

Fluoride and the Water Supply

Robert L Karlinsey*

Indiana Nanotech, 7750 Centerstone Drive, Indianapolis, Indiana, 46259, USA

***Corresponding Author:** Robert L Karlinsey, Indiana Nanotech, 7750 Centerstone Drive, Indianapolis, Indiana, 46259, USA.

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In the battle against tooth decay, fluoride remains the most clinically proven therapeutic. But, like a coin, fluoride's obverse benefit is offset on the reverse side by potentially negative aspects, including, for instance, enamel fluorosis and mottling. Perhaps fueled by its characteristics as being the most electronegative element in the periodic table, such concerns weigh heavy on certain individuals, groups and communities, where fluoride is treated with fear and/or hate, often supported with assumptions and/or inaccurate information. While these concerns are certainly understandable, it is helpful to refresh the topic with factual information. This Editorial is an attempt to do just that by remembering the history of water fluoridation.

Fluoride mottling was prominently observed in several towns farther from the east coast, especially in the United States' Rocky Mountain region as studied by Drs. Black and McKay beginning around 1909 and published in 1916 [1]. These doctors noted that while the mottling produced brownish stains in the enamel, these teeth were largely caries-free. These findings helped prompt nationwide assessments of mottled enamel throughout the 1930s, and were led by Dr. Dean, a dentist from Grand Rapids, Michigan and the head of the Dental Hygiene Unit at the National Institutes of Health. Dr. Dean and his team compiled data on fluoride content, severity of mottled enamel and the number of decayed, missing or filled teeth. While some mottling was due to drinking naturally fluoridated spring water that had inherently higher fluoride content, the industrial boom also created mottled enamel through its chemical by-products including fluoridated chemical waste which might be unknowingly introduced into a community's water source [2].

Meanwhile, in 1938, Drs. Armstrong and Brekhuis published on the fluoride content of sound and decayed enamel, with the former surmised as having greater resistance to decay by virtue of its higher fluoride content [3]. Separately, in 1940, Drs. Bibby and Van Kesteren published on the ability of fluoride to frustrate the growth and metabolics of decay-causing bacteria, demonstrating that levels of 1 ppm were sufficient to inhibit acid production from oral pathogens [4].

With newly developed and reliable methods of measuring fluoride content of a given water sample, it became possible to construct a risk-benefit relationship tied to fluoride concentration. Armed with ample survey and fluoride content data based on more than 5,800 children in 22 cities, Dr. Dean identified that a fluoride level near 1 ppm sufficiently provided maximum anti-decay benefits while minimizing fluorosis risk, while levels between 2 and 5 ppm were especially associated with enamel mottling [2,5]. With World War II in its penultimate year in 1944, Grand Rapids, Michigan became the first community to introduce Dr. Dean's proposal of adding fluoride to drinking water, followed shortly thereafter in Newburgh, New York and Brantford, Ontario, with large reductions in caries incidence in children (e.g. more than 60% reduction in Grand Rapids' children after five years) [5-7]. And, today, both adults and children benefit with at least a 25% reduction in caries incidence due to water fluoridation, even with fluoride concentrations below 1 ppm (e.g. fluoridation levels have been lowered to 0.7 ppm in the USA, which will further help reduce possible risk of fluorosis).

Though concerns about fluoride may continue to exist, it is important to understand and herald the responsible and effective use of fluoride, the most well-studied, relatively inexpensive and highly successful anti-caries tool we have. This is especially true for many populations as dental decay is actually increasing, and this is further underlined when other factors such as age, history of dental decay, diet,

and so on are considered. Just as the 'pencil does not write the lie', fluoride is not inherently evil and when used appropriately provides a tremendous public health benefit. In the words of Dr. Dean published in 1953 "Truth revealed through science has been challenged and stubbornly resisted again and again throughout history. If it were otherwise, it would deleterious to the advancement of scientific knowledge..." [6].

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