Validation of an in situ Fluoride Release and Clearance Model
S. L. Eversole*, and R. V. Faller
P&G, Mason, OH, USA

ABSTRACT
The ability of dentifrice to release fluoride (F) is one measure of potential anticaries efficacy. Previously, we proposed a novel method for measuring F release and clearance following brushing. (Eversole, IADR 2005). This demonstrated sensitivity to F dose. To fully validate new methods, the method should demonstrate the ability to distinguish "good" from "bad" products. OBJECTIVE: The objective of this study was to evaluate the ability of this method to differentiate "good" and "bad" dentifrice formulations. METHODS: A NaF dentifrice was formulated with CaCO₃ (rather than silica) to intentionally compromise long term F stability. The formulation was tested fresh (within 72 hours of making) and aged (4 months) and compared to NaF/Silica and placebo controls. Six (6) human subjects (full cross-over design) each brushed with their assigned dentifrice: a) 0ppm F; b) 1100ppm F (NaF/Silica); or c) 1100ppm F (NaF/CaCO₃) for one (1) minute, then rinsed with water for ten seconds. Subjects then placed a swab (Salivette, Sarstedt, Inc.) between the tongue and roof of the mouth, keeping their mouths closed for 1 minute collection periods at baseline (0), 5, 10, 15, 30 and 45 minutes post brushing. The swab was then expelled into an inner chamber of the Salivette container, capped and centrifuged. An aliquot was removed, buffered and analyzed by ISE. Four months later, the study was repeated using the same products. RESULTS: F clearance profiles (AUC ± SE) were: Fresh: a) 5.81 ± 0.42; b) 56.26 ± 8.94; c) 48.21 ± 15.54 (Auc C=>B) and Aged: a) 5.93 ± 0.36; b) 58.71 ± 13.96; c) 25.47 ± 3.95 (Auc C>B, p=0.05). CONCLUSION: This model differentiates between "good" and "bad" products. This, coupled with its ability to distinguish F dose sensitivity confirms the usefulness of this model for evaluating potential anticaries efficacy.

INTRODUCTION
Fluoride release and clearance methods are often used to measure the potential anticaries efficacy of oral care products. Accepted procedures involve the collection of saliva by pooling and expectorating saliva into a sample container at precise time points following tooth brushing. The procedure is often difficult, and creates a potentially non-hygienic situation in the lab. In addition, samples are often unreliable due to subjects unnatural pooling of saliva in order to expectorate at the appropriate sample time. Previously, we proposed a novel method for measuring fluoride release and clearance following tooth brushing (Eversole, IADR 2005) and demonstrated its sensitivity to fluoride dose. Additionally, to be fully validated, a new method must also be able to differentiate between "good" and "bad" formulations.

MATERIALS AND METHODS
A NaF dentifrice (1100 ppm F) was specifically formulated to compromise the long term stability of fluoride. This was achieved by replacing the silica in the formulation with CaCO₃. The Salivette in situ fluoride release and clearance model previously described (Eversole, 2005) was used to evaluate the attenuated or "bad" dentifrice. The formulation was tested at two different time points; fresh (within 72 hours of making) and aged (4 months). Crest® (1100ppm F as NaF/CaCO₃) and placebo controls were included. Six subjects completed both parts of this cross-over designed study.

Procedure:
Subjects (full cross-over design) each brushed with their assigned dentifrice: a) 0ppm F; b) 1100ppm F (NaF/Silica); or c) 1100ppm F (NaF/CaCO₃) for one (1) minute, then rinsed with water for ten seconds. Subjects then placed a swab (Salivette, Sarstedt, Inc.) between the tongue and roof of the mouth, keeping their mouths closed for 1 minute collection periods at baseline (0), 5, 10, 15, 30 and 45 minutes post brushing. The swab was then expelled into an inner chamber of the Salivette container, capped and centrifuged. An aliquot was removed, buffered and analyzed by ISE. Four months later, the study was repeated using the same products.

RESULTS
The graph above illustrates the fluoride clearance profiles. The Crest® and placebo data are presented as the mean values for the two studies. Mean area under the curve (AUC) data is shown below.

CONCLUSION:
- This model differentiates between viable "good" and attenuated "bad" products.
- These data coupled with results from a previously reported study demonstrating F dose sensitivity confirm the usefulness of this model for evaluating potential anticaries efficacy of oral care products.