 18s provide that they are being used for the treatment of disease. It is expected that there will be an increase in the amount of professional tooth whitening materials available for patients to use under the direction of the dentist, and there are many new innovative whitening products which are being brought onto the market for patients to continue to enjoy a whiter, brighter smile. ●

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