Calculus Removal with Ordinary and Abrasive Toothpastes: A Clinical Study

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2085

ABSTRACT

This study examined the effects of rigorous toothbrushing with commercial low and higher abrasive dentifrices on supragingival calculus removal *in vivo*. Fifty-two generally healthy subjects were recruited exhibiting high levels of supragingival calculus. Both written and verbal informed consent were obtained from each subject following the review of study design and treatment regimen. Following baseline calculus (VMI) and stain (Lobene) assessments and oral soft tissue safety exams, subjects were stratified into two treatments: Crest, Regular dentifrice (silica abrasive - RDA = 95) or Ultrabrite, dentifrice (aluminum oxide abrasive - RDA = 145). Twice daily, subjects visited the dental clinic for supervised toothbrushing including 60 seconds brushing of VMI teeth followed by 60 seconds brushing of the remainder of the dentition. Calculus was graded at weeks 1, 2, 3 and 4 following initiation. At the study initiation, subjects presented with heavy supragingival calculus accumulation, evidenced by the 78.5 mm and 88.9 mm mean VM scores for the Ultrabrite and Crest groups, respectively. The higher abrasive dentifrice removed small but significant amounts of supragingival calculus at Weeks 2 (4.7 mm), 3 (5.9 mm) and 4 (13.5 mm), while the regular dentifrice removed significant levels of calculus only at Week 4 (12.6 mm). No significant differences were observed in calculus cleaning with the two dentifrices. Results shows that rigorous hygiene with commercial toothpastes does remove supragingival calculus, but these effects may be slight and slow in developing, and moreover, there were no meaningful differences in cleaning rates between the high and low abrasive dentifrices. **This study showed no meaningful difference in calculus removal between dentifrices with differing levels of abrasivity.**

INTRODUCTION

While tartar control dentifrices have been clinically proven to inhibit the formation of new supragingival calculus following a prophylaxis, research on the ability of dentifrices to remove existing calculus has been limited. One theoretical approach to *in vivo* calculus removal based on laboratory experiments (Gerrard, *J Dent Res* 1987) involves incorporating abrasives in dentifrices, as the hardness of mature calculus is considerably softer than dental enamel (20-150 VHN vs. 350 VHN hardness units). For any potential removal benefit to be substantiated, however, it is necessary to test in a population with sufficient levels of existing calculus and to modify oral hygiene to ensure adequate abrasive-calculus contact. This study assessed the calculus removal benefits of two marketed dentifrices with differing abrasivity levels with frequent, rigorous use in a design without the conventional pre-treatment prophy.

MATERIALS AND METHODS

Products Tested

Lower Abrasive Product:
Crest® Regular dentifrice[2] (0.243% NaF); silica abrasive - **RDA = 95**

Higher Abrasive Product:
Ultrabrite" Advanced Whitening Formula' dentifrice[1] (0.76% NaMFP); aluminum oxide abrasive - **RDA = 145**
[1]Colgate-Palmolive Company [2]The Procter & Gamble Company

Study Protocol

This randomized, examiner-blind, parallel group, partially supervised 4-week clinical trial assessed the tartar removal effectiveness of two marketed dentifrices in a population with high existing supragingival calculus levels who performed rigorous and frequent toothbrushing. At baseline, 52 adult subjects with a Volpe-Manhold (VM) calculus score of at least 25 were stratified based on VM scores, gender and length of time since last prophylaxis and randomly assigned to one of the two dentifrice test groups: Ultrabrite or Crest Regular. The Ultrabrite dentifrice contained higher levels of cleaning abrasive than the Crest product, with neither dentifrice formulated or marketed as "tartar control". Subjects were instructed to use the test products 4 times daily: twice under supervision at the clinical test site and twice at home.

Subjects first brushed the lower anterior teeth ('VM teeth') for 60 seconds, then brushed the remaining dentition for an additional 60 seconds. All subjects received extensive pre-treatment training and ongoing remedial instruction as needed to ensure sufficient contact was achieved between the sites of calculus formation and the test dentifrice. Supragingival calculus was graded at 1, 2, 3 and 4 weeks post-baseline via the VMI (Volpe et al, *J Periodontol* 1965) on the 6 lower anterior teeth (linguals and facials - 36 possible sites total). Extrinsic stain was also assessed at these timepoints for secondary interest, as measured by the Lobene Stain Index (Lobene, *JADA* 1968) on the facial surfaces of the eight incisor teeth.

RESULTS

The Among the 52 Guatemalan nationals randomized to treatment, mean age was 35.3 years. The majority (64%) of subjects were males. This was a largely underserved population, as nearly two-thirds of the sample reported never having had a dental prophylaxis. Mean pre-treatment subject VM calculus scores were substantial (mean VM = 79-89 mm), and the test groups did not significantly differ as to baseline status.

Baseline VM Calculus (Evaluable Subjects)

Treatment	(n=)	VM Mean	SEM*	2-side p-value
Polyphosphate	(26)	78.5	6.398	
High Abrasive	(25)	88.9	6.659	0.268
*SEM = Standard Error				

Research presented at the 78th General Session of the IADR, April 5-8, 2000

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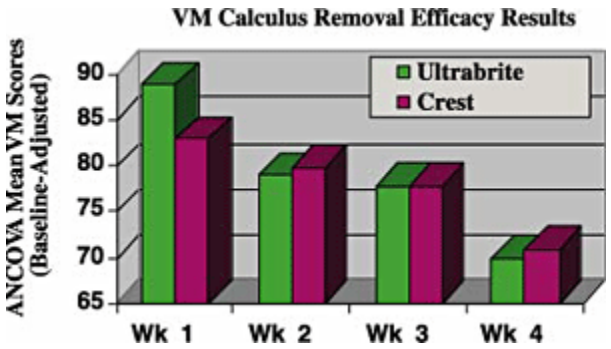
Mean tartar levels declined over time in both groups (Figure). Compared to baseline, use of the high abrasive dentifrice produced small but significant ($p \leq 0.022$) mean VM calculus reductions at Weeks 2 - 4 (4.7 mm, 5.9 mm and 13.5 mm respectively), while the lower abrasive dentifrice group had significant ($p = 0.001$) reductions at Week 4 only (12.6 mm).



For the between-group comparisons, there were no significant differences ($p>0.256$) in mean VM calculus scores between the high and lower abrasive dentifrices at any of the post-baseline time points (Weeks 1-4). Analyses of lingual sites only yielded analogous results.

There were no statistically significant difference in Lobene stain scores between groups at any time. As with tartar, both groups exhibited significant ($p = 0001$) stain area reductions vs. baseline at Weeks 1, 2, 3 and 4. Safety profiles for the test groups were comparable and unremarkable.

CONCLUSION

Rigorous use of regular (non-tartar control) commercial dentifrices in an otherwise untreated population with a heavy calculus burden resulted in small but statistically significant supragingival tartar removal. There were no meaningful differences in calculus removal efficacy between dentifrices having differing levels of abrasivity.

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