

PREVENTIVE DENTISTRY

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Systemic Fluorides

Communal Water fluoridation

History :

Early in the twentieth century (1901,1908) Dr.F. McKay began his extensive studies to find the cause of “brown stain,” which later was called mottled enamel and now is known as dental fluorosis. He observed that people in Colorado Springs, Colorado, with mottled enamel had significantly less dental caries. He associated the condition with the drinking water, but tests were inconclusive.

- G .V. Black, USA in 1916 accomplish a histological study on the teeth affected with the brown stain and the histological appearance revealed defect in Enamel and Hypocalcification with No dental caries
- H.V.Churchill a chief chemist of Aluminum company in USA analyses the water of an area with mottled enamel and found the high percentage of fluoride in water about 13.7 ppm
- Dr.H.T.Dean was a dentist who carry out a series of epidemiological investigations on 21-city study and concluded that mottling is rare at fluoride level 1ppm or below . Dean observed an inverse relationship between dental fluorosis and dental caries.

–Recent publications have suggested that over 300 million people in almost 40 countries are exposed to fluoride from adjusted fluoridated water supplies

In the USA alone, an estimated 195 million people (approximately 72.4% of the population) are currently receiving the benefits of optimally fluoridated water Considering these estimates, more than half of the population of the world receiving the benefits of water fluoridation live in the USA. In some countries only small proportion of population covered by artificial water fluoridation as example UK 10% ,China40%,Spain 10%, while in Hong Kong 100%.

Cost effectiveness

The average annual cost of this method per person has been estimated to range from USD 0.10 up to USD 5.41, which makes fluoridation a very cost- effective measure for reducing dental caries . Water fluoridation can be regarded as a low- cost method to deliver fluoride.

Variables that influence the costs per capita of a fluoridation project include:

- (1) the size of the community (the smaller the community, the higher the per capita cost);
- (2) the prevalence of dental caries in the population;
- (3) the number of water sources;
- (4) the type of equipment;
- (5) the fluoride compound;
- (6) the availability of technical support

Fluoridation is considered as one of the major public health measures of the 20th century. In spite of this, water fluoridation is frequently questioned by anti-fluoridationists who cite freedom- of choice issues or the potential dangers to humans from fluoride . However, there is no evidence of harmful effects of fluoride related to optimal water fluoridation, with the exception of the potential to increase the prevalence of dental fluorosis

-Reduction of dental caries Prevalence

In countries under artificial fluoride application; in early years of application the reduction of caries was ranging from 50-70%. Then after many years another decrease in caries prevalence reached 30-40% like in Brazil and reach 20-30% in Australia.

There is an extensive literature on the effectiveness of water fluoridation, with studies carried out in different parts of world. A review of fluoridation studies among children prior to 1980 reported caries reduction in children's permanent teeth. Based on studies, reduction in the prevalence of dental caries in primary teeth ranged from 40 to 50 percent and in permanent teeth was 50 to 60 percent approximately.

An apparent reduction is likely to be due to the phenomenon of declining caries prevalence recognized throughout the developed world since mid 1970, and influence of fluoride coming from other sources, e.g. use of fluoride toothpaste and supplements. Also due to indirect exposure to fluoride from food and beverages processed in fluoridated areas called as “Halo effect”. This Halo effect occurs when residents of non fluoridated and fluoridated communities are exposed to the benefits of fluoridation to some degrees by consuming food and beverages manufactured and processed in fluoridated communities.

Also several studies have shown that water fluoridation reduced the prevalence of caries and the number of affected teeth, as well as social inequalities, among groups with a different socioeconomic status

Artificial Fluoridation

Fluoridation is the controlled adjustment of a fluoride compound to a public water supply in order to bring the fluoride concentration up to a level which effectively prevents caries. Water fluoridation requires a level of dental caries in the community that is high or moderate, or a firm indication that the caries level is increasing.

History of artificial water Fluoridation

Water naturally fluoridated at 1ppm clearly benefited dental health. Following Dean’s studies they tried to add fluoride to unfluoridated water to test for beneficial effect. In 1945 Grand Rapids, Michigan city, became the first town in the world to be artificially fluoridated with Muskegon city as control in USA.

The previous year (1944) a baseline study comparing Grand Rapids with the neighboring town of Muskegon had found similar decay levels in deciduous and permanent teeth in both areas. Six years later, surveys indicated that decay levels in 6-year-old children (i.e. those born since fluoridation commenced) in Grand Rapids was almost half of that of Muskegon, in ‘non-fluoride’ Muskegon the average number of teeth with decay experience was 5.7, compared with 3.0 in ‘fluoridated’ Grand Rapids. The study was successful that it was decided to fluoridate the drinking water of Muskegon.

Fluoride Level in Water

In 1984 WHO (World Health Organization) guidelines suggested that in areas with a warm climate, the optimal fluoride concentration in drinking water should remain below 1 mg/ liter (1 ppm or part per million), while in cooler climates it could go up to 1.2 mg/liter. (A range of 0.7-1.2 ppm). The differentiation derives from the fact that perspiration is more in hot weather and consequently intake is more. Then the National Advisory Committee on Oral Health suggested a range 0.6-1.1 mg/L with variation within that range according to the mean maximum daily temperature.

Fluoride compound used in water fluoridation

The most common fluoride compounds used are hexafluorosilicic acid (H_2SiF_6), also known as fluorosilicic acid, which comes in a liquid form, and disodium hexafluorosilicate (Na_2SiF_6), also known as sodium fluorosilicate (a powder). Fluoride compound used in water fluoridation . It must be emphasized that these compounds are not from industrial waste. Fluorosilicic acid is more frequently used. When it is introduced into the water system, it dissociates to release fluoride ions into the water. This process is similar to what happens to the fluoride ion when it is naturally present in the water supplies. There is no difference chemically between natural and artificial fluoridation

Advantages of artificial water fluoridation:

1. Low cost.
2. No motivation or behavioral changes necessary.
3. Had pre and post eruptive benefit.
4. Caries reduction 50-60% in permanent teeth, and 40-50% in primary teeth.

Disadvantages

1. Political and/or emotional objections to water additives.
2. Possibility of mild to moderate fluorosis if other sources of fluoride are ingested.
3. Alleged toxicity.

Safety of Water Fluoridation

Safety of water fluoridation was a research concern from the time of fluoride's identification in water in 1930's .According to World Health Organization's monograph 'fluoride and human health' there is evidence that ingestion of fluoride at recommended levels presents no danger to humans.

Health benefits and risk of fluoridation has been the subject of searching reviews by expert committees throughout the world including the WHO. None has found evidence that drinking water with a concentration of around 1 ppm is harmful to health. In fact other than dental fluorosis only endemic skeletal fluorosis is known to result from long-term ingestion of water containing high levels of fluoride.

In recent years opponents of fluoridation have attempted to link fluoridation with a wide range of diseases, e.g. cancer, Alzheimer diseases or that it interferes with the immune function. But there is overwhelming agreement between the scientific, medical and dental community worldwide that fluoridation of water is a safe and effective public health measure.

Water fluoridation simply delay dental decay

- Since the introduction of fluorides, estimates for the delay in tooth eruption range from 0.7 years to as much as 2 years.
- Fluoride incorporation in the primary dentition and in the alveolar bone, which must be resorbed prior to the eruption of the permanent teeth is believed to be the cause of this generalized delay in tooth eruption. Using existing data, it is possible to estimate the effects on dental decay rates of a delay of tooth eruption of 1.0 year to 20% and for 1.5 years to 33.3%, These delays, could account for apparent difference in dental decay rates.

School Water Fluoridation

It is most applicable in rural schools, where fluoridation of community water is not practical. Reduction in dental caries was found to be about 40%.

Disadvantages:

- 1- The children do not receive the benefits until they begin school
 - 2- Children consume the fluoridated water only when the school is in session
- To compensate for this belated and abbreviated exposure the school water is usually fluoridated at 4.5 times the optimum concentration recommended for that place.