Influence of systemic diseases on the Periodontium

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MDS

- Systemic disorders have been implicated as risk indicators or risk factors for adverse periodontal conditions.

- In general, these disorders do not initiate chronic destructive periodontitis, but they may predispose, accelerate, or otherwise increase its progression toward periodontal tissue destruction.

- Nutritional
- Endocrine
- Hematological
- Immunologic
- Cardiovascular
- Other systemic
- Psycho somatic
- Hereditary

Effect of Nutrition on the Periodontium

Physical characters of diet

- Soft diets may lead to plaque and calculus formation.

- Hard and fibrous foods provide surface cleansing action and stimulation which results in less plaque and gingivitis.

Nutrition affect periodontal health at three levels

- Contributing to microbial growth in gingival crevice
- Affecting the immunological response to bacterial antigens
- Assisting in the repair of connective tissue at the local site after injury from plaque calculus and so forth.

Effect of Nutrition on Oral Microorganisms

- Dietary intake can be the source of nutrients for bacteria.(Direct effect)

- The second mechanism (indirect)

- Effect on the production of metabolic byproducts from one organism that provide nutrients for other organisms.
- e.g: Lactate and Formate from Streptococcus and Actinomyces species are used as nutrients by other bacteria

Proteins

- Proteins are complex organic nitrogenous compound.
- They are indispensible constituents of the diet because they are the only source of the amino-acids including essential amino-acids
- These are (valine, lysine, leucine, iso-leucine, methionine, trytophan, threonine, histidine, phenylalanine).

Fuctions

- Build up new tissues during the period of growth or pregnancy and lactation.
- Essential for repair and maintenance of worn out body tissue.
- Provide the raw material for the synthesis of certain substances eg. Antibodies, hemoglobin, enzymes, hormones and plasma proteins.

- Sources: fish, meat, chicken, milk products.

- Daily requirements:
  - For adults: 1.0gm/kg body weight
  - Children: 1.5-2gm/kg body weight
  - pregnant & lactating women: 1.5-2gm/kg body weight

Proteins and dental tissues

- Proteins are the constituents of the organic matrices of all dental tissues including the alveolar bone.

- The integrity of the periodontal ligament, the fibers of which are being remodeled constantly, is dependent on the protein (amino acids) supply.

- Protein deprivation causes following changes in periodontium:

I. Degeneration of connective tissue of the gingiva & periodontal ligament.
II. Osteoporosis of alveolar bone
III. Retardation in the deposition of cementum
IV. Delayed wound healing
V. Atrophy of the tongue epithelium

- High protein and low carbohydrate diet had a significant effect in reducing sulcus depth and clinical tooth mobility and in improving gingival health

(*Ringdorf and Cheraskin*)

Vitamins

- It is an organic compound which is required in small amounts by body but whose prolonged absence from diet leads to both general & specific disease symptoms.

- 13 vitamins are currently known divided into 2 groups

Fat Soluble Vitamins

Vitamins A,D, E & K

Water Soluble Vitamins

Thiamine(Vit B1)

Riboflavin(Vit B2)

Niacin(Vit B3)

Pyridoxine(Vit B6)

Biotin

Folic acid

Pantothenic Acid

Vit. B12

Vit.C (Ascorbic Acid)

FSV	WSV
Fat Soluble	Water Soluble
Absorbed from GIT in association with dietary fats	Absorbed from GIT independent of fats
Excess stored in body	Excess excreted through urine
Thus not required daily	Required daily

Fat-Soluble Vitamins

- Vitamins A, D, E & K

- **Vitamin A**

- Relationship b/n plant pigment Carotene & Vitamin A was first demonstrated in 1920 & in 1957 it was finally proved that carotene is precursor of Vit.A
- Other Names: Retinol, Provitamin A, Antiinfective Vitamin.
- Daily Requirements:

  -1000 μg RE for Men

  -800 μg RE for Women

  -400-700 μg RE for children

- Dietary Sources: Liver, Egg yolk, Green leafy Vegetables, Fruits, Whole milk, Cheese & Butter.

- Functions:

➢ Production of Rhodopsin for normal maintenance of the Retina.

➢ Maintains the health of epithelial cells of the skin and mucous membranes & epithelial integrity.

➢ Synthesis Glycoprotein

➢ Promotion of Bone Remodelling

- Deficiency results in dermatologic, mucosal, and ocular manifestations.

- Oral Manifestations:

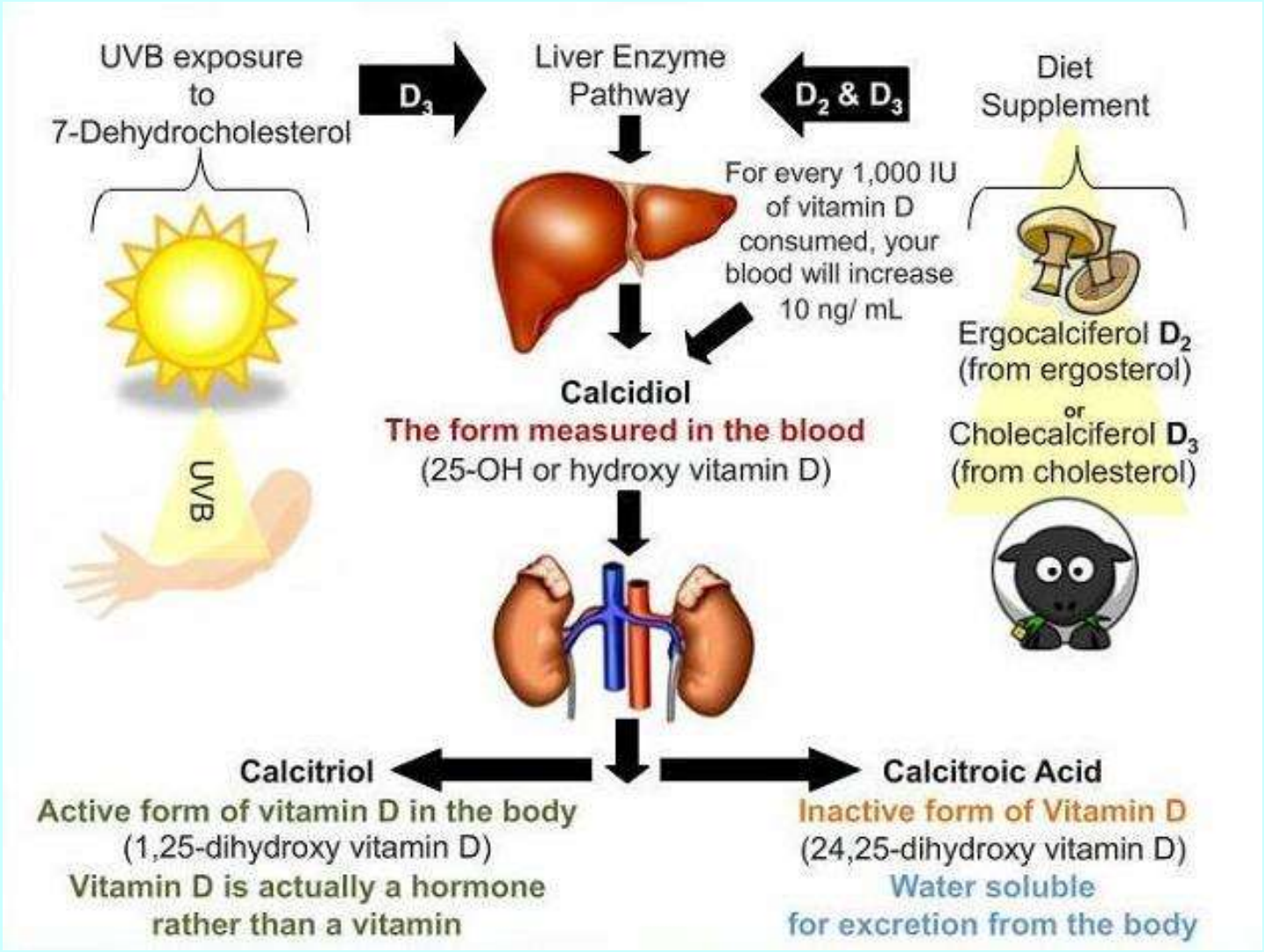
- Degenerative changes occur in epithelial tissues
- Hyperplasia & Hyperkeratinization of the gingival epithelium with proliferation of the junctional epithelium
- Retardation of gingival wound healing
- Decreased Salivary Flow

- **Vitamin D / calciferol**

- Daily requirements: 5 μg(adults >25yrs)

  10 μg(childrens & adults<25yrs)
- Dietary Sources: Fortified milk, fish oils, butter, egg yolk

-Essential for absorption of calcium from GIT, maintenance of calcium phosphorus balance.


UVB exposure
to
7-Dehydrocholesterol
D_3
Liver Enzyme
Pathway
D_2 & D_3
Diet
Supplement
For every 1,000 IU
of vitamin D
consumed, your
blood will increase
10 ng/ mL
Ergocalciferol D_2
(from ergosterol)
or
Cholecalciferol D_3
(from cholesterol)
UVB
Calcidiol
The form measured in the blood
(25-OH or hydroxy vitamin D)
Calcitriol
Active form of vitamin D in the body
(1,25-dihydroxy vitamin D)
Vitamin D is actually a hormone
rather than a vitamin
Calcitroic Acid
Inactive form of Vitamin D
(24,25-dihydroxy vitamin D)
Water soluble
for excretion from the body

Deficiency causes rickets in young, osteomalacia in adults.

Oral Manifestations

-Osteoporosis of alveolar bone ,

-Osteoid forms at normal rate but remains uncalcified .

-Disappearance of lamina dura,

-Reduced density of supporting bone,

-Loss of trabaculae & increased radiolucence of trabacular interstices

-Some cementum resorption.

- Hypervitaminosis

Loss of appetite, Nausea, Vomiting, Diarrhea, Headache, Anorexia, Renal failure.

Proposed Toxicity Levels

1,50,000-3,00,000 IU/Day.

- **Vitamin E**
- Discovered in 1922 by Dr.Herbet Evans & Dr.Katherine Bishop isolated from Lettuce & Wheat germ.

- Other Names: Tocopherol, Antisterility Vitamin.

- Daily Requirements: 10mg(Men)
  8mg (Women)

- Dietary Sources: Vegetable oils, Whole grains, Wheat germ, egg yolk, liver, fish, leafy vegetables.

- **Functions**
- Serves as an antioxidant to limit free-radical reactions and to protect cells from lipid peroxidation.
- Hemopoesis

- **Deficiency**

-RBC haemolysis

-Creatinuria

-Abnormal fat deposition

- Oral Findings

-Disarrangement of ameloblasts

-Chalky white incisors seen in rodents

Hypervitaminosis

-Skeletal Muscle weakness

-GIT upset

-Disturbances of reproductive functions

Proposed Toxicity Levels

-Daily dose above 600mg

- **Vitamin K**

- Discovered in 1934 by Henrik Dam & he named the antihaemorrhagic factor Vitamin K derived from Danish Koagulation.
- Forms: K1,K2,K3(Antihaemmorhagic vitamin)
- Daily requirements:

  -1mcg/kg body weight

  -80mcg (M), 65 mcg (F)
- Dietary Sources:Green leafy vegetables, Cauliflower,Cabbage,Egg yolk,Soya bean,liver.

Function: Production of prothrombin

- Deficiency:

-Rarely occurs

-Prolonged blood clotting time

-Hemorrhagic diseases of new born

- Periodontal disease

-Speculated that a particular antimetabolite of Vit.K interferes with the growth of Bacteroides Melaninogenicus (an organism closed associated with periodontal disease)

Water soluble vitamins Deficiency

Vitamins B and C

Vitamin B complex

-Thiamine

-Riboflavin

-Niacin

-Pyridoxine

-Biotin

-Folic acid

-Cobalamine

- Oral disease is rarely due to a deficiency in just one component of the B-complex group, the deficiency is generally multiple.

- Common Oral changes due to B complex deficiency are gingivitis, glossitis, angular cheilitis, glossodynia and inflammation of the entire oral mucosa.

Thiamine deficiency (beriberi)

Word Beriberi means ‘I Cannot’ in sinhalese- signifies the person with this disease is too sick to function.

Daily Requirements:1.2mg(M)

1.1mg(F)

Dietary Sources: Liver, Fish, Whole grains, Wheat germ

Functions: Serves energy & integrity of CNS

- **Deficiency**
- **General:**

Paralysis, cardiovascular symptoms (edema), loss of appetite, constipation, fatigue, depression,

Wernicke Syndrome (Confusion, loss of memory & Paralysis of eye muscles)

- **Oral disturbances**

-hyper sensitivity of oral mucosa,

-minute vesicles on buccal mucosa simulating Herpes, under the tongue or on palate

-erosions of the oral mucosa.

- **Riboflavin(Vit.B2)**
- Daily Requirements: 0.6mg/1000 kcal
  1.5mg(M) 1.3mg(F)

Dietary Sources: Liver, Fish, Meat,Eggs,Enriched cereal products

Function: Protein Metabolism & Healthy eyes.

Absorption: From intestinal tract after combining with phosphate

- Deficiency (ariboflavinosis)

-Glossitis

-angular cheilitis

-seborrheic dermatitis

-superficial vascularising keratitis.

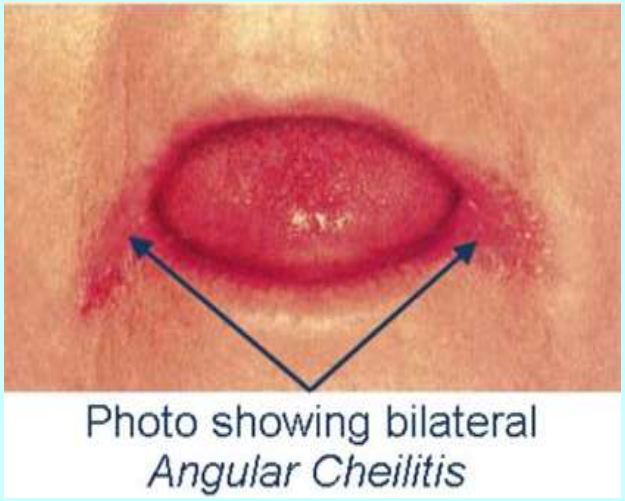


Photo showing bilateral
Angular Cheilitis

- Glossitis - magenta discoloration and atrophy of the papilla.
- In mild to moderate cases, the dorsum exhibits a patchy atrophy of the lingual papillae and engorged fungiform papillae, which project as pebble-like elevations.
- In severe deficiency, the entire dorsum is flat, with a dry and often fissured surface.

Ariboflavinosis

- Angular cheilitis begins as an inflammation of the commissure of the lips, followed by erosion, ulceration, and fissuring.

- Candidiasis may develop in the commissures of debilitated persons - perleche.

- **Niacin**
- Daily Requirements: 17mg(M) 15mg(F)
  9-13mg(Childrens)

- Dietary Sources: Liver, Fish, Meat,Eggs,Enriched cereal products,whole grains,peanuts, mushrooms

- Function: Serves energy & integrity of CNS

Deficiency –

General

-Pellagra charatcerized by dermatitis, diarrhea, dementia, depression & Death

-Weakness,Mental confusion

-Anorexia

Oral Manifestations:

-Glossitis,

-gingivitis,

-generalized stomatitis and

-ANUG.

- Glossitis and stomatitis may be the **earliest clinical signs** of niacin deficiency.

- Necrosis of the gingiva and other oral tissues, as well as leukopenia, are terminal features of niacin deficiency in experimental animals.

Pellagra

- **Pyridoxine (Vit B6)**
- Daily Requirements: 2.0mg(M) 1.4-1.6mg(F)
  1.0-1.4mg(Childrens)
- Dietary Sources:
  Pork,meat,fish,corn,peanuts,grains,bananas,green leafy vegetables.
- Functions: Protein metabolism,Conversion of tryptophan to niacin,Hb synthesis & integrity of CNS

- Deficiency:
- General

-Nervous irritability

-Skin lesions

-Hypochromic anaemia

-Convulsions(in infants)

- Oral Manifestations:

-Angular Cheilitus & Glossitis

-Atrohy of papillae

-Magenta discoloration

- Biotin

Sources: liver, meat, eggs, peanuts, grapes, vegetables, tomato, watermelon & strawberries.

Functions: Serves energy & synthesis of fatty acids & amino acids

Deficiency-Depression & Anorexia

- **Vit B12,Cyanocobalamin**
- Daily Requirements: 0.2 mcg
- Dietary sources : Only in animal foods,liver,meat,salt water fish,milk,eggs
- Function: RBC maturations,essential for normal functioning of all body cells
- Deficiency:

-Neurologic degeneration

-Pernicious Anaemia

- **Pantothenic Acid**
- Greek word Pantothenic which means ‘from everywhere’
- Daily Requirements: 4.7 mg
- Dietary sources : All plants & animal foods, milk, kidney, liver & yeast
- Functions:

-supplies energy

-Synthesis of Hb

- Deficiency:
- Seen only with severe Vit.B complex deficiency
- Oral Manifestations:

-Angular Cheilitis

-Ulceration & Necrosis of gingiva & Oral mucosa

-Resoption of crests of bone

- Oral Mucosa & Lips: Glistening red & sometimes ulceration
- Radiographically: narrowing of PDL space & loss of alveolar bone.

- **Folic acid**
- Also called Folacin
- Daily Requirements: 200 μg(M) 180mcg(F)
  50-100 μg(Children)
- Dietary sources : Green leafy vegetables, liver, fish, beef, lentils, whole grains
- Functions: RBC maturation

- Folic acid deficiency
- General

-macrocytic aenemia with megaloblastic erythropoiesis

-GI lesions

-diarrhea

-intestinal malabsorption

- Oral Manifestations

-stomatitis

-glossitis

-cheilitis.

- **Vitamin C**
- Also known as Ascorbic acid
- Daily Requirements: 90mg/day(M)
  75mg/day(F)
- Dietary Sources:

  Citrus fruits, kiwi, mango, strawberries, cranberries, papaya, pineapple, watermelon.

- Vit.C Deficiency
- Severe deficiency in humans results in scurvy that is characterized by retardation of wound healing and hemorrhagic diathesis .
- Clinical manifestations
- General

➢ Hemorrhagic lesions into muscles of extremities, joints and sometimes nail beds.

➢ Petechial hemorrhages often around hair follicles.

➢ Ecchymosis

➢ Increased susceptibility to infections

- Oral Manifestations
- **Gingival**

➢ Enlarged, hemorrhagic, bluish-red gingiva is classic sign of vitamin C deficiency,

➢ Deficiency aggravates the gingival response to plaque and worsen the edema, enlargement, and bleeding.

➢ Also retards gingival healing.

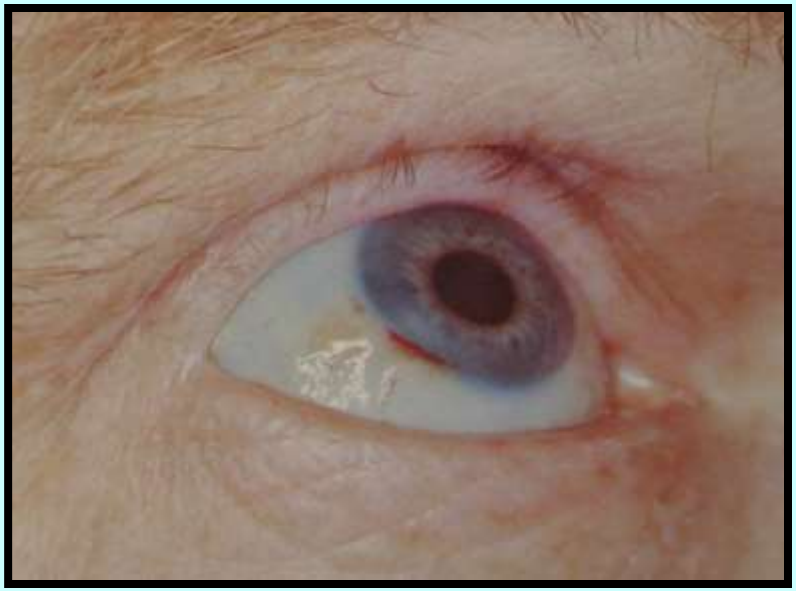
- **Periodontal**

➢ Edema and hemorrhage in the periodontal ligament,

➢ Osteoporosis of the alveolar bone

➢ Tooth mobility and degeneration of collagen fibers.

Scurvy – Clinical features



- Scurvy results in

1. Defective formation and maintenance of collagen,
2. Retardation or cessation of osteoid formation, and impaired osteoblastic function,
3. Increased capillary permeability, susceptibility to traumatic hemorrhages,
4. Hyporeactivity of the contractile elements of the peripheral blood vessels, and sluggishness of blood flow.

- Scurvy is uncommon in countries that have adequate food supplies, but it may appear in infants in their first year of life if formulas are not fortified with vitamins and in the very old, especially those living alone and on restricted diets.

- Alcoholism also may predispose an individual to scurvy.

Possible etiological relationship between ascorbic acid and periodontal disease

- Low levels of ascorbic acid-

➢ Influence metabolism of collagen within the periodontium affecting its ability to regenerate and repair.

➢ Interferes with bone formation leading to bone loss.

➢ Increases permeability of oral mucosa to endo toxins.

- Increasing levels of ascorbic acid enhance both the chemotactic and migratory action of leukocytes without influencing their phagocytic activity.

- Optimal levels is required to maintain integrity of periodontal microvasculature as well as vascular response to bacterial irritation and wound healing.

- Depletion of Ascorbic acid may interfere with ecological equilibrium of bacteria in plaque and thus increases their pathogenecity.

- The periodontal fibers that are just below the junctional epithelium and above the alveolar crest are least affected which explains the infrequent apical downgrowth of the epithelium.

- Thus vit c deficiency does not cause periodontal pockets but local bacterial factors are required for pocket formation.

Starvation

- Starvation is the ultimate nutritional challenge.
- Without any food intake, there is a total lack of nutrients, no physical stimulation and no fuel for energy.
- Acute starvation results in

-osteoporosis of bones

-loss of alveolar bone height

-gingival inflammation .

Conclusion

- Several studies have reported various degrees of association between nutritional elements/supplements and periodontal status, while several other studies have given no conclusive results.

Thank You