# ENAMAEL REMINERALISATION BY ARGININE-CALCIUM CARBONATE TOOTHPASTE

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Submitted for
POSTER ☒

## Introduction

White spot lesions (WSLs) are the first visual indication that the dynamic processes that maintain healthy tooth enamel have shifted in favour of demineralisation [1]. It is possible to reverse this early stage of enamel caries with good oral hygiene and home-use products that enhance the bioavailability of salivary calcium, phosphate and fluoride species [1]. Arginine ($C_6H_{14}N_4O_2$), a conditionally essential α-amino acid, is metabolised by oral bacteria to generate ammonia which protects enamel from acid-erosion [2]. It also forms complexes with $Ca^{2+}$ ions which increase the bioavailability of calcium and promote remineralisation [3]. The present *in vitro* study investigates the potential of a commercial arginine- and calcium carbonate-bearing toothpaste (Colgate Sensitive Pro-Relief, Colgate-Palmolive (UK) Limited) to repair WSLs in human enamel under optimum and aggressive acid-challenge conditions.

## Materials and Methods

Ten extracted human molars and premolars were coated with acrylic nail varnish leaving a 2 mm x 3 mm window on the buccal surface. The teeth were then individually immersed in acidic demineralising solution for 24 h to create WSLs [1]. The roots were removed, the teeth were sectioned longitudinally through the WSLs, de-pulped and re-varnished leaving only the WSLs exposed. The teeth were randomly assigned to two groups. Group A was subjected to an optimum remineralisation protocol in which the ‘control’ and ‘treatment’ halves of each tooth were incubated in artificial saliva for 24 h at 37 °C [1], with the ‘treatment’ tooth being brushed for 2 min with 1 $cm^3$ of Colgate Sensitive Pro-Relief at 0, 6 and 9 h. Group B was subjected to an aggressive acid-challenge remineralisation protocol, similar to that of Group A but with exposure to acidic demineralising solution (for 1 h) at 1, 3, 4 and 6 h. The surfaces of the original enamel, ‘control WSLs’ and ‘treatment WSLs’ for each tooth were observed by scanning electron microscopy (SEM) using secondary electrons. Lesion cross-sections were analysed by line-scanning energy dispersive X-ray analysis (EDX).

## Results and Discussion

Group A control WSLs (Fig. 1b) presented eroded surfaces with broken hydroxyapatite rods which were in contrast with the smooth surfaces of the original enamel (Fig. 1a). The Group A treatment WSLs were observed to be partially repaired (Fig. 1c). Original Group B enamel (Fig. 1d) cracked under acid-challenge (Fig. 1e). Group B treatment WSLs (Fig. 1f) were less damaged than the corresponding control WSLs. EDX line-scans (not shown) confirmed superior remineralisation within the bodies of the lesions of the treatment teeth compared with those of the controls for both Groups A and B.

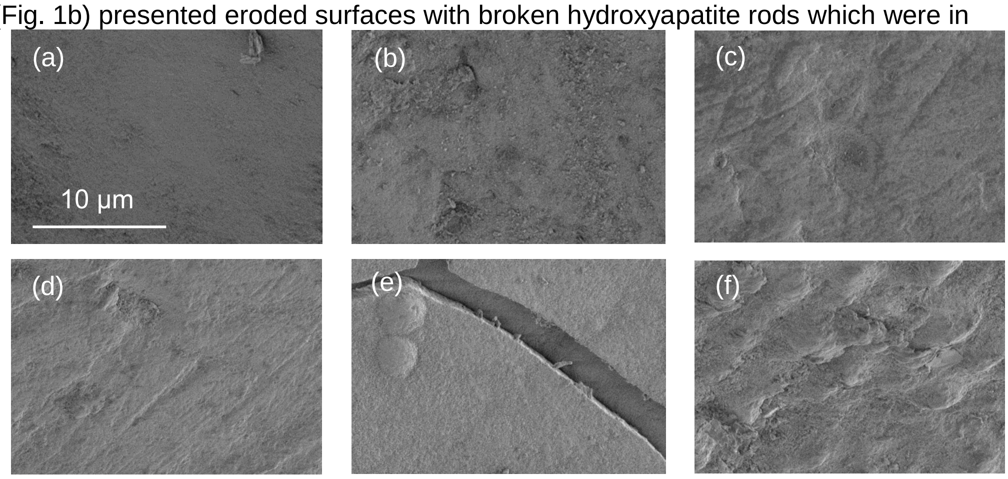


Fig. 1 SEM images of a Group A tooth (a) original enamel, (b) control WSL, (c) treatment WSL, and a Group B tooth (d) original enamel, (e) control WSL, (f) treatment WSL (x 5k)

## Conclusions

The commercial arginine- and calcium carbonate-bearing toothpaste partially remineralises WSLs under optimum conditions and significantly protects enamel against erosion under aggressive acid-challenge.

## References

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3. Antonilli M *et al*. Chemical Speciation & Bioavailability 21: 33-40, 2009.