In Vitro Evaluation of Extrinsic Stain Prevention Capability of Hexametaphosphate Chewing Gum

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1695

ABSTRACT

We previously reported on the use of hydroxyapatite powders to model stain chromogen interactions at hard tissue surfaces. This method predicted the clinical effectiveness of hexametaphosphate (Glass H, sodium polyphosphate) dentifrice in reducing dental stains *in vivo*. **Objective:** The purpose of this study was to develop a new model of chemical stain prevention efficacy applied to chewing gum expectorated saliva and to evaluate the efficacy of HMP containing chewing gum formulations for extrinsic stain prevention and whitening capability. **Method:** Subjects (n = 3) were provided with two pellets of assigned chewing gums with instructions to chew as normal for 3 or 5 minutes, collecting expectorate in 50 mL centrifuge tubes. HAP powder (BIO-RAD Laboratories, Hercules, CA, U.S.A.) was exposed to 20 ml of pooled saliva (or water control), vortex for one minute, and centrifuged @ 15,000 rpm/10 minutes. After twice washing with deionized water, the pre-treated powder was exposed to 20 ml of a filtered tea solution (1 bag/100 ml hot water), vortex for one minute and again centrifuged @ 15,000 rpm/10 minutes. Finally, the powder was twice washed with deionized water, filtered and air-dried. The powders were quantitatively analyzed for color evaluation via CIELAB L scores using a SpectraScan PR650 system. **Results:** Replicate experiments revealed reproducibility of HAP treatment to be ± 5 % relative L. For a 5 minute chew treated on 200 mg HAP expectorate L changes on tea exposure included: Water treated HAP: -32.4; HMP Gum: -19.5. For a 3 minute chew treated on 500 mg HAP results were: Water treated HAP: -26.4; Placebo Gum: -26.5; HMP Gum -18.4 (HMP gum significant difference @ $p < 0.05$ Students t). **Conclusions:** HMP chewing gum (Orbit® White – w/ Crest® Dual Action Whitening, Wm. Wrigley Jr. Company) produced significant resistance in susceptibility of HAP surfaces to stain chromogen acquisition *in vitro*.

INTRODUCTION

Wrigley's Orbit White with Crest Dual Action Whitening is a product from a joint venture between the W.M. Wrigley Jr. Company and The Procter & Gamble Company. Orbit White contains the same hexametaphosphate (e.g., polyphosphate) stain fighting ingredients used in Crest Dual Action Whitening. The hexametaphosphate removes stains and binds to the enamel preventing further stains from forming.

MATERIALS AND METHODS

Study Design: This was an experiment to determine if an *in vitro* chewing gum model could be developed using HAP powder to predict the clinical outcome for stain prevention potential. HAP powder was exposed to 20 mL of clarified, pooled saliva or water control, vortexed for one minute followed by centrifugation for 10 minutes at 15,000 rpm. After two consecutive deionized water washes, the treated HAP was exposed to 20 mL of a filtered tea solution, vortexed for 1 minute, and centrifuged for 10 minutes at 15,000 rpm. The HAP was again washed twice with deionized water to remove any non-bound tea, filtered onto a 5 µm filter paper and allowed to air dry in a dark environment to maintain stain integrity. After the samples were dried their lightness value was determined using a spectrometer.

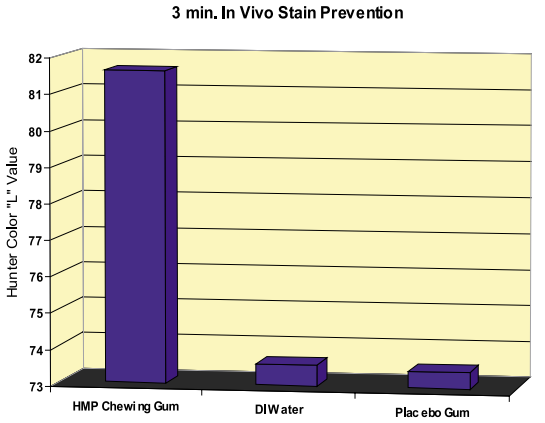
Sample Collection: After a 2 day wash-out period using Crest Cavity Protection, subjects were instructed to collect, in a 50 mL disposable centrifuge tube, the "naturally occurring" saliva that pooled in their mouth while chewing two pellets of gum. Samples were weighed for statistical purposes, pooled and centrifuged for 10 minutes at 15,000 rpm to clarify and remove the solids. 20 mL of the clarified, pooled saliva was used to treat the HAP. The collection periods for the two studies were 3 minutes and 5 minutes.

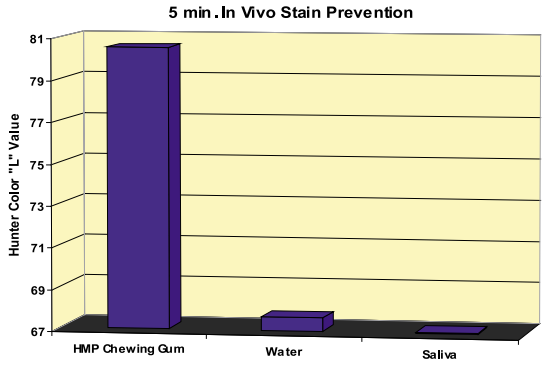
Sample Processing: After the HAP had been exposed to the tea and allowed to air dry on the filter paper, it was transferred to a ½ dram vial. The vial was then analyzed for L, a and b values using a CIELAB SpectraScan PR650 system after it had been standardized on pure HAP. Charcoal was used to determine the dynamic range and a blank vial was read to negate ½ dram vial interference with the SpectrScan. The SpectraScan was set to take an average of two readings and the samples were analyzed twice by rotating the vial 180°. The average of the two readings was plotted against other samples for comparison.

RESULTS

Replicate experiments revealed reproducibility of HAP treatment to be ± 5 % relative L. For a 5 minute chew treated on 200 mg HAP expectorate L (lightness value) changes on tea exposure included: Water treated HAP: -32.4; HMP Gum: -19.5. For a 3 minute chew treated on 500 mg HAP results were: Water treated HAP: -26.4; Placebo Gum: -26.5; HMP Gum -18.4.

RESULTS (Cont.)





CONCLUSION

HMP chewing gum (Wrigley's Orbit White with Crest Dual Action Whitening, WM Wrigley Jr. Company) produced significant resistance in susceptibility of HAP surfaces to stain chromogen acquisition in an *in vitro* model.

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