

Whitening Research

1. C Morris-Clapp^{*1}, S Yeganeh¹, E Lynch¹ and M Grootveld²
(Department of Conservative Dentistry¹, and Inflammation Research Group²,
LHMC UK)
AN IN VITRO STUDY TO TEST THE EFFICACY OF FIVE WHITENING
AGENTS
Journal of Dental Research 74: 866, 354, 1995.

Home bleaching systems are in use in both the UK and North America, the majority of which are based on carbamide peroxide. Many 'over-the-counter' brands are now available to whiten teeth. We tested the efficacy of the lightening capacity of five brands of these agents by rating and ranking their whitening effects on sectioned, freshly extracted teeth. Ten teeth were sectioned and tested in each group and the results assessed blind by three operators.

The agents tested were:- (1) 2% sodium chlorite¹; (2) 0.3% carbamide peroxide, 0.5% sodium peroxodisulphate, 0.5% bromelain and 0.125% papain (Ultrawhite Opal rinse¹); (3) 0.3% carbamide peroxide, 0.5% sodium peroxodisulphate, 0.5% bromelain and 0.125% papain (Ultrawhite Opal toothpaste¹); (4) 0.1% chlorine dioxide mouthwash (retarDEX²); (5) 2% sodium chlorate, 0.125% papain (Dental White³).

The results in descending order of whitening efficacy on *intrinsic* staining were: Ultrawhite Opal rinse¹; Ultrawhite Opal toothpaste¹; 2% sodium chlorite¹; retarDEX²; Dental White³. The control (H₂O, pH 7.0) had no effect. The results in descending order of whitening efficacy on *extrinsic* staining were: Ultrawhite Opal rinse¹; Ultrawhite Opal toothpaste¹; 2% sodium chlorite¹. The other agents failed to remove *extrinsic* staining.

This study showed that Janina Opal spray and toothpaste were the most effective tooth whitening agents.

¹Janina International, UK. ²Rowpar Pharmaceuticals, USA. ³Medex, UK.

N.B. Since this study was carried out Ultrawhite Opal rinse changed its name to Janina Liquid Toothpaste Spray and the Ultrawhite Opal toothpaste changed its name to Janina Opale Whitening Toothpaste.

2. D Samarawickrama¹, M C Grootveld², A Sheerin² and E Lynch¹
(Conservative Dentistry¹ and Inflammation Research Group², LHMC, UK)
BLEACHING ACTIONS OF H₂O₂ ON MELANOIDINS STUDIED BY
SPECTROPHOTOMETRY
Journal of Dental Research 74: 576, 1405, 1995.

Non-enzymatic browning via mallard reactions is thought to be of much aetiological importance in extrinsic tooth discoloration. This complex process is initiated via the condensation reactions of carbonyl compounds or reducing sugars

with free amino groups present in amino acids, peptides, polypeptides and proteins, a process giving rise to melanoidins or 'browning products'. Possible substrates for Maillard reactions include glycoproteins of the acquired pellicle. Therefore, spectrophotometric evaluation of the H₂O₂ mediated bleaching of brown-pigmented melanoidins arising from the reactions of 2-deoxy-D-ribose with (a) *l*-lysine and (b) taurine was conducted. Aqueous solutions of (a) and (b) ($5.00 \times 10^{-3} \text{ mol.dm}^{-3}$) in $4.00 \times 10^{-2} \text{ mol.dm}^{-3}$ phosphate buffer (pH 7.20) were treated with an equivalent concentration of 2-deoxy-D-ribose and each reaction mixture then equilibrated at 60°C for 24hrs. these samples were then allowed to cool to ambient temperature, treated with H₂O₂ ($1.00 \times 10^{-2} \text{ mol.dm}^{-3}$) and the decrease in absorbance in the 250-440nm wavelength range monitored at 15min intervals. The results obtained demonstrated a time dependent bleaching of melanoidins by H₂O₂.

Spectrophotometry can be utilised to study the kinetic mechanisms and extent of bleaching by H₂O₂ – containing tooth whitening products.

3. D Samarwickrama^{1*}, M C Grootveld², A Sheerin² and E Lynch¹
(Conservative Dentistry¹ and Inflammation Research Group², LHMC, UK)
MULTICOMPONENT EVALUATIONS OF THE OXIDISING ACTIONS OF A TOOTH WHITENING DENTIFRICE.
Journal of Dental Research 74: 872, 403, 1995.

The nature, rate and extent of salivary reductant consumption (e.g. that of pyruvate, urate, thiocyanate, etc.) by oxidants present in tooth whitening preparations reflect their oxidising capacity, a parameter of much relevance to their therapeutic and aesthetic actions. Therefore, high resolution proton (¹H) NMR analysis was used to investigate chemical modifications arising from equilibration of human saliva with a newly-developed dentifrice³ containing carbamide peroxide [CP, 0.30% (W/W)] and peroxodisulphate [S₂O₈²⁻, 0.50% (W/W)]. Unstimulated human saliva samples obtained from volunteers (n=10) were centrifuged, the supernatant removed, and an aqueous supernatant prepared from the dentifrice product added. The mixtures were incubated for six hours prior to ¹H NMR analysis. The results obtained demonstrated (1) complete consumption of salivary pyruvate (from a mean value of $1.30 \times 10^{-4} \text{ mol/dm}^{-3}$ in the untreated samples) by dentifrice-derived oxidants (e.g. H₂O₂), an oxidative decarboxylation reaction liberating acetate and CO₂, and (2) binding of dentifrice components (e.g. triclosan and methylparaben) by salivary macromolecules.

In conclusion, high resolution ¹H NMR analysis of human saliva provides much useful information regarding the molecular mechanisms associated with the therapeutic actions of active agents present in a commercially-available tooth whitening formulation.

³Ultrawhite Opal, Janina International, UK.

N.B. Since this study was carried out Ultrawhite Opale has changed its name to Janina Opale Whitening Toothpaste.

4. K Seymour, C Morris-Clapp*, N Patsias, P Patsias and E Lynch
(The London Hospital Medical College, London, E1 2AD, UK)
SHADE MODIFICATION USING A TOOTH WHITENING DENTIFRICE
OVER SIX MONTHS
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Meeting, 1182, 420, 1996.

Much media attention has recently been concentrated on a number of new multi-component dentifrice's which claim to have tooth whitening action. In this clinical trial, one such dentifrice¹ was tested for its ability to modify tooth shade as part of a wider double blind clinical trial. Sixty seven patients from a general dental practice were recruited and asked to brush twice daily for three minutes with either active¹ or placebo dentifrice for a period of six months. The placebo dentifrice was formulation as the active product except that fluoride was the only 'active' ingredient present. A standard Vita² shade of each subject's upper anterior teeth was taken at baseline and six months by two operators to achieve agreement. Vita shades were assigned a numerical score of 1-16 according to colour value, and data analysed. The test group (n=47) showed a mean \pm SE change of shade value of 1.75 ± 0.30 whilst the placebo group (n=20) showed a change of 1.00 ± 0.33 , and this shade lightening effect is significant ($P < 0.05$). the shade lightening seen in the placebo group may be surprising but could be as a result of regular toothbrushing following the formal oral hygiene education given as part of the trial. The whitening effect of the test dentifrice¹ gives a satisfactory amount of tooth whitening for clinical use.

The data from this clinical trial indicates that the test dentifrice¹ exhibits tooth whitening ability over a six month period.

¹Janina Ultrawhite, Janina International, UK. ²Vita Lumin, Vita Zahnfabrik, Germany.

N.B. Since this study was carried out Janina Ultrawhite has changed its name to Janina Opale Whitening Toothpaste.