

1945 Removal of Tooth Stain by a Tartar Control Whitening Dentifrice. R.W. GERLACH*, S.L. CAMPBELL, M.B. JONES, D.P. STEVENS and D.J. WHITE (The Procter & Gamble Co., Cincinnati, OH USA).

Tobacco use, coffee or tea drinking, use of chlorhexidine and other practices have been reported to induce or accelerate dental stain accumulation. A 9 week clinical trial was conducted to evaluate the effect of an experimental tartar control whitening dentifrice on induced dental stain. The study model involved 3 weeks of stain induction followed by 6 weeks unsupervised brushing to assess efficacy. To induce stain, 222 healthy adult volunteers received a dental prophylaxis, and then began a limited brushing regimen supplemented by 3 times daily rinsing with tea and once daily rinsing with 15 mL of 0.12% chlorhexidine. This regimen was suspended, and 187 subjects with tooth stain were entered into a 6 week clinical trial where they were randomized to either an experimental silica-based tartar control whitening dentifrice (Crest® Extra Whitening) or a marketed regular dentifrice control, balancing for stain levels and smoking status. At baseline, 3 and 6 weeks, stain area and stain intensity were measured on the 6 anterior teeth using the Lobene Index. A total of 176 subjects completed the 6 week regimen and were evaluable. At 6 weeks, composite Lobene means were 35% lower for the experimental dentifrice compared to the regular control. In addition to the overall reductions, there were statistically significant reductions in stain area ($p<0.015$) and stain intensity ($p<0.01$) at both 3 and 6 weeks. This stain reduction involved both the gingival and tooth body components of extrinsic stain as measured using this index. Safety profiles for the two test dentifrices were generally similar. After three and six weeks use, the experimental tartar control whitening dentifrice reduced dental stain compared to the marketed control. (This study was supported by The Procter & Gamble Co.)

1946 Removal of Long-Standing Tooth Stain by a Tartar Control Whitening Dentifrice. D.P. STEVENS*, J.C. BUISSON, J.F. FINKELDEY, J.D. HYDE, G.R. JERDACK, M.B. JONES and R.W. GERLACH (The Procter & Gamble Co., Cincinnati, OH USA).

Removal of long-standing tooth stain without excessive hard tissue abrasion may represent one of the more difficult challenges for whitening dentifrices. An 8 week clinical trial was conducted to evaluate stain removal by an experimental silica-based, enamel safe tartar control whitening dentifrice (Crest® Extra Whitening) compared to a marketed baking soda dentifrice control. First, a screening exercise was conducted to identify individuals with long-standing extrinsic dental stain. This targeted adults who reported "stained teeth" and coffee/tea drinking or smoking, but who had no recent history of dental prophylaxis. Targeted subjects were examined for stain (Lobene Index) and tooth shade/color (Vita). A total of 291 adults having extrinsic stain and tooth color A3 or darker were enrolled in the study. Subjects were randomized to one of the two treatment groups, and all dentifrice use was unsupervised. Tooth color was measured at 4 and 8 weeks from shade values collected from the 8 incisors, and averages were determined from a linear ordering of the shade guide. A total of 279 evaluable subjects completed the 8 week study. Overall, the experimental dentifrice group experienced an improvement in color, differing statistically from baseline ($p<0.001$) and from the marketed control ($p<0.05$). After 6 weeks use, the experimental dentifrice was effective in reducing maximum color (darkest shade of any of the incisor teeth) by 0.8 units, differing statistically from baseline ($p<0.001$) and from the marketed control ($p<0.05$). Safety profiles for the two test dentifrices were generally similar. Compared to the marketed baking soda control, the experimental tartar control whitening dentifrice was effective in removing long-standing dental stain, and reduced maximum or worst stain. (This study was supported by The Procter & Gamble Co.)

1947 Prevention of Tooth Stain Formation by a Tartar Control Whitening Dentifrice. R.L. ISAACS*, M.B. JONES*, T.S. OWENS, D.P. STEVENS, P.A. WALTERS and R.W. GERLACH (Indiana U., Indianapolis, IN & Procter & Gamble Co., Cincinnati, OH USA).

Plaque rapidly accumulates on tooth surfaces after prophylaxis and may acquire cosmetically unacceptable levels of stain. A 3 month clinical trial was conducted to evaluate the prevention of stain by an experimental silica-based tartar control whitening dentifrice (Crest® Extra Whitening) compared to marketed whitening and regular dentifrice controls. Prior to the trial, a one month screening exercise was conducted to identify adult subjects who accumulated extrinsic tooth stain after dental prophylaxis. A total of 874 subjects were stratified based on tooth whiteness, gender and tobacco usage, then given a dental prophylaxis and randomized to one of the three dentifrice treatment groups. All dentifrice use was unsupervised. Change in tooth whiteness (ΔL) was determined by comparing Chromameter (Minoita) measurements collected on the facial surfaces of the 4 central incisors at 1 and 3 months to baseline. Ninety-six percent of subjects completed the 3 month study and were evaluable. At both 1 and 3 months, the two whitening dentifrices did not differ from baseline in terms of ΔL . In contrast, the regular control had ΔL values of -0.25 and -0.39 at 1 and 3 months respectively, differing from baseline at both time points. Each of the whitening dentifrices differed statistically from the regular control in stain accumulation ($p<0.001$) at 1 and 3 months, but these whitening dentifrices were not different from each other. In general, all 3 test dentifrices were well tolerated. These data demonstrate the effectiveness of the experimental tartar control whitening dentifrice in preventing stain accumulation after dental prophylaxis compared to the marketed regular dentifrice control. (This study was supported by The Procter & Gamble Co.)

1948 *in vivo* Model Evaluating Xylitol's Effects on Plaque Acid Production L.A. BACCA*, S.J. HUNTER-RINDERLE, A.C. LANZALACO, AND D. M. MACKSOOD, (Procter & Gamble Co., Cincinnati, Ohio).

Sugar alcohols such as xylitol and sorbitol are effective as non-cariogenic substitutes when used in place of glucose or sucrose. Chewing gums containing xylitol have been shown to affect acid production by dental plaque (Soerling, et al, Caries Research, 23:378-384, 1989). The production of plaque acid is known to effect hard and soft tissue. An easy to use and reproducible methodology to evaluate the effects of sugar alcohols on plaque acid production is needed. The objective of this study was to determine whether changes in plaque acid production could be detected following exposure to xylitol solutions, utilizing a modification of the Plaque Glycolysis and Regrowth Model (PGRM) - [White, et al, J. Clin Dent, VI:59-70, 1995]. This study evaluated the changes in plaque acid production of the following variables: 1) xylitol levels (0-100 mM); 2) xylitol exposure times (0-240 min); 3) type of sugar and concentrations (sorbitol/glucose/etc. 0-100mM); 4) incubation media of the human plaque (0.03%-0.3% TSB with & without dextrose). In this modification of the PGRM model, on the morning of each test, subjects presented to the site having refrained from oral hygiene the previous 12 hours. A resting plaque sample was collected from the entire dentition of 4-8 subjects. Plaque samples suspended into a trypticase soy broth solution were pooled together to give a uniform sample. The biomass was normalized according to the PGRM methodology and divided into multiple samples. The plaque samples were treated to assess the variables described above, and incubated in TSB buffer at 37°C with gentle agitation for 4 hours. The pH of the samples was monitored Plaque acid production was determined by measuring the pH at different different time points during the 4 hours incubation. Profiles of the plaque pH curves were obtained for each set of conditions. Plaque samples exposed to xylitol and given a sugar challenge had different pH profiles than the control plaque samples. These results show that harvested plaque samples exposed to xylitol have an altered pH profile and produce less acid than the control samples (xylitol AUC 746.78 vs sucrose AUC 816.78). This suggests that this new methodology for assessing plaque acid production can be used to monitor acid production following exposure to xylitol containing oral care formulations.

1949 Thiocyanate Levels in Miswak Aqueous Extracts Assessed by Diffuse Reflectance Infrared Spectrometry. I.A. DAROUT*, A.A. CHRISTY, R.W. ALI, and N. SKAUG (School of Dentistry and Department of Chemistry, University of Bergen, Norway).

Miswak (meswak) chewing sticks prepared from the shrub *Salvadora persica* are widely used in North Africa and Middle East and regular use is claimed to prevent caries and periodontal diseases. Elvin-Lewis (Odontostom. Trop 3: 107-117, 1982) suggested that unstable products with antimicrobial activity can be released when isothiocyanate in *S. persica* reacts with enzymes in saliva. This has not been proven. The aim of our study, was to quantify thiocyanate anions (SCN^-) in aqueous extracts of those parts of *S. persica* which are used as miswak. Samples of *S. persica* stems and roots, collected from four distant geographical areas in Sudan, were sun-dried for 10 days, cut into small pieces with a sharp knife, and ground to powder. Extraction was performed by mixing 20g of the root and stem powder, respectively, with 150 mL sterile deionised distilled water and allowing it to soak for 48 hrs at 4°C. The mixtures were centrifuged at 2000 rpm for 10 min at 4°C. The supernatant was passed through a 0.45 µm membrane and a 0.22 µm filter before freeze-drying. SCN^- in the freeze-dried extracts were quantified by diffuse reflectance infrared spectrometry as described by Christy A.A. et al (Rev Sci Instrum 59: 423-26, 1988) mixing the freeze-dried plant extracts with KBr. KSCN in KBr served as control. Mean yields \pm SD of extracts from the four geographical areas were 3.4 \pm 0.8% and 4.3 \pm 0.5% for root and stem samples, respectively. Root extract contained 8.6% thiocyanate and stem extract 5.2%. The diffuse reflectance spectra of the extracts and the control showed absorption frequency around 2039 cm^{-1} , proving free SCN^- . The second derivative spectrum demonstrated that this single peak of the extracts in fact combined four absorption frequencies, three of which were higher than 2039 cm^{-1} , indicating complexed SCN^- . We have shown for the first time that *S. persica* water extracts contain high levels of thiocyanate occurring both as free anions and bound to other components, that root is richer in thiocyanate than stem, and that diffuse reflectance infrared spectrometry can be used successfully to analyze thiocyanate in *S. persica* water extracts. The study was supported by the School of Dentistry, Univ. of Bergen, and the Norwegian State Loan Fund for Education.

1950 The Importance of a Verified Reference Material for Testing Dentifrice Functionality. B.R.SCHEMEHORN*, M.SAIKI*, C.C.ZOPPE*, J.J.HEFFERREN*, Indiana University, Indianapolis, IPEN, University of Sao Paulo, Brazil, University of Kansas, Lawrence*

For more than a quarter of a century, the ADA Radioactive Dentin Method (Hefferren, JDR 1976) has been used to assess the abrasivity of dentifrices. The Abrasivity Reference Material used with the method, a specific batch of calcium pyrophosphate prepared by Monsanto Company, St Louis, Missouri, is the essential numerical baseline used to obtain the actual abrasivity number of the material tested. For example, different lots of calcium pyrophosphate had RDA values of 80±6 and 130±9 compared to the current ADA Reference calcium pyrophosphate which is set at RDA 100. A dentifrice grade chalk had a RDA 239±44 compared to the same ADA Reference Material. The situation is complicated, because this ADA Abrasivity Reference Material has been used as a reference for other laboratory studies of dentifrice cleaning power (Stoolky JDR 1982) as well as to measure tooth brush functionality (Imfeld IADR/CEJ April 1997). The International Standard Organization (ISO), International Standard 11609:1995 titled, "Dentistry - Toothpastes- Requirements, test methods and marking" includes this same ADA Reference Material, calcium pyrophosphate originally prepared by Monsanto. This ADA Reference Material in the ISO 11609 specification is also used as a reference abrasive for the French Dental Association (ADF)/National Laboratory testing (LNE). Dentin Abrasion Method. This French Abrasion Method uses a profilometer to measure the tooth substrate removed by brushing. The BSI Method, also in the ISO 11609 specification, uses a radiotracer procedure to measure the removed tooth substrate but has chalk as its abrasion reference material. With the passage of time, the availability of verified calcium pyrophosphate and chalk reference materials has dwindled, thus increasing the probability of dentifrice testing being done without the proper controls. The errors in data could be substantial as indicated by the 20-30% difference between lots of acoustically calcium pyrophosphate. Efforts are in process to renew supplies of these abrasion reference materials. Meanwhile, laboratories should use caution in selecting the reference abrasive to use with their method.

1951 Development of Post-Exercise-Muscle Soreness after Experimental Grinding. T. ARIMA*, P. SVENSSON, L. ARENDT-NIELSEN (Center for Sensory-Motor Interaction, Orofacial Pain Laboratory, Aalborg University; Royal Dental College, University of Aarhus, Denmark).

Pain in some bruxers has been suggested to represent a state of post-exercise-muscle-soreness (PEMS). This study was designed to investigate the effect of controlled grinding movements on the development of pain in the masticatory system. Twelve healthy men (21-42 years old) without signs or symptoms of TMD and without abnormal tooth wear participated in the study. Nine trials of 5 minutes repeated grinding from maximum intercuspation position to the right canine-canine position (0.5 Hz) were performed on the first day. The electromyographic (EMG) activity of the right masseter muscle during the lateral excursions was kept above 50% of the maximal voluntary contraction (MVC) with the use of visual feedback. The subjects scored pain intensity and tenderness on 100 mm-visual analogue scales (VAS). Before and after the exercise trials the MVC was determined and pressure pain thresholds (PPT) were measured at nine different sites on both masseter muscles. The subjects returned to the lab the three following days where PPT and MVC were measured. Data was analyzed with two-way-repeated analysis of variance. After the last grinding trials, there was a significant increase in pain intensity and tenderness as compared to baseline values (mean VAS \pm SEM: 42 \pm 8 mm; 58 \pm 12 mm, $p < 0.0001$). There was also a significant effect of grinding on both pain intensity and tenderness for the following days with peaks the first day after the exercise (10 \pm 4 mm; 17 \pm 5 mm, $p < 0.001$). The pain/tenderness was often (7/12) located to the left TMJ. There was a significant effect of grinding on PPT at both masseter muscles ($p < 0.042$) and significantly dependent on measurement sites ($p < 0.02$). The first day after the exercise the PPTs were significantly lower especially at the inferior parts of the muscles. There were no effects of clenching on MVC. These findings suggest that significant, but low-levels of PEMS can be elicited in the masticatory system by standardized grinding movements.

1952 Effects of increased hardness on jaw movements and muscle activities during chewing of food models. M.A. PEYRON*, C. LASSAUZAY and A. WODA (GEPTA Unit associée I.N.R.A. - UFR Odontologie, Clermont-Ferrand, France)

Food texture is known to influence several parameters of the masticatory process such as forces, muscular activities or jaw movements. However, results published until now have been limited by the lack of accurate reference to the mechanical food properties. This experiment was carried out to identify what masticatory parameters must be chosen to observe the variations in the chewing behavior induced by food texture. Electromyographic activity of masticatory muscles (masseter and temporalis) and jaw movements in the frontal plane were recorded simultaneously during mastication in 15 young men with intact dentition. Four elastic products identical in shape and size but differing in hardness were prepared with gelatin used in various quantities. They were mechanically controlled with an Instron machine. In this way, the masticatory process elicited a sensory stimulus that was limited to only one food mechanical property (elasticity). Each subject was invited at 3 sessions during which 5 samples of each hardness (3x4) were presented in a random order for mastication. Subjects were asked to chew the product on the preferred side until swallowing. The results showed that several parameters differed significantly following chewing of the 4 food models. The most relevant parameters were the number of masticatory strokes, the duration of masticatory sequence and the muscular work developed in the masseter and temporalis muscles during the complete sequence. All these parameters varied according to the hardness of the elastic models and the masticatory motor pattern seemed to be adjusted to the proposed hardness as early as the first strokes. These results confirm that the initial food hardness modifies the masticatory pattern and that the use of food models are of great interest to identify which parameters of the masticatory process are affected by food texture.

13092 / 3092