AN OUTBREAK OF FATAL FLUORIDE INTOXICATION IN A LONG-TERM HEMODIALYSIS UNIT

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Abstract from *Annals of Internal Medicine* 121 (5) 339-344 1994

Objective: To determine the cause of an outbreak of acute illness and death in a long-term hemodialysis unit.

Design: A retrospective cohort and case-control study of patients receiving hemodialysis and a laboratory study of a model deionization system to purify water for hemodialysis.

Setting: An outpatient hemodialysis unit of a university hospital.

Patients: 12 patients who became severely ill after hemodialysis treatment and 20 patients who did not become ill after receiving hemodialysis treatment in the same unit.

Measurements: Medical and dialysis unit records were reviewed to identify and characterize cases. Fluids for dialysis were tested for toxic substances, and fluoride was measured in patients’ serum. Resistivity and fluoride were measured in effluent from a model deionization system operated in the same way as the system associated with illness.

Results: During five consecutive hemodialysis shifts, 12 of 15 patients receiving dialysis treatment in one room became acutely ill, with severe pruritus, multiple nonspecific symptoms, and/or fatal ventricular fibrillation (3 patients). None of 17 patients treated in the adjacent room became ill (P < 0.0001). Death was associated with longer hemodialysis time and increased age compared with other patients who became ill. Serum concentrations of fluoride in the sick patients were markedly increased to as high as 716 μmol/L, and the source of fluoride was the temporary deionization system used to purify water for hemodialysis only in the affected room. Operation of a model deionization system showed how fluoride was adsorbed and then displaced in a massive efflux.

Conclusions: Because deionization systems are used widely in hemodialysis and can cause fatal fluoride intoxication, careful design and monitoring are essential.

Key words: Deionization systems; Fluoride poisoning; Hemodialysis; Hemodialysis units, Hospital; Water.

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ABNORMAL BONE MINERALIZATION AFTER FLUORIDE TREATMENT IN OSTEOPOROSIS: A SMALL-ANGLE X-RAY-SCATTERING STUDY

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Abstract from *Journal of Bone and Mineral Research* 9 (10) 1541-1549 1994

Sodium fluoride treatment of osteoporosis is known to stimulate bone formation and to increase bone mass, but recent clinical trials failed to prove its antifracture effectiveness. The formation of bone with abnormal structure and, therefore, increased fragility is discussed as a possible explanation. Until now, however, exact
information on the mineral structure of osteoporotic bone after fluoride treatment has been lacking. Bone biopsies were taken from three patients with postmenopausal osteoporosis before and after fluoride treatment (60 mg NaF/day for 1-2 years), from one patient with iatrogenic fluorosis, as well as from three normal controls. The mineral in these samples was investigated by a combination of backscattered electron imaging and small-angle X-ray scattering. Depending on the total dose of fluoride, an increasing amount of new bone is laid down on the surface of preexisting trabeculae. Its mineral structure is identical to that of heavy fluorosis and is characterized by the presence of additional large crystals, presumably located outside the collagen fibrils. These large crystals, which are not present in the controls or in osteoporotic bone before fluoride treatment, contribute to increase the mineral density without significantly improving the biomechanical properties of the bone. The possible success of fluoride treatment depends not only on the amount of newly formed bone but also on the rate of bone turnover. Indeed, as soon as significant amounts of fluoride are present, bone turnover leads to the replacement of old (normal) bone by new (pathologically mineralized) bone. In particular, in the case of high turnover rates we expect fluoride therapy even to lead to a deterioration in the overall mechanical stability of the skeleton.

Key words: Abnormal bone; Fluoride treatment; Mineralization; Osteoporosis; X-Ray.
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THE ASSOCIATION BETWEEN WATER FLUORIDATION AND HIP FRACTURE AMONG WHITE WOMEN AND MEN AGED 65 YEARS AND OLDER. A NATIONAL ECOLOGIC STUDY
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Abstract from Annals of Epidemiology 2 (5) 617-626 1992

For the past 45 years, there has been a great deal of debate regarding the health issues surrounding the fluoridation of public water supplies. In order to assess the association between fluoridation and hip fracture, we identified 129 counties across the United States considered to be exposed to public water fluoridation and 194 counties without exposure. Data from the Health Care Financing Administration and the Department of Veterans Affairs were used to calculate the incidence of hip fracture among white persons, aged 65 years or older, in fluoridated and non-fluoridated counties. There was a small statistically significant positive association between fracture rates and fluoridation. The relative risk (95% confidence interval) of fracture in fluoridated counties compared to nonfluoridated counties was 1.08 (1.06 to 1.10) for women and 1.17 (1.13 to 1.22) for men. As comparisons were made at the grouped level, it may be inappropriate at this time to draw inferences at the individual level. The relationship observed at the county level needs to be duplicated at the individual level with more precise measures of fluoride exposure.

Key words: Aged; Fluoridation; Hip fractures; Human; Men; USA; Women.
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**FLUOR IN THE TREATMENT OF OSTEOPOROSIS:
AN OVERVIEW OF THIRTY YEARS CLINICAL RESEARCH**

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Abstract from *Schweizerische Medizinische Wochenschrift. Journal Suisse de Medicine* 123 (47) 2228-2234 1993

It has long been known that fluoride "hardens" mineralized tissues. Fluoride ingestion through drinking water in areas naturally rich in fluoride leads to osteosclerosis, known as endemic fluorosis. The first suggestion that fluoride be used in the treatment of osteoporosis was made in 1964. However, despite 30 years of research, the treatment remains controversial. Fluoride has a dual effect on osteoblasts. On the one hand, it increases the birthrate of osteoblasts at tissue level by a mitogenic effect on precursors of osteoblasts, while on the other hand it has a toxic effect on the individual cell with mineralization impairment and reduced apposition rate resembling osteomalacia. Fluoride has a positive effect on axial bone density, but the axial bone gain is not matched by similar changes in cortical bone. Furthermore, approximately one third of patients are non-responders. The effect of the addition of fluoride to the drinking water on fracture rate is not clear. It probably only has a small relative impact on total hip fracture rates. In two controlled fluoride therapy studies the incidence of vertebral fractures decreased, while in two other studies it increased. Experience teaches that denser bones are not necessarily better bones. The major side effects of fluor therapy are skeletal fluorosis, gastrointestinal intolerance, and painful lower extremity syndrome. Fluoride is the single most effective agent for increasing axial bone volume in the osteoporotic skeleton; however, its therapeutic window is narrow. The best candidates for fluoride therapy are patients with axial osteoporosis but with good peripheral bone density. They should have a good renal function and vitamin D status.

Key words: Fluoride; Fluoride therapeutic use; Osteoporosis.

**THE EFFECT OF INVITRO FLUORIDE ION TREATMENT ON THE ULTRASONIC PROPERTIES OF CORTICAL BONE**

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Abstract from *Annals of Biomedical Engineering* 22 (4) 404-415 1994

The mechanical properties of composites are influenced, in part, by the volume fraction, orientation, constituent mechanical properties, and interfacial bonding. Cortical bone tissue represents a short-fibered biological composite where the hydroxyapatite phase is embedded in an organic matrix composed of type I collagen.
and other noncollagenous proteins. Destructive mechanical testing has revealed that fluoride ion treatment significantly lowers the Z-axis tensile and compressive properties of cortical bone through a constituent interfacial debonding mechanism. The present ultrasonic data indicates that fluoride ion treatment significantly alters the longitudinal velocity in the Z-axis as well as the circumferential and radial axes of cortical bone. This suggests that the distribution of constituents and interfacial bonding amongst them may contribute to the anisotropic nature of bone tissue.

Key words: Anisotropy; Bone; Fluoride; Interfacial bonding; Ultrasound.

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NORMAL AGE-RELATED CHANGES IN FLUORIDE CONTENT OF VERTEBRAL TRABECULAR BONE - RELATION TO BONE QUALITY

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Abstract from Bone 15 (1) 21-26 1994

In several clinical osteoporosis studies, fluoride treatment has been shown to have a positive effect on bone mass but without a concomitant decrease in vertebral fracture rate. In contrast, some studies have shown that increases in spinal BMD are also paralleled by decreased vertebral fracture incidence. We have previously demonstrated, in a pig model, that 6-month treatment with fluoride increased bone mass but decreased bone quality. The aim of the present study was to elucidate whether normal age-related fluoride accumulation in human bone per se influences bone quality. From 73 normal individuals, aged 20-91 years (36 females, 37 males) two trabecular bone cylinders were obtained from the central part of L3. Biomechanical competence, ash density, and fluoride content were assessed in one cylinder, and trabecular bone volume was determined in the other. The results showed an age-related decrease in bone mass for both men and women. Bone strength normalized for bone mass (bone quality also identical with bone material strength) also showed an age-related decrease in men and women. Bone fluoride concentration increased significantly in both sexes (range 463-4000 ppm). Multiple regression analyses disclosed that fluoride by itself had no influence on bone quality, in this study with a limited number of cases, when the influence of sex and age were taken into account. It is concluded that normal age-related accumulation of fluoride in vertebral trabecular bone does not seem to affect the quality of bone. Whether this is also the case during fluoride therapy has to be assessed.

Key words: Age-related changes; Bone quality; Fluoride; Human; Vertebral trabecular bone.

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FLUORIDE THERAPY: EFFECT ON BONE MICROSTRUCTURE AND BIOMECHANICS

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Abstract from *Presse Medicale* 23 (29) 1344-1348 1994

Fluoride, in the form prescribed as sodium or monophosphate fluoride for the treatment of vertebral osteoporosis, modifies the microscopic structure and biomechanical properties of bone tissue. For cancellous bone, the main effect of fluoride is a stimulation of bone formation leading to a hypertrophy of the remaining trabeculae. It may also have a beneficial effect by improving interconnections within the trabecular network. Although the mechanisms have yet to be fully understood, the process is probably dependant on the quality of the remaining network. The biomechanical properties of bone after fluoride therapy also are partly dependent on these modifications in the bone microstructure but also on fluoride's effect on bone minerals. When the concentration of fluoride becomes too high in bone, mineralization defects can occur causing major loss in mechanical resistance despite an increase in bone mass. Thus the beneficial effect of fluoride on wedge fractures of the spine in osteoporosis is probably the result of a balance between the effects of increased trabecular bone mass and modifications in bone mineralization. The respective intensities of these two phenomena also depend on the concentration of fluoride accumulated within the bone. This concentration is a function of the level of fluoride salt intake and its biodisposability during treatment.

Key words: Bone; Fluoride therapy.
Reprints: C Marcelli, Hop Lapeyronie, Service Rhumatologie, F-34295 Montpellier 5, France.

PHARMACOKINETIC PROFILE OF A NEW FLUORIDE PREPARATION: SUSTAINED-RELEASE MONOFLUOROPHOSPHATE

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Abstract from *Calcified Tissue International* 54 (1) 7-11 1994

The pharmacokinetic profiles of a sustained-release monofluorophosphate (MFP-SR) preparation (76 mg) and of plain MFP (76 mg) were compared in six osteoporotic females. These studies were performed in a randomized, crossover, double-blind design to select a preparation that would result in therapeutic serum levels while avoiding high serum peak values. Following a single dose of 76 mg MFP-SR, the serum fluoride levels remained within the accepted therapeutic range (5-10
μM/Liter) for 24 hours. In contrast, following a single dose of 76 mg plain MFP, serum fluoride levels exhibited a wide circadian fluctuation and serum levels approximately threefold higher than those of the MFP-SR preparation (9.5 ± 1.6 vs 3.5 ± 0.8 μM/Liter, P < 0.005). Compared with plain MFP, the sustained-release MFP had a significantly lower peak concentration (C_{max} MFP-SR: 10.6 ± 3 vs C_{max} MFP: 18.9 ± 5 μM/Liter, P < 0.005) and a significantly longer absorption lag time (T_{max} MFP-SR 7.3 ± 1.6 vs T_{max} MFP: 3.0 ± 0.6 h, P < 0.05). Twenty-four-hour urinary fluoride excretion after ingestion of plain or SR fluoride was significantly increased from pretreatment values documenting absorption with either MFP formulation. Our results show that the use of sustained-release MFP preparation that we tested prevents the development of high peak levels associated with the use of plain MFP preparations. Furthermore, a single dose of MFP-SR resulted in serum fluoride levels within the accepted range of 5-10 μM/Liter for 24 hours.

Key words: Monofluorophosphate; Osteoporotic females; Serum fluoride; Sustained-release.
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PHARMACOKINETIC DIFFERENCES BETWEEN SODIUM FLUORIDE AND SODIUM MONOFLUOROPHOSPHATE AND COMPARATIVE BONE MASS INCREASING ACTIVITY OF BOTH COMPOUNDS IN THE RAT
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Abstract from Arzneimittelforschung 44 (6) 762-766 1994

After the administration of an oral dose of 80 μmol/L of NaF (CAS 7681-49-4) to rats, the area under the curve of total plasma fluoride equals 10,200 μmol.min/L. After an oral dose of 80 μmol of monofluorophosphate (MFP/CAS 10,163-15-2), two forms of fluoride appear in plasma: protein-bound MFP and diffusible fluoride. The areas under the curve of total (protein-bound + diffusible) and diffusible fluoride equal 22,200 and 8,850 μmol.min/L, respectively. The activity of MFP for increasing the bone mass of the rat was assessed with NaF as the standard. The animals were treated chronically for 100 days since weaning with food ad libitum and 5 mmol/L NaF, 5 or 2.5 mmol/L MFP solutions as the water supply. The effect obtained with 2.5 mmol/L MFP was similar to that produced by 5 mmol/L NaF, indicating a potency ratio MFP is twice as active as NaF.

Key words: Bone; Sodium fluoride, Sodium monofluorophosphate.
Reprints: A Rigalli, Laboratorio de Biologia Osea, Facultad de Medicina, Rosario, Argentina.
TOXIC EFFECTS OF CHRONIC FLUORIDE INGESTION ON THE UPPER GASTROINTESTINAL TRACT

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Abstract from Journal of Clinical Gastroenterology 18 (3) 194-199 1994

In a prospective case controlled study, we evaluated the adverse effects of long-term fluoride ingestion on the gastrointestinal tract. Ten patients with otosclerosis who were receiving sodium fluoride 30 mg/day for a period of 3-12 months, and 10 age- and sex-matched healthy volunteers were included. They were all evaluated clinically and subjected to a real time ultrasound examination, upper gastrointestinal endoscopy, and biopsies from the gastric antrum and duodenum. The biopsies were subjected to a rapid urease test as well as light and electron microscopic examinations. Ionic fluoride was estimated in the serum, urine, and drinking water using an ION 85 Ion Analyzer. Seven subjects (70%) ingesting fluoride had abdominal pain, vomiting, and nausea. Petechiae, erosions, and erythema were seen on endoscopy in all the subjects, but not in the controls. Histological examination of the gastric antral biopsy showed chronic atrophic gastritis in all the subjects but in only one (10%) healthy volunteer. Scanning electron microscopic examination showed “cracked-clay” appearance, scanty microvilli, surface abrasions, and desquamated epithelium in the subjects ingesting fluoride, but not in the controls. We conclude that long-term fluoride ingestion is associated with a high incidence of dyspeptic symptoms as well as histological and electron microscopic abnormalities.

Key words: Fluoride; Gastrointestinal tract; Toxic effects.

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IN VITRO FLUORIDE TOXICITY IN HUMAN SPERMATOZOA

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Abstract from Reproductive Toxicology 8 (2) 155-159 1994

Effects of sodium fluoride (NaF) on washed, ejaculated human spermatozoa at doses of 25, 50, and 250 mM were investigated in vitro at intervals of 5, 10, and 20 min. Sodium fluoride (NaF) did not affect the extracellular pH of sperm, except that a slight acidification was caused by the 250 mM dose only. The treatment caused a significant enhancement in acid phosphatase (ACPase) and hyaluronidase activities after 5 and 10 min. However, the decrease in the lysosomal enzyme activity after 20
min treatment could have been due to the gradual increase in fluoride accumulation by spermatozoa leading to membrane damage. Silver nitrate staining of sperm revealed elongated heads, deflagellation, and loss of the acrosome together with coiling of the tail. Sperm glutathione levels also showed a time-dependent decrease with complete depletion after 20 min indicating rapid glutathione oxidation in detoxification of the NaF. The altered lysosomal enzyme activity and glutathione levels together with morphologic anomalies resulted in a significant decline in sperm motility with an effective dose of 250 mM.

Key words: Fluoride; Human; In vitro; Spermatozoa; Toxicity.

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ULTRASTRUCTURAL STUDIES OF SPERMIOGENESIS IN RABBIT EXPOSED TO CHRONIC FLUORIDE TOXICITY

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Objective: To address the role of fluoride in causing defects to spermatids and epididymal spermatozoa.

Methods: Male rabbits were treated with 10 mg NaF/kg body weight daily for 18 months and maintained under identical laboratory conditions along with the control rabbits not given NaF. Testis and epididymis (caput) were investigated for ultrastructural details of spermatids and spermatozoa.

Results: A wide variety of structural defects were observed in the flagellum, the acrosome, and the nucleus of the spermatids and epididymal spermatozoa of fluoride-treated rabbits. Abnormalities included absence of outer microtubules, complete absence of axonemes, structural and numeric aberrations of outer dense fibers, breakdown of the fibrous sheath, and structural defects in the mitochondria of the middle piece of the flagellum. Detachment and peeling off of the acrosome from the flat surfaces of the nucleus were also observed.

Conclusion: The abnormalities observed render the sperm nonfunctional and ineffective, and thus there is a possible role of fluoride in causing infertility.

Key words: Fluoride; Rabbit; Spermiogenesis; Toxicity.

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PREVALENCE OF DEVELOPMENTAL DEFECTS OF ENAMEL IN AREAS WITH DIFFERING WATER FLUORIDE LEVELS AND SOCIOECONOMIC GROUPS IN SRI LANKA AND ENGLAND

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Abstract from International Dental Journal 44 (2) 165-173 1994

Defects of dental enamel were recorded in 607 12-year-old children in Sri Lanka and north-east England in 1990/91. In each country, children were included from areas which received drinking water containing 0.1, 0.5 or 1.0 ppm F. In some of these areas, children from both low and high socio-economic groups were examined. The index of Developmental Defects of Enamel (DDE) was recorded clinically for the undried buccal surfaces of 10 permanent teeth (maxillary incisors, canines and first premolars, and mandibular first molars). The results revealed a higher prevalence of enamel defects and more teeth affected per person in children in: the high socio-economic group than in the low socio-economic group in the 1.0 ppm F area in England; in the 1.0 ppm F area than in the 0.1 ppm F area in Sri Lanka (in the low socio-economic groups), and in the 1.0 ppm F area than in the 0.1 ppm F area in England (in the high socio-economic groups but not in the low socio-economic groups); in general in Sri Lanka than in England. The occurrence of diffuse opacities increased greatly with increasing water fluoride level. A high prevalence of hypoplastic lesions was recorded in Sri Lanka.

Key words: Enamel defects; Fluoride; Socio-economic.
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YOUNG CHILDREN AND FLUORIDE TOOTHPASTE

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Abstract from British Dental Journal 177 (1) 17-20 1994

Studies have shown a higher prevalence of enamel mottling in children who live in fluoridated areas than in those from low fluoride areas. It is possible that the additive effect of fluoride ingestion from water and toothpaste may be responsible since it is known that young children may swallow up to half of the toothpaste on the brush. Parents must supervise toothbrushing for young children, low fluoride paste should be used, and the brush merely smeared with paste. The commonly recommended pea-sized quantity may be too much.

Key words: Fluoride, Fluorosis, Toothpaste.
Reprints: W P Rock, Orthodontic Unit, School of Dentistry, University of Birmingham, St Chad's Queensway, Birmingham B4 6NN, England.
DISTRIBUTION OF FLUORIDE IN THE DENTAL TISSUES AND THEIR SUPPORTING MANDIBULAR BONE FROM THE SAME INDIVIDUAL

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Abstract from Archives of Oral Biology 39 (6) 535-537 1994

Dental and skeletal tissues have their own distinct fluoride distribution profiles. It was thought useful to compare these within individuals as normally comparisons are made between different groups of individuals. The average fluoride concentration decreased in the following order; cementum, alveolar bone, cancellous bone, mandible, dentine and enamel.

Key words: Dental tissues; Fluoride; Human; Mandibular bone.
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RELATIONSHIP BETWEEN CARIES, WATER FLUORIDE LEVEL AND SOCIOECONOMIC CLASS IN 15-YEAR-OLD INDIAN SCHOOL CHILDREN

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Abstract from Indian Journal of Dental Research 4 (1) 17-20 1993

The purpose of this study was to determine the relation between caries experience, water fluoride level and socioeconomic class among the 15-year-old school children of Tamilnadu. The study children were stratified on the basis of water fluoride level and socioeconomic (SE) class. The children were divided into low, medium and high SE classes. There was a highly significant (P < .001) difference in the carious experience of 15-year-old children from low fluoride (LF) areas in relation to the SE class, the low SE class having the highest caries experience. There was almost no difference between the caries experience of low SE class 15-year-old children from the LF area and high fluoride (HF) area (Z < 1.96 and P > 0.05). The difference between caries experience of 15-year-old children from LF and HF areas was not statistically significant (Z < 1.96 and P > 0.05). The present study has indicated towards the need of provision of more vigorous preventive efforts in lower SE class children in both the urban and rural population.

Key words: Children; Dental caries; India; Socioeconomic class; Water fluoride level.
Reprints: M Rahmatulla, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.
FACTORS ASSOCIATED WITH THE USE OF FLUORIDE SUPPLEMENTS AND FLUORIDE DENTIFRICE BY INFANTS AND TODDLERS
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Abstract from Journal of Public Health Dentistry 54 (1) 47-54 1994

Dental fluorosis may be associated with the inappropriate use of fluoride dentifrices and/or dietary fluoride supplements by young children, especially for those who consume optimally fluoridated water. Studies to date have used retrospective designs that rely on anamnestic responses of adults to determine fluoride exposures in their children. The 1986 National Health Interview Survey (NHIS) collected information on current use of fluoride-containing dental products (dentifrices, drops, tablets, and mouthrinses) by all household members during home interviews. This report contains information obtained from adults for 1,996 children younger than two years of age. Nearly half of the children used fluoride dentifrices or dietary fluoride supplements. Eleven percent of the children younger than one year of age and nearly 60 percent of children between one and two years of age reportedly used a fluoride toothpaste. Dietary fluoride supplements were used about equally in these age groups (about 16%). The use of a fluoride dentifrice was similar across racial-ethnic groups, but the use of dietary fluoride supplements was less among blacks and Hispanics. A significantly higher proportion of children whose respondent knew the purpose of water fluoridation used some type of fluoride product. Because young children tend to swallow dentifrices, the findings of this study suggest the need for educational programs targeted to parents and health care providers regarding the appropriate use of fluorides and the risk of fluorosis when they are used inappropriately.

Key words: Dentifrice; Fluoride tablets; Fluorosis; Infants; Toddlers; Toothpaste use.
Reprints: A M Horowitz, Epidemiology and Oral Disease Prevention Program, National Institute of Dental Research, National Institutes of Health, Room 536, Westwood Building, 5333 Westbard Avenue, Bethesda, MD 20892 USA.

FACTORS AFFECTING CARIES EXPERIENCE IN FRENCH ADOLESCENTS
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Clermont-Ferrand, France

Abstract from Community Dentistry and Oral Epidemiology 22 (1) 30-35 1994

Three hundred French 14-15-yr-old adolescents were randomly selected. They were examined clinically and caries experience was determined by using the DMFS index. The aim of this investigation was to evaluate children's habits using a self-administered questionnaire, to clarify the actual influence of well-known factors such as fluoride exposure, diet, oral hygiene and socioeconomic factors on caries experience and to stress those factors of primary importance. A multiple regression analysis revealed the variables which significantly contributed to explain DMFS scores in a final model: Age, sex, frequency of sweet consumption, use of standard or high fluoride toothpastes, bleeding during toothbrushing, living in St Yorre ($F^- = 0.45$ mg/L). At a time when caries experience is decreasing, it seems that fluoride
supply, snacking and oral hygiene are still independent and significant determinants of caries experience in French adolescents.

Key words: Adolescents; Dental caries; Fluoride; France; Oral hygiene; Snacking.
Reprints: S Tubert-Jeannin, Faculté de Chirurgie Dentaire, 11 Bd Charles de Gaulle, 6300 Clermont-Ferrand, France.

SECULAR TRENDS OF CARIES PREVALENCE
IN 6- AND 12-YEAR OLD DUTCH CHILDREN
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Abstract from Caries Research 28 (3) 176-180 1994

Since a first survey in 1969, juvenile caries prevalence in the second largest city of the Netherlands has attained a European minimum of DMFT = 0.8 in 11.9-year-old children. However, the curves of improvement have been flattening out since the mid-eighties. Incidental variations between 1984 and 1993, especially of caries prevalence in the deciduous teeth of 5- and 7-year-old children, do not indicate a turn to the secular downward trend. The stability of juvenile oral health does not seem to be due to changes in dietary habits, nor to public health measures, but is mainly due to good oral health and use of fluoride dentifrices by the children.

Key words: Caries; Children; Hague; Prevalence.
Reprints: G J Truin, Department of Cariology and Endodontology, School of Dentistry, University of Nijmegen, PO Box 9101, NL-6500 HB Nijmegen, The Netherlands.

PREDICTION OF CARIES INCIDENCE IN SCHOOLCHILDREN
LIVING IN A HIGH AND A LOW FLUORIDE AREA
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Abstract from Community Dentistry and Oral Epidemiology 21 (6) 365-369 1993

A salivary mutans streptococci test and past caries experience were used as predictors for caries increment in a 3-yr study comprising 655 12-yr-old schoolchildren from two areas with contrasting levels of fluoride in the drinking water. The mean caries (DMFS) increment was similar in both groups during the study period, but a significantly (P < 0.05) higher incidence of approximal enamel lesions was registered in children from the high fluoride area. In both groups, a statistically significant (P < 0.05-0.001) positive relationship between salivary mutans streptococci score and/or past caries experience at baseline on one hand and caries increment during the study period on the other was established. The past caries experience was the most powerful predictor of caries risk in both the low fluoride and the high fluoride area. The sum of the sensitivity and specificity was somewhat higher in the low fluoride area (138%) compared to the high fluoride area (123%). The salivary bacterial enumeration used alone or in combination with past caries experience as well as past approximal caries experience were less useful as predictors in both groups. The present findings indicate that the natural fluoride exposure has a limited influence on caries risk assessment and the caries predictive ability of the salivary bacterial test and past caries in populations with a low level of disease.

Key words: Caries prediction; Dental caries; Fluoridation; Mutans streptococci.
Reprints: S Twetman, Department of Pedodontics, Faculty of Odontology, University of Gothenburg, Länsjukhuset, S-301 85 Halmstad, Sweden.
RECENT ADVANCES IN STANNOUS FLUORIDE TECHNOLOGY: ANTIBACTERIAL EFFICACY AND MECHANISM OF ACTION TOWARDS HYPERSENSITIVITY

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Abstract from International Dental Journal 44 (1 Suppl 1) 83-98 1994

Stannous fluoride (SnF₂) is highly susceptible to oxidation and hydrolysis but both anhydrous and aqueous preparations can be well established by proper formulation. When stability in aqueous preparations is achieved by the use of certain strong complexing agents, reduced antibacterial activity is observed which may be attributed to reduced bioavailability of the stannous ion. In contrast, an anhydrous SnF₂ preparation maintains stannous ion in a stable but uncomplexed form. This preparation displays antibacterial activity in saliva and delivers stannous ion which is absorbed onto surfaces making them less susceptible to plaque formation for an extended period of time (hours). When this anhydrous preparation is brushed onto dentine in vitro or in situ, one observes a nearly complete coverage of the dentine surface and occlusion of tubules by a tin-rich surface deposit. This finding indicates that the observed clinical efficacy of this preparation at relieving hypersensitivity is due to occlusion of tubules by a mixture of low solubility complexes of tin. A water-based SnF₂ preparation containing strongly complexed stannous ions does not form a surface coating on dentine in vitro suggesting that this preparation may not be optimal for treating hypersensitivity. Overall, the findings indicate that the stannous ions in a SnF₂ preparation must be maintained in a stable, bioavailable form for optimal efficacy against plaque and hypersensitivity to be obtained. The results suggest that these properties are provided by stable anhydrous preparations but are difficult to achieve simultaneously in aqueous preparations. When properly formulated, stannous fluoride preparations can provide multiple oral therapeutic benefits.

Key words: Antibacterial efficacy; Hypersensitivity; Stannous fluoride.
Reprints: S Miller, Colgate-Palmolive Technology Center, Piscataway, NJ 08854 USA.

RISK FACTORS FOR ENAMEL FLUOROSIS IN A FLUORIDATED POPULATION

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Abstract from American Journal of Epidemiology 140 (5) 461-471 1994

The purpose of this case-control investigation was to investigate the possible association between mild-to-moderate enamel fluorosis and exposure during early childhood to infant formula, fluoride toothpaste, and/or fluoride supplements. Analysis was performed on 401 residents of fluoridated communities in Connecticut, who were 12-16 years old and born prior to 1980. The case and control subjects for this study were selected on the basis of a clinical examination given in 1991. Subject
fluorosis status was determined using the Fluorosis Risk Index. Risk factor exposure was ascertained via a mailed questionnaire with a response rate of 89% and a questionnaire reliability of 87%. Logistic regression analyses, which adjusted for confounding variables, revealed that mild-to-moderate enamel fluorosis on early forming (Fluorosis Risk Index (FRI) classification I) enamel surfaces was strongly associated with both milk-based (odds ratio (OR) = 3.34, 95% confidence interval (CI) 1.38-8.07) and soy-based (OR = 7.16, 95% CI 1.35-37.89) infant formula use, as well as with frequent brushing (OR = 2.80, 95% CI 1.15-6.81). A very strong association was observed with inappropriate fluoride supplement use (OR = 23.74, 95% CI 3.43-164.30). Respectively similar associations were observed between mild-to-moderate enamel fluorosis on later forming (FRI classification II) enamel surfaces and frequent brushing and fluoride supplement use, but not with infant formula use.

Key words: Dental enamel; Fluoridation; Fluorosis; Mottled enamel; Risk factors.
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PREVALENCE OF FLUOROSIS AND OTHER ENAMEL DEFECTS RELATED TO CARIES AMONG ADULTS IN COMMUNITIES WITH OPTIMAL AND LOW WATER FLUORIDE CONCENTRATIONS

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Abstract from Community Dental Health 11 (2) 75-78 1994

The aim of this Swedish study, performed in 1982, was to determine the prevalence of fluorotic and nonfluorotic enamel defects among adults in areas with optimal and low fluoride concentrations in water. The fluorosis prevalence was also related to caries prevalence in these areas. The study was based on clinical examinations of subjects born between 1939-1951 who had been drinking water with a fluoride content representative of their area of residence all their lives. This water was the only appreciable source of fluoride during tooth formation. Two hundred and sixty individuals living in the optimal fluoride area were included in the study and 236 individuals from the low fluoride area. The results showed first, a low prevalence of mild dental fluorosis in the area with optimal fluoride content in its drinking water; secondly, a low prevalence of non-fluorotic enamel defects, which was, however, higher in the low fluoride area than in the optimal fluoride area; thirdly, that caries prevalence was lower among those with fluorotic enamel defects in the optimal fluoride area; and lastly, caries prevalence was not influenced by non-fluorotic enamel defects.

Key words: Dental enamel defects; Fluoride; Fluorosis; Water.
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NON-DENTAL TISSUE EFFECTS OF FLUORIDE
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Abstract from Advances in Dental Research 8 (1) 32-38 1994

The anti-caries effects of water fluoridation are well-established. The non-dental tissue effects of fluoride in drinking water, either naturally occurring or as an additive, have been too poorly studied to permit definitive conclusions to be drawn. Claims have been made that fluoride results in an increased occurrence of malignancies, particularly osteogenic sarcoma. Experimental rat data have not resolved this issue, and epidemiologic studies are equally unclear. Initial claims that fluoride offers protection against atherosclerosis remain viable, but here too, much more directed research is needed. Early studies suggested that a water fluoride content greater than 1 ppm resulted in a lower prevalence of osteoporotic fractures. Recent epidemiologic data seriously question this conclusion and raise the possibility that even this relatively low level may increase the prevalence of osteoporotic hip fractures. Other elements, including calcium and magnesium, also vary in amount as water fluoride content varies, and it has proved difficult to distinguish the independent effects of the various nutrients in water from each other. Therapeutic use of fluoride has been largely restricted to studies of its effect on the osteoporotic vertebral fracture rate. After more than 30 years of detailed study, this important issue remains unresolved. This review provides an overview of these issues, focusing on the uncertainties alluded to, and attempting to develop strategies for future research.

Key words: Fluoride; Malignancies; Non-dental tissue effects; Osteogenic sarcoma; Osteoporotic fractures; Vertebral fractures; Water fluoridation.

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[The correspondent who sent us the above abstract commented: "The first sentence is untrue. Comprehensive studies now suggest the opposite. Recent claims of effectiveness rest on small sample studies from selected communities, and the early studies are admitted to be defective. Assertions that anti-caries effects of fluoridation are 'well-established' seem now to accompany admissions, compelled by recent evidence, of the procedure's uncertain safety. The only credible anti-caries effects of fluoride are from its topical, not systemic, uses, at high concentrations." Comprehensive studies which belie the assertion have been reported in Fluoride 27 (4) 238 (2) 59-66 (1) 45-47 1994, 26 (4) 263-266 1993, 23 (2) 55-67 1990, 21 (3) 141-142 (1) 40-41 1989, 20 (2) 51-53 1987. Editor]