Summary of: Tooth-whitening activity of a novel home-bleaching system utilising thermal diffusion: a multifactorial simultaneous evaluation of efficacy at cervical, body and incisal tooth sites

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FULL PAPER DETAILS

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Introduction The ability of a thermal diffusion system (TDS) to promote the tooth-whitening actions of a bleaching gel/bleaching activator combination product (containing a final hydrogen peroxide (H_2O_2) content of 10.0% (w/v)) towards discoloured 'smile-zone' teeth was examined. **Methods** Fifty teeth in 15 participants aged 18-62 years were investigated. The CIE tooth shade parameters L*, a* and b*, together with Vitapan shade scores (VSSs), were simultaneously recorded at three separate tooth areas (cervical, body and incisal sites) with a novel spectrophotometric monitoring system before treatment, and also at 14 days after completion of a 10-day treatment period in which the product was applied 'at-home' (twice daily). **Results** The tooth-whitening treatment administered gave rise to extremely significant increases in L*, and decreases in the a* and b* shade parameters for each of the tooth areas investigated ($p < 10^{-10}$). Post-treatment mean decreases in the VSS values were 8.26, 9.70 and 9.14 for the cervical, body and incisal areas respectively ($p < 10^{-8}$ in each case). Mean ΔE values determined post-treatment were also very highly significant for each tooth region examined ($p < 10^{-10}$ in each case). **Conclusions** The tooth-whitening system tested exerted extremely powerful bleaching actions in all tooth areas investigated. The order of tooth-whitening effectiveness was body > incisal > cervical for Δb^* and ΔE, and incisal > body > cervical for Δa^* and ΔL^*, and this may reflect the TDS's ability to promote the penetration of H_2O_2 to intrinsic stain sites.

EDITOR'S SUMMARY

We should not really be surprised at the growth of tooth whitening as a treatment procedure given the shift away from the treatment of caries in an increasingly healthy population combined with the desire to have good looking teeth and a great smile.

The science behind tooth whitening has also grown considerably in recent years as the demand for a more evidence-based approach has also increased. At a time when beauty was perhaps accepted as rather more transitory than it is now with increased longevity, then the robustness of the method and the ability to sustain the result become of increasing importance.

The method used in this research aimed to discover some of these hitherto less well understood concepts and pit them against measurable quantities rather than subjective, visual impressions pointing out that colour is a sensation rather than the property of an object. Indeed, the spectrophotometric shade determination system readily detected very highly significant differences between the three tooth regions investigated (cervical, body and incisal) for each of the shade parameters monitored. Perhaps not surprisingly, the cervical areas of the teeth exhibited the least bleaching agent-induced modification in terms of the overall score measurements. This phenomenon may be ascribable to the thin and translucent enamel layer present in the cervical areas, which allows a greater visibility of the more highly-discoloured underlying dentine. Hence, the dentine colour in this area is required to be bleached to a greater level so that the overall discoloured appearance of the teeth is significantly diminished.

The development of safe and effective tooth whitening systems can only serve to enhance the service that we can provide to patients who are likely to seek aesthetically pleasing solutions to what they perceive as less than 'bright white' smiles. While the UK version of this vision may differ from those of other nations, the importance of the efficacy remains the same and research into these aspects remains of great importance.

The full paper can be accessed from the *BDJ* website (www.bdj.co.uk), under 'Research' in the table of contents for Volume 212 issue 4.

Stephen Hancocks
Editor-in-Chief

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IN BRIEF
- Monitors the intensities of different tooth shade parameters simultaneously at three different regions of stained 'smile-zone' teeth.
- Studies the differential response of the cervical, body and incisal tooth areas to tooth-whitening treatment.
- Analyses the highly significant reduction observed for the tooth shade parameter a* by the treatment applied, which is difficult to achieve in clinical practice.

RESEARCH

COMMENTARY

The ability to provide tooth whitening can make significant differences to the colour of a person's teeth. Techniques vary and include 'in house bleaching' systems as well as a variety of 'at home' techniques using either customised or pre-formed trays, strips or paint on materials.

The efficacy of these techniques is a subjective decision, usually assessed against a shade guide. Differing light sources can influence what the naked eye sees, therefore under differing lighting conditions a tooth's colour can appear different.

The bleaching process is dependent on the diffusion of the active ingredients through the tooth surface. The effect is time dependent and influenced by the concentration of the active ingredients, the time it is in contact with the tooth surface and the temperature gradient between the tooth and agent.

This study by Grootveld *et al*. used a Crystaleye digital dental spectrophotometer to assess colour changes following the bleaching of the teeth of 15 patients (50 teeth). The patients' teeth were bleached with the get2smile Home Whitening system that included the use of a power thermal diffuser and 10% H_2O_2. Bleaching was done for ten days (40 minutes per session). The thermal diffuser raised the enamel surface to 38°C.

The spectrophotometer was used on the incisal, body and cervical regions of the tooth at base line and 14 days after bleaching to assess colour change. This enabled changes in L* (brightness) and a* and b* (intensities in green-red and blue-yellow colourations respectively) to be assessed as well as a corresponding Vita shade and a composite measure of overall colour modifications (ΔE).

The results indicated that there are differences in the effectiveness of tooth whitening for the three areas examined. The order of tooth whitening effectiveness was body area > incisal area > cervical area for Δb* and ΔE, and incisal > body > cervical for Δa* and ΔL*. This observation may relate to the thin and translucent layer of enamel in the cervical area overlying the more highly coloured dentine.

Instruments such as those used in this study will be of value in assessing the efficacy of bleaching products as they are developed or come to market.

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AUTHOR QUESTIONS AND ANSWERS

1. Why did you undertake this research?

The research was initiated to explore the ability of a thermal diffusion system to facilitate the tooth-whitening actions of a bleaching gel/bleaching activator combination product (for 'at-home' use) towards discoloured 'smile-zone' teeth in the cervical, body and incisal regions. Additionally we wanted to determine the effectiveness of a novel digital spectrophotometric system for the simultaneous monitoring of the above tooth shade parameters at each tooth region. We employed an ANOVA-based experimental design to determine the differential response of tooth regions towards the treatment applied, and the significance of further variables which contribute towards tooth stain intensities.

2. What would you like to do next in this area to follow on from this work?

Since this investigation provided much valuable information regarding the (differential) response status of tooth regions and their sub-regions to the tooth-whitening treatment applied, we shall employ multivariate statistical analysis techniques to explore relationships and inter-relationships between a) their pre-treatment shade intensity parameters and also the cervical, body and incisal regions and/or their sub-regions; and b) their corresponding differences observed following tooth-whitening treatment. The experimental design and techniques employed here will be further applied in clinical trials focused on a comparative examination of the bleaching activities of a series of tooth-whitening products.