

summary

No association between water fluoridation and bone fractures

McDonagh M, Whiting P, Bradley M, Cooper J, Sutton A, Chestnutt I, et al. *A Systematic Review of Public Water Fluoridation*. York: Publications Office, NHS Centre for Reviews and Dissemination, University of York. ISBN 1 900640 16 3; 2000

Objective Does water fluoridation have negative effects? This objective was broken down into four sections: fluorosis, bone fracture and bone development effects, cancer and other possible adverse effects.

Data sources See page 37.

Study selection All studies were level C except one which was level B. The mean validity score was only 3.4 out of 8. Only four studies used a prospective design, none used any form of blinding and only one study conducted a baseline examination prior to the introduction of fluoridation.

Data extraction and synthesis A forest plot of all the bone studies was produced showing the measures of effect and the 95% confidence intervals for all those that provided sufficient data to allow calculation.

Results A total of 29 studies met inclusion criteria: 18 studies investigated hip fracture alone. Fourteen found decreased hip fracture associated with increased water fluoride level, of which five were statistically significant (positive association). Thirteen studies,

however, showed an increased occurrence of hip fracture with increased water fluoride level, of which four were statistically significant (negative association). The remaining three studies found no association. Three of the 18 studies found the direction of association positive in women but negative in men and one study found a negative effect in women and a positive effect in men. There were no definite patterns of association for any of the fractures

Conclusions The best available evidence on the association of water fluoridation and bone fractures (27 out of 29 studies evidence level C) show no association.

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Commentary

The York review has shown that fluoridating water reduces the impact of dental disease but one of the areas of concern over fluoridation has been the possible adverse effects on bone. Fluoride accumulates in bone where it has a biological half-life of several years. Fluoride is known to stimulate osteoblast activity in humans in contrast to most other drugs used for the prevention and treatment of osteoporosis which inhibit bone resorption. Because of this property, fluoride has been used for over 30 years as a treatment for osteoporosis. Studies suggest, however, that although fluoride increases bone mineral density, there is a corresponding decrease in elasticity and strength of the bone tissue. Fluoride is also thought to alter the crystalline structure of the bone tissue.¹

A variety of fracture sites, slipped epiphysis in older children and young adults, and otosclerosis (malformation of bones in the ear) were considered by the 29 included studies. The majority (18) were concerned with hip fracture only. The figure showing the size of effect for each study and their 95% confidence intervals were distributed around 1, the line of no effect. This suggests no association between fluoridation and increased or decreased fracture risk.

Hip fracture is strongly associated with age and sex so these, together with other potential confounders — which include body mass index (BMI), ethnicity, calcium intake, certain drugs, nonwater fluoride exposure and the menopausal status of women — should be controlled for. Out of 27 studies considering fracture incidence, however, six studies failed

to control for the effect of any possible confounding factors and three studies controlled for age only. Three studies controlled for age, sex and BMI and four studies controlled for other variables in addition to these three variables. This has a bearing on the overall quality of the evidence included.

In a more recent study, Phipps *et al.*² controlled for the potential confounding effect of other factors known to be associated with fractures in individual women, such as oestrogen use, smoking and body weight. They found that ambulatory women aged 65 years or older who had been continuously exposed to fluoridated water for the past 20 years had higher bone mineral density at the lumbar spine and hip and a slightly lower risk of hip and vertebral fractures than women who had not been exposed to fluoridated water. In

another recent review³ which includes animal feeding studies (specifically excluded from the York review) similar conclusions are reached relating to the effect of fluoridation on bone.

The message from this review and subsequent studies is that there is no clear association of bone fracture with water fluoridation.

1. Haguenaer D, Welch V, Shea B, Tugwell P, Wells G. Fluoride for treating postmenopausal osteoporosis (Cochrane Review). In The Cochrane Library; 2002: Issue 2. Oxford: Update Software.
2. Phipps KR, Orwoll ES, Mason JD, Cauley JA. Community water fluoridation, bone mineral density, and fractures: a prospective study of effects in older women. *BMJ* 2000; 321:860–864.
3. Demaos LL, Kazda H, Cicuttini FM, Sinclair MI, Fairley CK. Water fluoridation, osteoporosis, fractures — recent developments. *Australian Dent J* 2001; 46:80–87.

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