Preventive Dentistry

Systemic fluoride Lec. 4

Introduction

The benefits from ingesting fluoride for controlling dental caries have been suggested more than a century ago, Ingestion of excess fluoride, most commonly in drinking-water, can cause ***fluorosis*** which affects the teeth and bones. Moderate amounts lead to dental effects, but long-term ingestion of large amounts can lead to potentially severe skeletal problems. Paradoxically, low levels of fluoride intake help to prevent dental caries. The dental effects of fluorosis develop much earlier than the skeletal effects in people exposed to large amounts of fluoride.

Dental Fluorosis:

Dental Fluorosis is a developmental disturbance of dental enamel, caused by excessive exposures to high concentrations of fluoride during tooth development, leading to enamel with lower mineral content and increased porosity.

Dental fluorosis is generalized within the dentition and over the entire tooth surface which makes it easy to distinguish fluoride-induced enamel changes from other enamel defects (non-fluoride origin) which may be symmetrically distributed in the oral cavity. ***According to age and amount of fluoride intake:***

Infants and toddlers are especially at risk for dental fluorosis of the anterior teeth since it is during the first 3 years of life that the permanent front teeth are the most sensitive to the effects of fluoride (The central incisor takes approximately 3 years to go through complete enamel mineralization. Timing of chronic daily fluoride ingestion and the corresponding dental fluorosis pattern that can be expected.). Fluoride accumulates at the transition/ maturation stage of tooth development so that the entire tooth surface can be affected. Children fed formula made with fluoridated water are at higher risk to develop dental fluorosis.

1. Child from birth -3year takes **excess fluoride from** tap water used for infant formula, Incisors, and first molars are most affected teeth.
2. Child from 3–6 years takes **excess fluoride from** early toothpaste use, premolars, canines and second molars are most affected teeth.
3. Child from 0-6years takes **excess fluoride from** Fluoride supplements and fluoridated water (drinking water >4 ppm fluoride), all teeth affected.

A direct relationship is present between dental fluorosis and level of F ingested, the severity of dental fluorosis depend on:

1. Stage of tooth development.
2. Duration of exposure to fluoride.
3. Concentration of fluoride in foods and drinks.

Clinical Appearance and classification of dental fluorosis:

Dental fluorosis is characterized by staining and pitting of the teeth. In more severe cases all the enamel may be damaged. It is difficult to differentiate between dental fluorosis and other enamel disturbances. Clinically dental fluorosis is characterized by a white opaque appearance of the enamel, caused by increased subsurface porosity. The earliest sign is a change in color, showing many thin white horizontal lines running across the surfaces of the teeth, with white opacities at the newly erupted incisal end. The white lines run along the 'perikymata', a term referring to transverse ridges on the surface of the tooth, which correspond to the incremental lines in the enamel known as Striae of Retzius .

At higher levels of fluoride exposure, the white lines in the enamel become more and more defined and thicker. Some patchy cloudy areas and thick opaque bands also appear on the involved teeth. With increased dental fluorosis, the entire tooth can be chalky white and lose transparency.

With higher fluoride doses or prolonged exposure, deeper layers of enamel are affected; the enamel becomes less mineralized. Damage to the enamel surface occurs in patients with moderate- to- severe degrees of enamel fluorosis. Teeth can erupt with pits, with additional pitting occurring with posteruptive enamel fracture. In the individuals with moderate dental fluorosis,yellow to light brown staining is observed in the areas of enamel damage. In very severe cases, the enamel is porous, poorly mineralized, stains brown, and contains relatively less mineral and more proteins than sound enamel. Severely fluorosed enamel can easily chip posteruptively during normal mechanical use . Although teeth with mild dental fluorosis may be more resistant to dental decay because of the higher levels of fluoride contained in the enamel surface,severely fluorosed teeth are more susceptible to decay, most likely because of the uneven surface or loss of the outer protective layer.

Dean in 1942 classified dental fluorosis as follow(***Dean's Classification of Dental Fluorosis***): **Criteria of index.**

Normal 0 Enamel (trancelucent, smooth, glossy and creamy white color).

Questionable (0.5) Enamel discolored(slight aberration from the traclucency of normal enamel, ranging from a few white flecks to occasional white spot.

Very mild (1) Small, opaque , paper, white area scattered irregularly over the tooth, but not involving as much as approximately 25% of tooth surface(no more than 1-2 mm of white opacity at the tip of cusps of bicuspids or second molar.

Mild (2) The white opaque areas in the enamel of teeth are more extensive, but not involve as much as 50% of tooth.

Moderate(3) All enamel surfaces of teeth are affected and subject to attrition show wear, brown stains is a disfiguring feature.

Sever(4) All enamel surfaces of teeth are affected and hypoplasia is so marked that general form of the tooth may be affected, discrete pitting , brown stain wide spread teeth often present a corroded like appearance.

Pathogenesis of dental fluorosis:

Dental fluorosis is related to physiological conditions, including body weight, rate of skeletal growth and remodeling, nutrition, and renal function.***it is widely known that F- affects the kinetics of*** **bio mineralization, , *triggering the incomplete mineralization of enamel crystals and producing porous enamel-which is typical of dental fluorosis.*** Bone is a reservoir of fluoride, as fluoride is incorporated in the forming apatite crystals, and this ion can also be released from these crystals as bone remodels. Therefore, rapid bone growth, as occurs in the growing child, will remove fluoride from the blood stream, possibly reducing the risk of dental fluorosis by lowering serum fluoride levels. Also Nutrition is also important for controlling the serum level of fluoride, as ions such as calcium, magnesium and aluminum can reduce the bioavailability of fluoride. A deficiency in these ions in food can also affect (enhance) fluoride uptake.

Treatment of Dental Fluorosis:

Type of fluorosis	Treatment
Mild	bleaching, to make the color of the tooth surface uniform
Moderate	Composite restorations combined with micro abrasion or application of aesthetic veneers
Sever	prosthetic crowns

Incipient Caries and Fluorosis Diagnosis:

It is important to differentiate visually between incipient caries and developmental white spot hypocalcifications (fluorosis) of enamel.

1. Dental fluorosis is common to observe and is unaffected by drying and wetting. So, a white spot that is an incipient lesion will disappear upon wetting and a hypocalcification will remain whether dry or moist.
2. White spot carious lesions usually occur around margins of gingival (the favorable site for plaque deposition) **Dental fluorosis and bone fluorosis**:

Skeletal or bone fluorosis affects children as well as adults. It does not easily manifest until the disease attains an advanced stage. Symptoms of bone fluorosis:

1. Early symptom include sporadic pain, back stiffness, burning like sensation, pricking and tingling in the limbs, muscle weakness, chronic fatigue, abnormal calcium deposits in bones and ligaments.
2. The advanced stage is osteoporosis in long bones and bony outgrowths may occur. Vertebrae may fuse together and eventually the victim may be crippled.

Generalized dental fluorosis of all the permanent teeth indicates that the bone is potentially a major source of the excess fluoride that causes dental fluorosis in children. People ingesting fluoridated water for many years have higher levels of fluoride in their entire skeletal systems.