RADIOACTIVE DENTISTRY!
In 1987, the United States Food and Drug Administration (FDA) released its Final Rule on classification of the safety and effectiveness of accepted dental devices [FR 52(155):30082-30108, 12 Aug 1987]. One issue addressed by FDA was the radioactivity of dental porcelain [19a., pp. 30093-4]. FDA stated: “Some comments on the proposed classifications of porcelain teeth and porcelain powder for clinical use (used fused to make porcelain teeth) agreed that these devices should be classified into Class II as proposed, because the amount of depleted uranium that is used in these devices to provide fluorescing characteristics should be controlled by a standard.”
FDA cited levels of depleted uranium ranging from 300-1000 ppm and stated: “The devices present increased risks from ionizing radiation” (at levels greater than 300 ppm), and “FDA has suggested that manufacturers develop suitable substitute materials to provide fluorescing characteristics to replace depleted uranium.” Note that FDA only “suggested” the replacement of radioactive uranium, whereas previous government action had banned the use of radioactive materials in watch dials!

Is There a Renewed Trend of Radioactive Compounds in Dental Materials?
Bio-Probe is very grateful for permission to report on recent dedicated work by Ulf Bengtsson of Sweden, who researched patents on various dental products with radioactive materials. Ulf points out that this information is based only on patent search, not on chemical analysis. In the case of dental composites, he points out that the concern is more with the filler materials used, rather than the polymer.
Abstract: In order to mimic the fluorescence of human enamel radioactive compounds including both natural and depleted uranium has been used in artificial teeth and ceramic powders. This use of uranium has been going on at least since 1925. Strong indications point at a new and accelerated use of radioactive compounds in other dental materials. Especially thorium but also uranium and perhaps others might have been added to some of the new composite resins dominating the market today. The main reason is to achieve the necessary X-ray opacity. Non-radioactive alternatives do however exist. When used as a fluorescent agent in artificial teeth and ceramic powders, uranium must not exceed 0.03% by weight according to the only standard regulating radioactive compounds in dental materials (USA). This standard explicitly says that the limitations are only valid for uranium in dental porcelain. When used as a radio-opaque agent in dental composites, radioactive compounds are expected to be at a considerably higher level, perhaps as high as 10% or more.

In one scientific article an acrylic resin for polymeric appliances is proposed to contain 11-14% uranium. It is uncertain whether this has materialized into a marketed product. One patent describes a dental cement containing uranium in order to render the product X-ray opacity.

No relationship between radioactive dental materials and cancer has been established. In fact, it has not even been investigated. No scientific article discussing a possible trend towards modern radioactive dental materials has been found.

The use of radioactive compounds in dental materials has to be investigated. It has to be established if radioactive fillings are used and, if so, the problem has to be quantified. Dental materials are ground and polished in the patient’s mouth, sometimes with unintentional damage to the oral mucosa, thus resulting in an imbedding of dental material. This possibility has to be taken into account when examining the biocompatibility of these dental materials. The possibility that the patient is swallowing radioactive particles due to teeth grinding or dental treatment has to be addressed. Possible inhalation of radioactive compounds by patients, technicians and dentists has to be taken into account.

The use of intentionally radioactive implants where radioactivity is not used for its therapeutic effects but for technological reasons alone has to be carefully reviewed.

Ingredients of Dental Materials (excerpts):
* Due to very imprecise listing of ingredients and very poor quality of information, this data base is however of limited use to professionals. This especially is true for the more complex materials such as composites.
* The components of composite resins are often disclosed by manufacturers in general terms, but significant information may only be attained by chemical analysis.
* Members from dental industry hold official positions in dental scientific organizations. Few, if any, scientific areas show such a heavy organizational amalgamation of industry with science as dental science does. This connection can be further studied at: http://vest.gu.se/~bosse/ybfrBEN95a.html.

Radioactive Compounds in Some Dental Composites and Other Materials (excerpts):
* Polymers used in dental composites are X-ray translucent. In composites X-ray opacity has been achieved by adding various heavy metal fillers, some being toxic, others being radioactive. Proposed fillers include uranium, thorium, lead, mercury, barium, bismuth, etc. Zirconium glass is also noted as radioactive.

[Ed Note: The author cites 35 references verifying radioactive agents in dental materials.]

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ROOT CANALS - YES OR NO?
The controversy over the significance of devital teeth continues to grow. Fundamentally, there are three positions available:
1. All devital teeth are health threats as a systemic focus and must be removed.
2. Conventional endodontic therapy is highly successful (circa 90%) and the Focus of Infection position has been scientifically refuted.
3. Somewhere in between; some endodontically treated teeth are harmful to systemic health, some are of minimal risk, if at all. Nonetheless, alternative approaches to conventional endodontic therapy should be addressed.
On 31 March - 1 April 2000, the International Academy of Oral Medicine and Toxicology (IAOMT) will hold its 2000 Mid-Year Meeting in Orlando, Florida [see Forum announcement, page 8 this issue]. The Friday morning theme will address endodontic therapy.
For the past year, IAOMT has been reviewing scientific research on endodontics and will present the information at the meeting. Topics will include the history and documentation of the focus of infection position, documentation on the success of conventional endodontic therapy, the role of the dentinal tubules, the composition of various endodontic materials, and research on the safety and effectiveness of these materials.
Dr. J. Curt Pendergrass will present additional information on devital teeth as a focus, as well as laboratory findings on devital teeth. Dr. Stephen Koral, Endodontic Committee Chair, will then lead a panel to discuss scientific and clinical considerations.
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WHO SHOULD DO WHAT?
Addressing the patient who may be experiencing adverse health effects from amalgam mercury is one of the most serious current problems.
Opinions abound! Many health professionals have had positive results, and wish to share these experiences with others. Unfortunately, the negative results from these techniques are mostly untold. Everything seems to work on some people; nothing seems to work on everyone. Unfortunately, unless sound scientific evidence supports the methods used, the failures frequently lead to legal or licensure problems. A valid starting point is desperately needed. It is vital that practitioners have a foundation that is based on knowledge of both safety and effectiveness. Once the foundation has been established, practitioners will at least have a degree of confidence in beginning to address the patients, without relying solely on the opinions of others.
The International Academy of Oral Medicine and Toxicology (IAOMT) - whose membership consists of dentists, physicians and medical research scientists - is now attempting to establish a solid foundation for Anti-Toxic Therapy. Dr. Walter Pressey is the Chair and Pam Floener is the Vice-Chair of the IAOMT committee. Each item will be investigated individually, resulting in the development of IAOMT Standards of Care. Without a group effort, this task could not be accomplished.
IAOMT members, especially those in the Accreditation Program, are asked to investigate one item, thoroughly researching the documentation on that item.
The IAOMT format for Anti-Toxic Therapy consists of five separate areas: 1) Verification (identifying adverse effects to the toxin); 2) Prevention; 3) Elimination; 4) Neutralization (countering the toxin's effects in the body); and 5) Restoration (repairing damage).
Obviously, some of these areas are uniquely in the realm of the physician. IAOMT has continuously stressed that dentists who try to incorporate medical diagnosis and treatment into their practices are definitely at risk from the courts and licensing boards. This is why the subject must be addressed from the perspective of a number of disciplines. IAOMT is in an excellent position to do so.
Anti-Toxic Therapy will be the theme at the
2,3-Dimercaptopropionate-1-Sulfonic Acid (DMPS)

DMPS is an antidote for acute and chronic toxic metal poisoning. Its molecular formula is \( \text{C}_2\text{H}_7\text{O}_3\text{S}_3\text{Na} \). DMPS belongs to the vicinal dithiol group of chelating agents and has been used extensively in Europe for approximately 50 years. The leading manufacturer is Heyl Chem.-Pharm Fabrik Corporation in Berlin, Germany who has produced the pharmaceutical chemical since the 1970's. It is available in Germany as a finished drug (oral and injectable) under a brand name. In the U.S., DMPS is only available as a bulk chemical for pharmaceutical compounding. DMPS does not react selectively with a given heavy metal, but mobilizes a wide range of both toxic and essential endogenous metals. The equilibrium constant for the 1:1 DMPS-metal-complexes decrease in the following order: \( \text{Hg}^{2+} > \Ag^{+} > \text{CH}_3\text{Hg}^{+} > \text{Cd}^{2+} > \text{Cu}^{2+} > \text{Pb}^{2+} > \text{Zn}^{2+} \). Because of the two neighboring SH groups it has a high affinity for heavy metals that seek sulfur proteins. Once DMPS is bound with a metal, a stable complex is formed. Once complexed, there is a reduction in toxicity of the metal and it becomes unavailable for binding to sulfhydryl group-containing essential biological components such as enzymes (which would result in functional disorders of the organs and tissues). DMPS complexes with mercury, arsenic, antimony, bismuth, lead, cadmium, cobalt, chromium, copper, gold, iron, manganese, molybdenum, nickel, osmium, palladium, polonium, rhenium, rhodium, ruthenium, silver, technetium, thallium, tungsten and zinc. DMPS does not react with calcium or magnesium. Even in long-term treatment, DMPS normally does not result in a deficiency of essential elements.

DMPS WS is water-soluble, which gives it the advantage of administration by oral and intravenous routes. Oral is most often used in chronic poisoning while IV administration is used in acute poisoning (such as accidents or attempted suicide).

DMPS is stable in the crystalline form. It retains its antidote action after being exposed to heat for 2 hours at 140° C. Like all dithiols, once in solution, DMPS is sensitive to oxidation especially in the alkaline range at \( \text{pH} > 7 \).

Approximately 50% of orally administered DMPS is rapidly absorbed in the GI tract and is excreted via the kidney. The highest urinary concentration occurs 2-3 hours after oral administration. Neither DMPS nor its metabolites are detected 12 hours after oral administration in animal models.

DMPS is excreted relatively rapidly via the kidneys after IV administration (half of the administered dose is excreted in 1 hour, more than 90% at 24 hours). DMPS is also excreted via the bowel and bile with IV administration. Accumulation in the organs does not occur even with repeated administrations with either oral or IV routes.

The increased excretion or reductions of blood or plasma levels of the toxic metals are usually used for assessing the clinical efficacy for chelating agents. It would appear, however, to be more important to consider the reduced burden of critical target organs and recovery from pathological changes. Thus, the organs can be cleared without any change in the blood level. The danger of redistribution of the heavy metal to critical organs (e.g., brain), which has been demonstrated with other chelating agents must also be taken into account. Animal experiments demonstrated that DMPS does not increase the metal level in the brain.

DMPS has chelating and antioxidant effects. In animal models, DMPS provided protective
action against radiation exposure (as a pre-exposure preventive measure). It also demonstrated a positive effect in preventing the ototoxic effects of streptomycin, reduced the toxicity of cyanides and exhibited antioxidant and reparative effects in chronic hepatitis. DMPS is not an approved drug in the United States. It is, as of this writing, on the List of Bulk drug Substances That May Be Used in Pharmacy Compounding. Final approval of this list is expected in November of 1999. This does not infer that the chemical has been FDA approved for use, safety or efficacy. [This information is offered solely for educational purposes. It is not intended to offer advice, diagnosis or treatment with DMPS.]

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SCIENCE

Amalgam Allergy Associated With Exacerbation of Aspirin-Intolerant Asthma.
Yoshida, S; Mikami, H; Nakagawa, H. Onuma, K; Ishizaki, Y; Shoji, T; Amayasu, H.
ABSTRACT: Background: Aspirin-intolerant asthma can be induced not only by acidic analgesics (including acetylsalicylic acid), which effectively inhibit cyclo-oxygenase, but also by cross-reactivity with paraben, and other chemical additives. Objective: We examined whether amalgam allergy is involved in the pathogenesis of a aspirin-intolerant asthma. Methods: We present the first case of aspirin-intolerant asthma that improved after the removal of dental amalgam. In addition, we performed both the methacholine provocation testing and sulpyrine provocation testing before and after the removal of dental amalgam. Results: In addition, the methacholine concentration causing a 20% fall in FEV1 in provocation tests rose significantly, though hypersensitivity to analgesics evaluated with sulpyrine provocation testing did not decrease. These results suggest that amalgam sensitization is involved in bronchial hyper-responsiveness in aspirin-intolerant asthma. Conclusion: Sensitivity to amalgam may cause exacerbation of aspirin-intolerant asthma in some patients. To the best of our knowledge, this is the first case report of amalgam allergy associated with aspirin-intolerant asthma.

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Dental Amalgam Mercury Exposure in Rats.
Galic, N; Prpic-Mehictic; G; Prester, L; Blanusa, M; Krmic, Z; Ferencic, Z.
ABSTRACT: The aim of this study was to measure the distribution of mercury, in tissues of rats exposed to amalgam over a two months period. Possible interaction of mercury with copper and zinc in organs was also evaluated. Rats were either exposed to mercury from 4 dental amalgams, or fed the diet containing powdered amalgam during two months. Mercury was measured in the kidney, liver and brain; copper in kidney and brain, and zinc in kidney. The results showed significantly higher concentrations of mercury in the kidneys and the brains of rats in both exposed groups compared to control. Even after two months of exposure to mercury brain mercury concentration in rats with amalgam fillings was 8 times higher than in the control and 2 times higher than in rats exposed to amalgam supplemented diet. The highest mercury concentration in the latter group was found in the kidneys and it was 5 times higher than in the control group. We found no significant differences between mercury levels in exposed and control rat’s liver. Exposure to mercury from dental amalgams did not alter the concentrations of copper and zinc in the tissues. Histopathological analyses of rats tissues did not show any pathological changes. These results support previously proposed nes-brain transport of mercury released from dental amalgam fillings.

BIO-PROBE COMMENT: Scientifically, it has been well established that the pathology caused
by mercury is not histologic, but rather functional disturbance which is not manifested histologically.

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**Neurobehavioral Effects of Acute Exposure to Inorganic Mercury Vapor.**

Haut, MW; Morrow, LA; Pool, D; Callahan, TS; Haupt, JS; Franzen, MD.


ABSTRACT: Mercury has well established toxic effects on the central nervous system. This article describes comprehensive neuro-psychological and emotional functioning of a group of 13 workers exposed to inorganic mercury vapor compared to that of a normal control group. The exposed group was exposed over a 2- to 4-week period and had elevated blood mercury levels. The evaluations were conducted between 10 and 15 months after exposure was terminated.

Observed cognitive deficits included impairment in the following domains: motor coordination, speeded processing with and without a motor component, cognitive flexibility, verbal fluency, verbal memory, and visual problem solving and conceptualization.

Emotional problems included increased focus on physical functioning, depression, anxiety, and social withdrawal. Cognitive deficits were, for the most part, not significantly associated with the degree of depression present.

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**Metal Ions Alter Monocyte Metabolism at Low Concentrations, Long Term Exposure.**

Wataha, JC; Lockwood, JC.


ABSTRACT: Metal ions kill monocytes at micromol/L conc. after 24-72 h of exposure. Our hypothesis was that lower metal concentrations (<10% of 24-h LD50 values) applied over 1-4 wk could alter monocyte metabolism without cell death. These metabolic changes could be important in how monocytes direct inflammatory processes when exposed to metal ions released from dental materials.

Methods: THP-1 human monocytes were exposed to Ni (5-40 micromol/L), Cu (5-60), Ag (4-12), and Hg (0.2-1.5) in vitro (n=3). Controls contained anions of the metals. Mitochondrial function (MTT-SDH method) and total protein (BCA method) were measured weekly up to 4 weeks. Both cellular assays were normalized to cell number (hemocytometer) by performing the assays on equal numbers of cells each week. Average activity per cell was expressed as a percentage of the control cultures. ANOVA (Tukey) was used to compare metabolism at different exposure times for each metal ion.

Results: At 40 micromol/L, Ni ions decreased mitochondrial function 40-60% (p<0.05) in wk 1 and 2, but cells died by wk 3; total protein increased by 50% (p<0.05) at wk 2 before cell death in wk 3. Five and 10 micromol/L had no significant effects on mitochondrial function or protein. Cu ions at 60 micromol/L increased mitochondrial function and total protein 120% (p<0.05) by wk 2, followed by a decline to control levels by wk 4. Lower concentrations (5, 20 micromol) had no significant effects. Ag ions had no significant effects at 4 or 8 micromol/L, up to 4 wk, but killed cells after 1 wk at 12 micromol/L. Hg ions at 1 micromol/L increased both mitochondrial function and total protein by 15-20% (p<0.05) in wk 2-4, whole 1.5 micromol/L killed cells after wk 1 and 0.2 micromol/L had no significant effects after 4 wk.

Conclusions: Low concentrations of Ni, Cu, Ag and Hg ions applied to monocytes over 4 weeks can alter mitochondrial function and total protein without cell death, but rapidly become totally cytotoxic in a narrow concentration range.

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**Skeletal Fluorosis and Excessive Fluoride Exposure.**

Li, Y; Liang, C; Ji, R; Zhang, W; Cao, J; Sun, S; Cao, S; Feller, R; Niu, S.

ABSTRACT: Skeletal fluorosis is poorly understood. The extent of skeletal fluorosis among individuals exposed to high concentrations of fluoride (F) in drinking water varies greatly. Differences in oxidative stress have been implicated as a possible cause. Thus, this study was designed to determine the prevalence of skeletal fluorosis and to evaluate oxidative stress in a Chinese population aged >40 who have always resided in a community with 5.0 ppm F in Drinking water.

Diagnosis by clinical and x-ray examination revealed that 51 of 111 subjects (45.9%) had skeletal fluorosis. Plasma and Urine F, blood alkaline phosphatase (AP) and plasma calcium concentrations were comparable between the two groups. There was no significant difference in the daily F intake of 15.7 mg in subjects with skeletal fluorosis and 14.6 mg in healthy subjects.

To study oxidative stress, 24 subjects with skeletal fluorosis and 35 healthy subjects were selected to evaluate plasma superoxide dismutase (SOD) activity and malonaldehyde (MDA) activity. Analysis of SOD showed that Cu, Zn-SOD and total SOD were significantly (p<0.05) lower among subjects with skeletal fluorosis. The level of Mn-SOD also was lower in subjects with the disease, but the difference was not significant. A significantly (p<0.05) higher plasma MDA level in skeletal fluorosis patients also was detected.

Although the results indicate that individuals respond differently to the biological effects of fluoride, it is unclear whether oxidative stress is a cause or a result of skeletal fluorosis.

Testing Calcium Hydroxide Antimicrobial Potential by Different Method.
Estrela, C; Estrela, CRA; Moura, J; Bamman, L. J Dental Research, 79(S1):529, A3081, 2000.
ABSTRACT: The purpose of this study was to determine the antimicrobial effect of calcium hydroxide (CH) plus normal saline (CH +S); associated with polyethylene glycol (CH + PG); and with camphorated paramonochlorophenol (CH + CP) by two in vitro techniques - direct exposure and agar diffusion. Normal saline was used as control.
S. aureus, E. faecalis, P. aeruginosa, B. subtilis, C. albicans and their mixtures were used as biological indicators. Paper points were contaminated with the standardized microbial suspensions and exposed to the previously mentioned intracanal dressings, for 1, 24, 48 and 72 hrs., in triplicate. The points were immersed in Lethen Broth, followed by incubation at 37°C/48 hours and checked for growth.
The pastes studied have shown activity between one and 72 hours, depending upon the microorganism/mixture tested. Each diffusion assay was carried out in 10 BHI agar plates; the tested CH pastes were put into standard holes made in the medium, previously inoculated with 0.1 mL of each experimental suspension, following the same incubation conditions. The inhibition zone around each hole was recorded in mm and submitted to ANOVA and Tukey test.
All intracanal dressings induced inhibition zones, varying between 5.0 and 10.0 mm. Statistically significant activity was observed with CH + S (9.1 +/- .3, 8.1 +/- .3, 10.0 +/- .0) when compared to CH + PG and CH + CP with E. faecalis, B. subtilis and C. Albicans, and (7.0 +/- .0) in relation to CH + CP against S. aureus. CH + PG (6.8 +/- .4, 8.1 +/- .3, 9.2 +/- .6) has shown better effect than CH + CP against S. aureus, E. faecalis and C. albicans; whereas CH + CP (7.0 +/- .0) appeared to be more effective than CH +S and CH + PG when tested with P. aeruginosa. They have shown the same effectiveness (5.0 +/- .0) when assayed with the mixture. Collectively, the data obtained have shown that both testing procedures may be useful to establish the CH antimicrobial spectrum, thus, improving the infection control protocols.

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Mercury Vapor Release From Dental Amalgam After Laser Treatment.
Pioch, T; Mathias, J.
ABSTRACT: The aim of this study was to determine whether the treatment of amalgam with different lasers leads to an increased release of mercury (Hg) vapor. In the case of CO2-lasers in pulse and continuous-wave mode, there was no effect visible on the amalgam surface and no Hg vapor could be detected. Using an Nd:YAG, Er:YAG or Nd:YLF laser, crater formation could be observed on the amalgam surfaces. With the solid state lasers tested, however, the Hg vapor measurements taken indicated that pulses applied to amalgam cause a substantially increased release of Hg vapor. This vapor may contribute to the patient's total mercury exposure.

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FORUM
IAOMT 2000 MID-YEAR MEETING
DATE: Friday-Saturday, 31 March-1 April, 2000.
SITE: Orlando, Florida.
HOTEL: Sheraton World Resort Orlando; 10100
International Drive, Orlando, FL 32821-8095
(adjacent to Sea World). T: (407) 352-1100, (800)
341-4292 [inside Florida], (800) 327-0363 [outside
Florida]; F: (407) 352-3679. Specify ORAL MED
room rate: $119.00/night/1-2; $134.00/ night/3 -4.
Suites $295-$495. [Book early or rent car!] 15
minutes from airport; transportation available to
nearby attractions.
MEETING REGISTRATION: IAOMT, P.O. Box
608531, Orlando, FL. 32860-8531. T: (407)
298-2450; F: (407) 298-3075. email:
mziff@iaomt.org. Members: $375; non-members:
$475: additional persons: $125 ea. [Registration
includes continental breakfast and lunch on Friday
and Saturday, if registered prior to 03/28/2000.
Cancellation Fee of 15% after 03/15/2000.]
MEETING HOST: Dr. Janet Stopka.
WELCOME NO-HOST RECEPTION: Thursday,
30 March 2000, 7:30pm.

PROGRAM: Friday morning Clinical Theme: “Root
Canals: Yes or No?”
Michael F. Ziff, DDS: The Science on Endodontics.
J. C. Pendergrass, PhD: ALT Findings on Root
Canals.
Root Canal Therapy Panel: IAOMT Committee;
Chair Stephen M. Koral, DMD.
Friday Afternoon Speakers:
Richard J. Chanin, DMD: “Practice Management
Strategies: Part I.”
IAOMT Clinical Practice Committee: “Tips for the
Biological Practice.”
Thomas E. Baldwin, DDS: “Biological Periodontal
Therapy: Update.”
Saturday Speakers:
David C. Kennedy, DDS: “Dental and Skeletal
Effects of Fluoride.”
Boyd E. Haley, PhD: “A Review of Mercury and
Alzheimer’s Disease.”
Murray J. Vimy, DMD: “Dental Amalgam: The
Science and the Nonsense.”
Louis W. Chang, PhD: “The Toxic Effects of
Mercury.”
James E. Hardy, DMD: “Bio-Electromagnetism and
Dental Metals.”

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Second Annual Dental, Medical and
Scientific Conference on Sources, Diagnosis
and Treatment of Oral Toxicities
Affinity Labeling Technologies
SITE: Lexington, Kentucky.
HOTEL: Marriot Griffin Gate Resort Hotel, 1800
Newtown Pike, Lexington, KY. 40511. T: 606-231-
5100 or 800-228-9290; F: 606-255-9944. ALT rate=
$99.00/n; s/d (+9% tax).
MEETING REGISTRATION: See ALT website:
PROGRAM: Boyd E. Haley, PhD; J. Curt
Pendergrass, PhD; Hal Huggins, DDS; John
Roberts; BCHD; Wesley Shankland, DDS;
Steven Carini, DDS; Kimberly Anderson, PhD;
Joseph Sarkissian, DDS. Dave Swankin, JD; Jim
Turner, JD; Charlie Brown, JD on Sunday.