HEALTH/BIOLOGICAL EFFECTS

ASSOCIATION BETWEEN FLUORIDE, MAGNESIUM, ALUMINUM AND BONE QUALITY IN RENAL OSTEODYSTROPHY

INTRODUCTION: Trace elements are known to influence bone metabolism; however, their effects may be exacerbated in renal failure because dialysis patients are unable to excrete excess elements properly. Our study correlated bone quality in dialysis patients with levels of bone fluoride, magnesium, and aluminum. A number of studies have linked trace elements, including fluoride, magnesium, and aluminum, to the development of renal osteodystrophy (ROD). However, little is known about the relationship between trace elements and changes in bone quality in ROD patients. The purpose of this study was to examine bone quality in ROD patients, and correlate differences in bone quality to trace element concentrations in bone. Bone quality encompasses parameters that contribute to the mechanical integrity of the bone. METHODS: One hundred fifty-three anterior iliac crest bone biopsies from patients with ROD were examined and subdivided into five groups based on the pathological features. Parameters contributing to bone quality, such as bone structure and remodeling, connectivity, mineralization, and microhardness, were assessed and correlated to bone chemical composition. In addition, clinical symptoms of ROD were assessed and correlated with bone composition. RESULTS AND CONCLUSIONS: There were no differences in bone architecture between the different ROD bone groups; however, differences in bone mineralization and microhardness were observed. Increase in bone fluoride was associated with increased osteoid parameters and decreased bone microhardness. Bone mineralization and microhardness decreased with increasing bone magnesium content and intact parathyroid hormone (PTH) level. Moreover, bone magnesium increased with intact PTH levels. The relationship between PTH, bone magnesium, mineralization, and microhardness was primarily observed in aplastic bone disorder. Furthermore, bone magnesium and aluminum contents were positively associated with bone pain and proximal myopathy in these patients. Most importantly, fluoride, magnesium, and aluminum showed significant correlations with one another. These results suggested that in ROD, bone fluoride may diminish bone microhardness by interfering with mineralization. Magnesium may be involved in the suppression of PTH secretion, lowering bone turnover thus leading to an increase in bone mineralization profile and microhardness in aplastic bone disorder. The effects of fluoride and magnesium on bone quality may be exacerbated by their interaction with aluminum.

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Keywords: Aluminum; Aplastic bone disorder; Bone quality; Fluoride; Magnesium; Microhardness; Mineralization; Parathyroid hormone; Proximal myopathy; Renal osteodystrophy; Trace elements.

DENTAL EFFECTS

CHANGING PARADIGMS IN CONCEPTS ON DENTAL CARIES: CONSEQUENCES FOR ORAL HEALTH CARE

Kuhn proposed in his Structure of Scientific Revolutions (1962) that the theoretical framework of a science (paradigm) determines how each generation of researchers construes a causal sequence. Paradigm change is infrequent and revolutionary; thereafter previous knowledge and ideas become partially redundant. This paper discusses two paradigms central to cariology. The first concerns the most successful caries-preventive agent: fluoride. When it was thought that fluoride had to be present during tooth mineralisation to 'improve' the biological apatite and the 'caries resistance' of the teeth, systemic fluoride administration was
necessary for maximum benefit. Caries reduction therefore had to be balanced against increasing dental fluorosis. The 'caries resistance' concept was shown to be erroneous 25 years ago, but the new paradigm is not yet fully adopted in public health dentistry, so we still await real breakthroughs in more effective use of fluorides for caries prevention. The second paradigm is that caries is a transmittable, infectious disease: even one caused by specific microorganisms. This paradigm would require caries prevention by vaccination, but there is evidence that caries is not a classical infectious disease. Rather it results from an ecological shift in the tooth-surface biofilm, leading to a mineral imbalance between plaque fluid and tooth and hence net loss of tooth mineral. Therefore, caries belongs to common 'complex' or 'multifactorial' diseases, such as cancer, cardiovascular diseases, diabetes, in which many genetic, environmental and behavioural risk factors interact. The paper emphasises how these paradigm changes raise new research questions which need to be addressed to make caries prevention and treatment more cost-effective.

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Keywords: Cariology; Changing dental paradigms; Dental fluorosis; Dental plaque; Mineral imbalance; Oral health care.

CONSUMPTION OF NONPUBLIC WATER: IMPLICATIONS FOR CHILDREN'S CARIES EXPERIENCE

There are concerns that the consumption of unfluoridated bottled and tank water may put children at increased risk of developing caries. OBJECTIVES: The aim of this study was to investigate the relationship between nonpublic water consumption (either from bottles or rainwater tanks) and socioeconomic status (SES) and both deciduous and permanent caries experience. METHODS: A random sample of children enrolled in the School Dental Service of South Australia participated in the study (response rate = 71.8%, n = 9988). RESULTS: Forty-five per cent of children had greater than 50% lifetime consumption of nonpublic water while 36% of children had 0% lifetime consumption. Increased use of nonpublic water occurred for children from lower socioeconomic groups, two-parent families and children from nonmetropolitan areas, with these results most likely a result of the residential location of the children. Multivariate modelling revealed a significant positive relationship between deciduous caries experience and consumption of nonpublic water, even after controlling for the age and sex of the child, SES and residential location. This relationship was significant only for those children with 100% lifetime availability of fluoridated water. The effect of consumption of nonpublic water on permanent caries experience was not significant. It is postulated that these findings may result from the lower caries activity in the permanent dentition of children aged 10-15 and possible dietary confounders. CONCLUSION: Recommendations are made for the addition of fluoride to bottled water, especially with regard to the oral health of younger children.

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Keywords: Dental caries; Fluoride in water; Nonpublic water; Australia and nonpublic water.

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11 November 2004
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This paper is a cross-sectional study, which means that the authors compared fluoridated and unfluoridated communities at a fixed point in time (1991-92). In theory they have
allowed for differences in household income, "occupational prestige", education, and residential location. The key results are:

1. Permanent teeth

The authors found NO difference in tooth decay measured by DMFS in permanent teeth between children aged 10-15 drinking fluoridated water from public supplies compared with those drinking 100% "non-public water", meaning tank or bottled water (mostly tank), for a lifetime. This is a very important result from pro-fluoridation authors.

Armfield and Spencer attempt to explain the absence of benefit in permanent teeth by assuming that bottled water substitutes for sugary soft drinks. However, they present no dietary evidence. Anyway their argument would not be true for tank water, and their data set does not distinguish between those who drink bottled and tank water. Since the vast majority of the children drinking non-public water reside in rural and remote communities, most would drink tank water rather than bottled water.

The authors also attempt to explain the absence of benefit in permanent teeth by the halo effect (children in unfluoridated areas ingesting soft drinks manufactured in fluoridated areas), but fail to explain convincingly why the halo effect is not seen in their results for deciduous teeth. (More on the halo effect in Section 3, below.)

2. Primary (deciduous) teeth

The authors found about 50% more tooth decay measured by dmfs in deciduous teeth of children aged 4-9 drinking 100% tank or bottled water for a lifetime. This result was obtained before allowing for differences in household income, "occupational prestige" and education. Once they allowed for these factors, they say the benefit "remained significant, although the effect size ... of this relationship was small", but omit to publish the actual quantitative results. This is where an unbiased statistician is needed to interpret.

There are some inconsistencies in the results that are published: for instance, there is no difference in dmfs between groups of males who consumed 1-50% fluoridated water and 51-99% fluoridated water. Combining these two groups, the authors found no statistically significant benefit for children who drank fluoridated water for less than 100% of their lifetimes.

The authors of course believe that the observed reduction in caries is due to fluoridation, but they may be wrong. For instance, the authors have not tested the possibilities that:

a. dietary differences could explain the results;

b. fluoridation might delay the eruption of primary teeth (Personally, I'm sceptical about this one, but it still should be checked.);

c. in rural/remote communities there may be a higher prevalence of bottle feeding of infants with sugary drinks;

d. dental examinations were not "blind". Therefore, the well-known phenomenon of examiner bias may have influenced examiners, subconsciously or otherwise, to find more caries in non-fluoridated children.

3. Further discussion of halo effect

Having considered the results for both deciduous and permanent teeth, we can now make an additional deduction about the halo effect. If the halo effect is so large that it wipes out the alleged enormous benefits of fluoridation in permanent teeth, then surely water fluoridated at (say) 0.5 ppm instead of the standard 1 ppm should be sufficient to reduce tooth decay substantially. But, ingesting 100% of drinking water with fluoride content 0.5 ppm water is equivalent to ingesting 50% of drinking water with 1 ppm fluoride. Now Armfield and Spencer’s results find no benefit in either deciduous or permanent teeth from ingesting less than 100% of drinking water fluoridated at 1 ppm. Therefore, the initial hypothesis, that the halo effect is large, must be wrong.
THE RELATIONSHIP BETWEEN DENTAL CARIES AND DENTAL FLUOROSIS IN AREAS WITH MODERATE- AND HIGH-FLUORIDE DRINKING WATER IN ETHIOPIA

OBJECTIVE: The aim of the study is to assess the relationship between caries and dental fluorosis in Ethiopian children living in Rift Valley areas known for endemic fluorosis.

METHOD: A total of 306 children (12-15 years old), selected from areas with moderate (0.3-2.2 mg/L), or high (10-14 mg/L) fluoride concentration in the drinking water were interviewed and examined for caries and dental fluorosis. Scorings were recorded according to the DMF system, and the Thylstrup-Fejerskov (TF) Index.

RESULTS: Prevalence of dental fluorosis (TF-score > or = 1) was 91.8% (moderate area) and 100% (high-fluoride area). The corresponding caries prevalence and mean DMFT in the areas were 45.3% versus 61.6%, and 1.2 versus 1.8, respectively. Age and severity of dental fluorosis were found to be independent predictors for DMFT > or = 1. When compared with 12-year olds with TF-scores 0-4, odds ratios were 3.0 (95% CI 1.6-5.7) and 2.0 (95% CI 1.2-3.2) if TF-scores were > or = 5 and age 13-15 years, respectively. A positive relationship between caries and fluorosis was observed across tooth types in both areas. The percentage of children with DMFT > or = 1 was highest in groups with TF-score > or = 5 in the second molar, followed by the first molar.

CONCLUSION: The present findings indicate that the second molar is the tooth most severely affected by dental fluorosis and dental caries. Dental caries increased with increasing severity of dental fluorosis, both in moderate- and high-fluoride areas. Thus, a positive relationship between dental caries and dental fluorosis was observed across various tooth types, in both areas.

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Keywords: Children; Dental caries; Dental fluorosis; Rift valley, Ethiopia.

ASSOCIATIONS BETWEEN INTAKES OF FLUORIDE FROM BEVERAGES DURING INFANCY AND DENTAL FLUOROSIS OF PRIMARY TEETH

OBJECTIVE: We describe associations between primary tooth fluorosis status and intakes of beverages and fluoride from these beverages during infancy. METHODS: Subjects (n = 677) are members of the Iowa Fluoride Study, a cohort of young children followed from birth. Food and nutrient intakes were obtained from 3-day diet records. Diets were analyzed at 6 weeks, 3, 6, 9, 12, and 16 months and cumulatively for 6 weeks through 16 months of age. Primary tooth fluorosis was assessed at 4.5-6.9 years of age and defined as present or absent. Multiple logistic regression analyses were used to develop models to predict fluorosis status.

RESULTS: Water-based beverage intakes were higher in subjects with fluorosis than in those without. Specifically, higher intakes of water used to reconstitute formulas at 3, 6, and 9 months; any intake of water as a beverage at 16 months; and higher intakes of combined 100% juice and miscellaneous beverages at 16 months were positively associated with fluorosis (p < 0.05). Fluoride intakes from water sources were also higher in subjects with fluorosis than in those without. Specifically, higher intakes of fluoride from water used to reconstitute formulas at 3, 6, 9, and 12 months and for 6 weeks through 16 months, and higher intakes of fluoride from water as a beverage at 16 months and for 6 weeks through 16 months were positively associated with fluorosis (p < 0.05).

CONCLUSION: Infant beverages, particularly infant formulas prepared with fluoridated water, can increase the risk of fluorosis in primary teeth.

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Keywords: Beverages; Fluoride intake; Fluoridated water; Infants; Infant formulas; Dental fluorosis.
WATER FLUORIDATION AND DENTAL CARIES IN 5- AND 12-YEAR-OLD CHILDREN FROM CANTERBURY AND WELLINGTON

OBJECTIVES: Claims have been made that the effectiveness of water fluoridation has decreased due to the widespread availability of other sources of fluoride. This study examines the differences in the oral health of children living in fluoridated and non-fluoridated areas of Canterbury and Wellington, New Zealand. DESIGN: The data used in this cross-sectional study had been routinely collected into a computerized data-collection system by the School Dental Services in the two study areas. SUBJECTS AND METHODS: Records of dental status (dmfs/DMFS), fluoridation status, ethnicity, and socio-economic status for 8030 5-year-olds, and 6916 12-year-olds in 1996 were analysed. RESULTS: Caries prevalence and severity was consistently lower for children in the fluoridated area for both age groups, and within all subgroups. Five-year-olds in the fluoridated area had 2.63 dmfs (sd, 5.88), and those in the non-fluoridated area 3.80 dmfs (sd, 6.79). For 12-year-olds the respective figures were 1.39 DMFS (sd, 2.30) and 2.37 DMFS (sd, 3.46). Multivariable analysis confirmed the independent association between water fluoridation and better dental health. CONCLUSIONS: This results of this study show children living in a fluoridated area to have significantly better oral health compared to those not in a fluoridated area. These differences are greater for Maori and Pacific children and children of low socio-economic status.

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Keywords: Canterbury, New Zealand; Caries prevalence; Dental caries; Ethnicity, Maori children; Multivariable analysis; Pacific children; School dental services; Socioeconomic status; Water fluoridation; Wellington, New Zealand.

Comments by Bill Wilson: The data in the above report were part of the annual routine collection by the school dental services of dental data by a large number of dental therapists at a large number of sites for all 5 to 12 year-old children. The examiners were not standardized, and examiner reliability is not known. The above study compared only 5 and 12 year-old children in fluoridated Wellington and nonfluoridated Christchurch with a generally lower socio-economic living standard. The difference in caries rates between children in the fluoridated and nonfluoridated areas is approximately only one tooth surface for both 5 and 12 year-olds with very large standard deviations. It is therefore a gross exaggeration to claim significantly better dental health in the fluoridated area at these small difference levels. It is also noteworthy that data collected for 1996 were not published until 2004, which happens to coincide with a New Zealand Ministry of Health campaign to fluoridate Christchurch.

In relation to this study, data released in 2002 by the Ministry of Health after a Freedom of Information request are of interest. A covering letter addressed to a professional inquirer stated: “The Ministry of Health has provided the following data, which show that Child dental health has improved [emphasis in letter] across the whole country, in Fluoridated and Non-Fluoridated Communities, over the last seven years. Also, since Fluoride was removed from Tauranga, the Dental Health of Children in Western Bay has improved as follows...”

Without fluoridation, five-year-olds in 1992 had an mft [missing, filled, primary tooth score] of 2.84, and 41.65% were caries-free. For 1995 the corresponding figures were 1.6 mft and 56.03% caries-free. One document showed that the mean numbers of mft for 5-year-old children in F and non-F areas decreased nationally from 1990 to 2000. It is interesting that the decline in mft extended to and included 1996 but then started to increase in both F and non-F areas up to the year 2000. Another interesting document released by the Ministry of Health shows dental extractions and restorations for children under age six by the District Health Provider Hospitals during the period 1990/1991 to 2000/2001. Non-fluoridated Canterbury

CORRECTIONS

Adverse effects of fluoride and/or arsenic on the cerebral hemisphere of mice and recovery by some antidotes by SD Shah and NJ Chinoy. *Fluoride* 2004;37(3):162–171.

In reference 10, p.171, the page numbers are 151–161 rather than ????????


In Table 12 the data for Xinhuai for children whose parent’s education level was primary school and below and senior high school or above were transposed. The description of the results in the text is unchanged: “As shown in Table 12, no significant relationships were present between the children’s IQ and education level of parents, in both Wamiao and Xinhuai (Pearson correlation coefficient: –0.119 and 0.113, respectively, \( p >0.05 \)). At each parent’s education level, the children’s IQ in Xinhuai was higher than in Wamiao.” The corrected table is:

<table>
<thead>
<tr>
<th>Parent’s education level</th>
<th>Wamiao</th>
<th>Xinhuai</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. children</td>
<td>IQ (Mean±SD)</td>
<td>No. children</td>
</tr>
<tr>
<td>Primary school and below</td>
<td>74 93.26±12.69</td>
<td>121 99.79±13.64</td>
</tr>
<tr>
<td>Junior high school</td>
<td>118 92.16±12.59</td>
<td>131 100.09±13.19</td>
</tr>
<tr>
<td>Senior high school and above</td>
<td>30 88.43±15.05</td>
<td>38 103.50±11.72</td>
</tr>
</tbody>
</table>

THIRD ANNOUNCEMENT: XXVITH CONFERENCE OF THE INTERNATIONAL SOCIETY FOR FLUORIDE RESEARCH

The XXVIth Conference of the International Society for Fluoride Research will be held at the Dorint Sofitel Pallas Wiesbaden hotel in Wiesbaden, Germany, September 26–29, 2005. The meeting will be hosted by Professor Jörg Spitz, Society for Medical Information and Prevention, Wiesbaden, Germany.

Abstracts: Papers for platform or poster presentation on fluoride research are invited. Conference participants planning to present orally (15 minutes) or by poster should submit by June 1, 2005, a single-spaced and typed abstract, not exceeding 350 words in the text and 20 words in the title, by E-mail as an attachment in a Word document and as a paper copy together with a floppy disc or cd, to Professor Jörg Spitz, Society for Medical Information and Prevention (mip), Kornweg 13, D 65388 Schlangenbad, Germany. E-mail: info@mip-spitz.de.

Published by the International Society for Fluoride Research.
http://homepages.ihug.co.nz/~spittle/fluoride-journal.htm
Editorial Office: 727 Brighton Road, Ocean View, Dunedin 9051, New Zealand

Fluoride 2004;37(4)