Addition of new ingredients to clinically proven, fluoride toothpaste formulations often raise concerns that the new ingredient may adversely impact the anticaries efficacy of the base formulation. "Profile" tests are often used to gauge whether or not these new ingredients have introduced any deleterious effects on product efficacy. Several such studies have demonstrated "no effect" for the incorporation of anticalculus agents such as soluble pyrophosphate and zinc into fluoride toothpaste. One of the newest additives to be used in toothpaste is sodium tripolyphosphate (STPP), an anionic anticalculus ingredient that is claimed to enhance toothpaste ability to whiten teeth. The purpose of this study was to assess the anticaries efficacy of a new toothpaste containing sodium fluoride (NaF) and STPP relative to a conventional, clinically proven NaF dentifrice which contains 3.3% soluble pyrophosphate but no STPP. Products were evaluated using a well defined animal (rat) caries model (Francis, et. al., Whitening, containing Arch Oral Biol 1966;11:141). Test products included (a) Aquafresh™ 1100ppm F (NaF) + STPP in a silica based abrasive; (b) original Crest which contains 1100ppm F F Tartar Control as NaF in a silica based abrasive and 3.3% soluble pyrophosphate (clinical benchmark); (c) 250ppm F (NaF)/silica; and (d) Placebo (0ppm F)/silica. Caries scores (hypomineralized areas: x HMA) were (a) 84.9; (b) 69.2; (c) 109.3; and (d) 126.7 which translate to a reduction in caries of 33%, 45% and 14%, respectively, for the three test products relative to placebo (0ppm F). A Duncan’s Multiple Range Test (p=0.05) demonstrated (b) > (a) > (c) > (d). These results suggest the addition of sodium tripolyphosphate (STPP), fluoride toothpaste might significantly reduce the anticaries efficacy of the toothpaste. Further studies are warranted to determine whether the observed effect is related to (1) an issue of fluoride incompatibility for this particular formulation or (2) an issue with STPP itself.

INTRODUCTION

Since the introduction of tartar control toothpastes in the late 1980’s, some researchers have expressed concern that the addition of pyrophosphate, a crystal growth inhibitor, could have a negative effect on enamel remineralization, and thus anticaries efficacy. Caries clinical studies have since eliminated these concerns.

Dentifrices were applied with long-stem cotton-tipped swabs. The swab was dipped into a slurry of toothpaste diluted 1:1 (w/v) with deionized water. This dilution was mixed thoroughly for five minutes prior to treatment. The swab was brushed against the maxillary molars with a front-to-back stroke, repeated six times. On the mandible, the swab was dipped into the treatment slurry and then rotated toward the cheek, moving around the tongue to reach the mandible molars. Again, this included six rotations per mouth with a fresh quantity of toothpaste slurry. Treatment was applied twice daily for a total of ten treatment days (excluding Saturdays and Sundays).

At the end of the study, animals were sacrificed. The jaws were stained with 2% silver nitrate, then hemisectioned longitudinally for evaluation. Using 30X magnification, the first, second and third molars of each quadrant were graded. These results suggest the addition of sodium tripolyphosphate (STPP), fluoride toothpaste might significantly reduce the anticaries efficacy of the toothpaste. The objective of this study was to assess the anticaries efficacy of a new toothpaste containing sodium fluoride (NaF) and sodium tripolyphosphate (STPP) relative to a conventional, clinically proven NaF dentifrice which contains 3.3% soluble pyrophosphate but no STPP. The animal (rat) caries model (Francis, et. al., Arch Oral Biol 1966;11:141), a profile test method which has been validated with respect to fluoride dose response sensitivity, was used to evaluate this new formulation.

OBJECTIVE

The objective of this study was to assess the anticaries efficacy of a new toothpaste containing sodium fluoride (NaF) and sodium tripolyphosphate (STPP) relative to a conventional, clinically proven NaF dentifrice which contains 3.3% soluble pyrophosphate but no STPP. The animal (rat) caries model (Francis, et. al., Arch Oral Biol 1966;11:141), a profile test method which has been validated with respect to fluoride dose response sensitivity, was used to evaluate this new formulation.

PROTOCOL

Harlan Sprague Dawley rats (22-23 days old) were allocated into test groups of 20 animals each and immediately placed on a high cariogenic diet #469 (63% granular sucrose, 32% non-fat dry milk, 2% liver powder, 3% cellulflour). Food and water (deionized) were administered ad libitum.

Research presented at the ADA/FDI World Dental Congress, Orlando, September 28 - October 1, 1996
**TEST PRODUCTS AND RESULTS**

<table>
<thead>
<tr>
<th>Dentifrice</th>
<th>F (ppm)</th>
<th>Abrasive</th>
<th>Anticalculus Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquafresh® Whitening</td>
<td>1100</td>
<td>silica</td>
<td>STPP</td>
</tr>
<tr>
<td>Crest® Tartar Control</td>
<td>1100</td>
<td>silica</td>
<td>pyrophosphate</td>
</tr>
<tr>
<td>Dose Response Control</td>
<td>250</td>
<td>silica</td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>0</td>
<td>silica</td>
<td></td>
</tr>
</tbody>
</table>

*All products were significantly different from one another at \( p = 0.05\), Duncan's Multiple Range test.

**CONCLUSION**

- The results of this study suggest that, under the conditions of this test, the addition of sodium tripolyphosphate (STPP), a whitening agent, to fluoride toothpaste significantly reduces the anticaries efficacy of the toothpaste.

- Further studies are planned to determine whether the results observed in this study are related to fluoride incompatibility for this particular formulation or an issue with STPP itself.

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