
بسم الله الرحمن الرحيم

Microelements and oral health
Part II

Assist. Prof. Dr. Nada Jafer Radhi
B.D.S., M.Sc., Ph.D.
(Preventive Dentistry)

Ultratrace elements may enter the body through absorption from water and diet as well as inhalation from the atmosphere. Ultratrace elements comprises fluorine (F), aluminium (Al), molybdenum (Mo), and cobalt (Co).

- Ultratrace element defined as those elements with an established, es□timated, or suspected dietary requirement of minute amount, generally of the order of µg/day

- The presence of low but constant levels of topical F in the fluid phase at the tooth enamel surface are more important in controlling tooth decay in people of all ages. An inverse relationship between incidence of dental caries and levels of Al in drinking water, food, and soils has been indicated by some epidemiological studies. Co and Mo, whilst occasionally showing potential beneficial oral health effects in laboratory experiments, do so at concentrations much higher than found in vivo.

- Tooth enamel contains both organic and inorganic phases. The inorganic phase is composed of calcium-deficient calcium hydroxyapatite (HA) with small amounts of incorporated trace and ultratrace elements. The enamel hardness and optical properties can be affected by the organisation and size of apatite crystals, which in turn can be influenced by the presence of impurity elements

- It has been demonstrated that elements in circulation are primarily deposited into the structure of the tooth during calcification, before eruption. At the post-eruptive stage, elements might be incorporated into or lost from the enamel through exchange with either the blood supply to the pulp cavity via the dentine or with saliva, and likewise the dentine with the pulp

Fluoride

- Although F only appears in trace amounts in the body, it is of nutritional and public health importance and considered as a valuable nutrient because of its role in the mineralisation of bones and teeth. F achieves its anticaries effect through systemic and topical actions. During tooth development, ingested (sysemic) F is incorporated into the apatite crystals of the developing tooth which helps in improving resistance to acid demineralisation. In addition, the ingested F can return to the oral cavity through saliva and crevicular fluid and influence de- and re-mineralisation processes.

Fluoride

- F helps lessen demineralisation of tooth enamel and dentine hypersensitivity not only by reducing acid solubility of enamel but, more importantly, by encouraging the uptake of tooth minerals (calcium and phosphate) and the precipitation of fluoridated HA within the enamel, and consequently by reducing the net rate of transport of minerals out of the enamel. F also affects the cariogenic bacteria in oral plaque that produce the acid, which can dissolve the teeth. F enters bacterial cells and is able to interfere with their acid production and, consequently, decreases the potential for enamel destruction.

Fluoride

- Chronic exposure to excessive systemic F, during critical periods of tooth development, can result in fluorosis in both primary and permanent teeth. The most important period for development of dental fluorosis in permanent incisors as well as the first permanent molars is the first 3 years of life, especially between 6 and 24 months; whereas for the later developing permanent canines and premolars the risk period could be up to 8 years of age

Fluoride

- Skeletal fluorosis, a chronic metabolic bone and joint disease caused by systemic ingestion of large amounts of F over many years during periods of bone modelling (growth) and/or remodelling, results in weaker bones and stiffness and pain in the joints

Fluoride

- Acute F toxicity can happen when F is ingested in large quantities in a single dose or in multiple doses within a few hours. Since the first organ to be affected by systemic acute exposure is the stomach, clinical systemic toxicity starts with gastric signs and symptoms, ranging from some degree of nausea to abdominal pain, haemorrhagic gastroenteritis, vomiting, and diarrhoea

Aluminium

- Al is the most abundant metal and the third most copious element; making up about 8% of the earth's crust. Al is virtually never found in the elemental form, due to its strong affinity for oxygen

Aluminium

- An inverse relationship between incidence of dental caries and levels of Al in drinking water, food, and soils has been indicated by some epidemiological studies.
- The primary mechanism for the potential car□iostatic action of Al has been linked to its steady incorporation at the surface of both sound and demineralised enamel

Aluminium

- It has been proposed that in acidic conditions producing a Ca-deficient mineral lattice environment, interaction between Al and apatite phosphate may be favoured, leading to the formation of a more stable, insoluble mineral. Al may inhibit the initiation and progression of caries by forming very acid-insoluble reaction products within the surface enamel or incipient lesions

Aluminium

- The Al-F combination has been advocated to have a stronger inhibitory effect on acid dissolution of powdered enamel and synthetic HA than those of these substances separately.
- A significant reduction in salivary levels of oral Streptococci (S. mutans, S. mitis, and S. salivarius) has been reported in children rinsing daily with a mouthwash containing hydrated Al potassiumsulphate

Cobalt

- Co2+ replaced Ca2+ in synthetic HA, following the equation Ca10–x Cox (PO4)6 (OH)2, with an exchange limit of 1.35 wt% Co. Co-substituted apatites had improved crystallinity, consistent with lower solubility.

Molybdenum

- Mo could affect enamel solubility, production of bacterial acid, and/or morphology of the teeth.
- Mo can be incorporated into enamel at both pre- and post-eruptive stages and might therefore affect the physical-chemical characteristics of the enamel. concentrations are low and unlikely to influence enamel or dentine solubility.

Reference

- The impact of nutrition and diet on oral health 2020.(book)
- Others from scientific articles

THANK YOU