Today's Periodontal Medicine: Bridging the Gap between the Dental and Medical Professions

Dr. Shruti Gupta[1] , Dr. Neelam Das[2] , Dr. Ira Gupta [3], DR. Rohit Gupta [4],

[1]*MDS, Reader, Department of Periodontology, Rama Dental College, Hospital & Research Centre, Kanpur (UP)*

[2]*MDS,Senior Lecturer, Department of Periodontology ,Rama Dental College, Hospital & Research Centre, Kanpur (UP)*

[3]*MDS ,Professor,Department of Periodontology , Rama Dental College, Hospital & Research Centre, Kanpur (UP)*

[4]*MDS,Reader,Department of Periodontology ,Rama Dental College, Hospital & Research Centre, Kanpur (UP)*

Abstract

The interrelationship between oral and systemic health, has been a matter of debate since the controversial theory of focal infection by Dr. Miller. He stated that the oral pathogens had the capability to either directly enter or release their toxic products into the systemic circulation. In the past, a substantial part of focal infection was attributed to pulpal and periapical pathologies. Influence of systemic disorders on periodontal diseases is well established. The concept has evolved with considerable evidence linking periodontal status with systemic conditions including atherosclerosis, bacterial endocarditic, diabetes mellitus, and respiratory disease. Extensive research on the complex relationship between oral and systemic health, has given rise to the emerging field of "periodontal medicine." Currently, we have reached a point at which experimental studies have shown a significant improvement in systemic health following regimental maintenance of oral health. Since, oral health has a significant influence over the final prognosis of a number of systemic disorders, it is essential that we understand the underlying patho-physiology linking oral to systemic health. This review article highlights the concept, importance of prevention and treatment of periodontal diseases as an essential part of preventive medicine to circumvent its deleterious effects on general health. It will highlight the many advances and opportunities for improved health care in the 21st century.

Keywords: Cardiovascular, Oral systemic, periodontal medicine, Periodontitis, Pre term delivery, Bacteremia and Endocarditic

Introduction

Health profession organization has been divided in specialties and sub specialties according to different body parts and this system is more realistic and practical than scientific. Many biologic processes and parts make a single human body therefore it interweaved that any irregularities and changes at any single parts and processes could have noticeable effect on other body structures. The link between the oral cavity and general health is similar and it can be stated very correctly, "The mouth is the window to your body's health". It can be present with sign and symptoms of general infections, nutritional deficiencies & illness. [1]

Health &Medical emergencies can be happen with any patient; but it has been more profound occur with medically compromised and old aged patients. Oral and dental treatment may also have been complicated for the expanded group of populations who suffer from psychological and physical disorders. The geriatric or medically compromised group of peoples may also need special care and precautions before or during dental treatment because they commonly having medicines like anticoagulants, steroids, cardiac and immuno-suppressive drugs. Therefore when such groups of patients, needed oral and dental treatment, it's liability of Dental surgeon to overcome with these medical emergencies and keep away the patients from any adverse drug interactions.[2] Periodontal diseases, now recognized as bacterial infections, are among the most common, chronic diseases of humans, affecting 5 to 30% of the adult population in the age group of 25 to 75+ years.

Periodontal diseases are also among the most important causes of pain, discomfort, and tooth loss in adults [3] with an increasing likelihood of medical emergencies in this population, the practicing dentist and auxiliary staffs are responsible for identifying patients with a potential for medical risk by obtaining a comprehensive pre-treatment physical evaluation. [4]

Patient Assessment at Dental Clinics

"How well the patient will bear any dental treatment" and their emotional & physical state has been determined through patient evaluation at dental clinics. Little and King, in 1971, presented the

reasons for an evaluation of general health in the dental office. They concluded that it should be done:

a) To recognised individuals with undiagnosed systemic disease, because it may be cause life threatening condition or condition can be worsen by dental therapy.
b) To recognise individuals who are on medications due to any systemic condition, that could have an adverse drugs interactions with prescribed medicines, it may complicate dental treatment, or it can give an idea of underlying systemic disorder for which patient didn't aware.
c) To give details to dental surgeon to alter the treatment plan due to any systemic condition or adverse drug interactions.
d) To allow the dental surgeon to select and refer the patient to particular medical specialist for concerning medical conditions.
e) To aid in establishment of a healthy patient-doctor relationship. When patient see doctor's concerned and interest for their overall health, their relationship become stronger.

Medical emergencies may be prevented by the information obtained from thorough medical evaluation. A well-versed assessment & evaluation includes, primarily personal interview and medical history with the help of questionnaire, secondarily patient's current health status and medical condition in term of their last physical tests i.e. blood pressure, diabetes, thyroid etc. with dates and results. Third, asked about any past medical treatment or history that can also affects management plan, fourth, is to asked about allergies to any food, chemical agents, environmental factors, drugs (specially local anaesthetics, aspirin, antibiotics etc.) Which can be used in dental treatment? Fifth is Medication, it is imperative to determine the brand and/or generic name of the drug, why and by whom it was prescribed, the dosage, and the length of time the medication has been taken. Patients may not include medications used for allaying anxiety or for inducing sleep, such as tranquilizers and sedative-hypnotic drugs. Sixth is family history, which is taken to determine if there is a familial predisposition to diseases or if there are diseases in which inheritance is an important factor.

Finally, Positive findings should be summarized and recommendations recorded. This will enable the dentist and the dental staff to quickly review a patient‘s medical status at each visit and facilitate the diagnosis and treatment of any medical emergency that may arise. A comprehensive medical history is an important procedure that dentists must adopt and routinely use to ensure that their patients are receiving the optimum benefit from all available health resources.

Mechanisms have been Proposed to Link Oral Infection with Systemic Diseases [5]

[1] **Metastatic infection:** Transient bacteraemia can be produced by oro-dental infection and treatment. Reticulo-endothelium system eliminated the bacteria within minutes which enter the blood and spread all over body due to transient bacteraemia. However if the disseminated microorganisms find favourable conditions, they may settle at a given site, and after a certain time lag start to multiple.

[2] **Metastatic injury:** Some microorganisms have the ability to produce diffusible proteins, or exotoxins, which include cytolytic enzymes and dimeric toxins with A and B subunits. The exotoxins are considered the most powerful and lethal poisons known6 conversely; endotoxins are part of the outer membranes released after cell death. End toxins is compositionally a lip polysaccharide (LPS) that when introduced into the host, give rise to a variety of pathological manifestations. LPS is continuously shed from periodontal gram-negative rods during their growth in vivo.[7]

[3] **Metastatic inflammation:** A macromolecular complex has been formed by reaction between soluble antigens, which may enter in blood stream and circulating specific antibody. These immuno-complexes may give rise to variety of acute and chronic inflammatory reactions at the sites of deposition.[8]

Current Era

The Focal infection theory fell in to dispute in the 1950's when widespread extraction failed to reduce or eliminate the systemic conditions. The theory had been based on very little, if any, scientific evidence. Mattila and colleagues stated that patients reported with cardiac arrest in causality ward, they have raised index of oro-dental disease e.g. periodontitis, gingivitis & endodontic lesions. [Figure.1]

Genetics Aspect of Periodontal Disease and its Clinical Perspective

Genetic disorders have been categorized in three main parts: Mendelian disorders, chromosomal disorders, and non-Mendelian disorders. Periodontal disease has been originated by several types of micro-organisms and is commanded by environmental factors, genetic factors and host responses. Scientists had done the research to find the role of genes and pattern of inheritance in periodontal disease. There are chromosome regions that

potentially harbour susceptibility genes for periodontal diseases.

Genetic information can be use practically and clinically to alter treatment plan. Patients also can be identified before disease starts by means of Genetic predisposition to the onset of periodontitis. Treatment outcome also extended by Genetic heterogeneity which associated with the periodontal disease. Drugs intervention and use of chemotherapeutic agents will be used more accurately when separation between good and bad responders will be done.

Interlinking between Cardiovascular disease and Oro-dental infections & its clinical Aspects

The relationship between cardiovascular disease and oral infections is well versed, particularly in bacterial endocarditic, infected heart valve can get the source of infection from the micro-organisms involved in oral bacteraemia. In recent researches, much evidence have been found which show a positive interrelationship between periodontal disease to coronary artery disorders and stroke.

Bacterial Infective endocarditic (IE) is a microbial infection of a native or prosthetic cardiac valve or surrounding cardiac tissue. It originated by Multiple microorganisms e.g. fungi, bacteria, Chlamydia or rickettsia. Current studies shows interlinking between coronary artery disorders and periodontal disease, explained that periodontist must do the safe and efficient periodontal treatment to the patients suffering from various heart disease.[9] Dentists may provide dental care for patients with any of these disorders, most often they are called upon to manage patients at risk of IE.[10] Some surgical and nonsurgical treatment of oral cavity can produce transient bacteraemia due to bleeding. However, these bacteraemia rarely persist longer than 15 minutes and the majority dissipate within 3 to *5* minute.[11] The Chances of Infective endocarditis and its complications which produced from transient bacteraemia due to oral tissue management must be reduced by use of systemic antibiotics.

The American Heart Association (AHA) recommendations for specific prophylactic antibiotic regimens for dental procedures are widely published. For most adults, oral administration of 2 gm of amoxicillin 1 hour before the dental procedure is recommended. Clindamycin (600 mg 1 hour before the dental procedure), cephalexin/cefadroxil, orazithromycin/clarithromycin are recommended as alternatives in patients that are allergic to penicillin. Intramuscular or intravascular antibiotic regimens are prescribed for patients that cannot take oral medications. There commendations are considered adequate for patients that are at high risk from IE, including those with cardiac valve prostheses.[12]

Before to cardiac surgery, prophylactic antibiotic has been recommended during oral and dental procedures, associated with a high risk of significant bacteraemia. Tooth Extractions should be planed 2 weeks before cardiac surgeries to achieve proper wound healing, if possible. Patients those are on anticoagulant regimen i.e. Aspirin which is often used as an antithrombotic agent because of its inhibition of platelet aggregation, most cardiologists prescribe very small daily dosages (80 to 325mg). At these dose levels, the medication will not significantly alter bleeding time.[13] When patient is on higher dose of aspirin, there is some risk of prolonged bleeding postoperatively following periodontal therapy. For these individuals, the medication should be discontinued for 4 to 7 days prior to the scheduled procedure with the concurrence of the cardiologist. 14

Potential Association between Periodontal infections & Respiratory Diseases

Research showed, two respiratory diseases, bacterial pneumonia and chronic obstructive pulmonary disease (COPD) have a positive association with periodontal infections. Bacterial pneumonia is either community-acquired or hospital acquired (nosocomial). The main cause of community acquired pneumonia is aspiration of micro-organism, stay in oro-pharynx region. Primary site for main respiratory micro-organism is Oro pharynx, can lead to pneumonia, with subsequent aspiration. History of prolonged cigarette smoking is known as established risk factor for COPD. Some reports also told about relationship between poor oral hygiene and COPD. It can be concluded that improvement of oral hygiene and professional oral health care are vital for reducing the occurrence of pneumonia among high-risk elderly adults especially those living in nursing homes.

Mechanisms of Action of Oral Bacteria in the Pathogenesis of Respiratory Infection

Several mechanisms can be envisioned to help explain how oral bacteria can participate in the pathogenesis of respiratory infection:

1) Oral pathogens (such as P. gingivalis, A. actinomycetemcomituns) may be aspirated into the lung to cause infection.

2) Periodontal disease-associated enzymes in saliva may modify mucosal surfaces to promote adhesion and colonization by respiratory pathogens.
3) Periodontal disease-associated enzymes may destroy salivary pellicles on pathogenic bacteria.
4) Cytokines originating from periodontal tissues may alter respiratory epithelium to promote infection by respiratory pathogens.

Periodontal Disease and Diabetes; Interrelated Diseases

Diabetes mellitus predisposes oral and periodontal tissues to greater periodontal destruction but many researchers have now found that poor glycemic control also has been produced by periodontal infections. Hence it is predicted that periodontal disease and diabetes mellitus have exists a two-way relationship. [Figure. 2] Both conditions are produced inflammatory mediators due to immuno-inflammatory response although periodontal disease is infectious and diabetes mellitus is metabolic disorder. These pro-inflammatory cytokines such as Interleukin-6 impair the glucose- stimulated release of insulin from the pancreas. In fact, periodontal disease has been considered as the sixth complication of diabetes. Diabetes is often associated with increased gingival inflammation in response to bacterial plaque.[15]

Patients with diabetic history must be evaluated carefully along with assessment of their response to periodontal treatment. Undiagnosed diabetic patients, who have suggestive oral symptoms, should be examined closely and questioned about the sign and symptoms of diabetes like polyuria, polydipsia, polyphagia, or current history of unexplained weight loss. Family history of diabetes should also be asked from individuals.

Patients with uncontrolled diabetes, only emergency periodontal & dental treatment should be advisable.[16] Patient must be referred to general physician with a descriptive intraoral symptom along with his brief dental treatment plans. Before the oral and dental treatment the dental surgeon should request to physician for assessment of the patient's glycaemic condition and necessary medical treatment. Patients with known diabetes, controlled glycaemic level should be try to achieve at early examination with the help of patient's physician and past medical records. Some Key points must be considered during dental treatment of the diabetic patient include modification in diet, stress reduction protocol, use of antibiotics, appointment timings, in patient versus outpatient care and changes in medication regimens.[17]

Morning treatment appointments have been recommended for diabetic patients. This also recommended for many other medically compromised patients. While morning appointments may be preferable for some diabetic patients, others may be better treated in the afternoon. Appointment scheduling of diabetic patients depend upon the medication used by particular patient. It is better to plan dental appointment either before or after peak periods of insulin activity because hypoglycaemic reactions are more likely to occur when insulin levels are high.[18] For establishing the oral health in diabetes patients, clinician must acquire the vast scope of dental and medical knowledge.

Relationship between Periodontal Disease and Rheumatoid Arthritis

These two diseases, Periodontal Disease and Rheumatoid Arthritis have shared some basic features: both, diseased gingival tissues and joints affected by rheumatoid arthritis (RA) produce similar cytokines and growth factors that promote the dissolution of bone. This favours the presence of a common underlying inflammatory mechanism. Levels of anti-CCP antibodies (anti-cyclic citrullinated peptide antibody) are considerably higher in RA patients with periodontal disease, suggesting that periodontitis may be a contributing factor in the pathogenesis of RA.

Female's health and Periodontal Medicine; challenges to Oro-dental treatment

Dental professionals face some special challenges during the treatment of female patients due to their unique life cycles. Diagnosis and treatment phase can become difficult due to hormonal changes occurring in woman's fertilization phase and it can also modify the oral and periodontal tissue response to local & environmental factors therefore it is essential that Dental surgeon diagnose the disease and plan the periodontal treatment according to individual female life phases.

An Impact of Female Hormones on Periodontal Health:

At Puberty

Female sex hormones i.e. estrogen and progestrone increases during puberty and remains relatively same till fertilization phase of female lifecycle. In the presence of plaque, gingivitis become more prevalent there.[19] In latest studies Prevotella nigrescens and

P. intermedia have been found in gingival inflammation associated with puberty gingivitis.[20] Preventive care, including a vigorous program of oral hygiene, is vital. Periodontal treatment i.e. scaling & root planning along with reinforced oral hygiene maintenance program responded positively in milder gingivitis cases. Microbial culturing, antibiotic drug therapy, mouth rinses and local drug delivery may be needed in severe cases. Supportive periodontal therapy appointments may be required to increased frequency. Whenever needed, home care remedies also has been advisable with the help of parents or guardian.

During Menses

In females, during the menstrual cycle, gonodotrophins & ovarian hormones concentration changes monthly. Ovaries produce estrogens and progesterone steroid hormones during the monthly menstrual cycle. The gonadotrophins follicle stimulating hormone (FSH) and luteinizing hormone (LH) influence estrogen and progesterone to prepare the uterus for implantation of the egg. Several studies revealed that gingival tissue inflammation increases by overian hormones which exaggerate in presence of local factor. Alteration and elevation in sex hormones aggravated the gingival inflammation.[21] Progesterone has been associated with increased permeability of the micro-vasculature, altering the rate and pattern of collagen production in the gingiva, increasing folate metabolism,[22] altering the immune response. In some females gingival become more erythematous and edematous during menstrual cycle. In addition, an increase of gingival exudates has been observed during the menstrual period and is sometimes associated with a minor increase in tooth mobility.[23]

At Pregnancy

Periodontal surgeon also has been faced challenges during diagnosis and treatment in pregnant patients. During pregnancy phase, patient may undergo extreme psychologic and physiologic changes so Dental surgeon should provide special care to those patients. Awareness exists regarding pregnancy and its effect on periodontal disease; however, recent evidence indicates an inverse relationship to systemic disease. Latest studies stated that periodontal disease alter the general health and adversely affect the wellbeing of the foetus by elevating the risk of low-birth-weight, preterm infants.

Association between Periodontal Disease and Preterm Low-Birth weight Births

Offenbach and co-workers reported in their pioneer evidence based research work, untreated periodontal infection in pregnant females may be a potential risk factor for preterm (<37weeks) low-birth-weight (<2,500 g) babies. [24] They suspecting, mothers of low-birth-weight infants with periodontal infection had high risk and more periodontal attachment loss than the control group mothers having normal-weight infants at birth. The current opinion is that PLBW occurs as a result of infection and is mediated indirectly, principally by the translocation of bacterial products such as endotoxin lip polysaccharide (LPS) and by the action of maternally produced inflammatory mediators. [25]

The periodontal assessment of the pregnant female patient includes thorough medical history and clinical evaluation. Dental surgeon should be aware of total well being of patient oral as well as systemic. Because during the pregnancy females had compromised immune state, leukemia, Gestational diabetes, and other medical conditions may appear during pregnancy.

During the first and the last half of third pregnancy trimester, any elective treatment should be avoided if possible rather than maintaining good oral hygiene. Because during the first trimester foetus become more susceptible to environmental influences due to organogenesis. The chances of premature delivery occur because the uterus is very sensitive to external stimuli in last half of the third pregnancy trimester. Short time appointment and less chair time may prefer because the females are not feel comfortable at this time. Further, there is a possibility that supine hypertensive syndrome may occur. In a semi-reclining or supine position, the great vessels, particularly the inferior vena cava, are compressed by the gravid uterus. By interfering with venous return, this compression will cause maternal hypotension, decreased cardiac output, and eventual loss of consciousness. Compression on inferior vena cava can be relived and reversed by turning the patient on her left side, allowing blood to return from the lower extremities and pelvic area.

During pregnancy, the second trimester is considered as the relatively safe period for dental treatment. At this period, dental surgeon can provide the treatment to control active stage of disease which eliminates long term problems that may arise at last trimester. Extensive periodontal surgeries and major procedure should be delayed and may be planned after delivery. Condition like Pregnancy tumors may needed immediate treatment i.e. excision because

they are painful, suppurative that bleeds easily and interfered with mastication. One more controversial area is Dental radiography in the treatment of pregnant women. It is most desirable not to have any irradiation during pregnancy, especially during the first trimester, because the developing fetus is particularly susceptible to radiation damage.[26] However, now days, safety features like lead aprons, filtration, high speed film and collimation established a new safety standard in dental radiography.

Another area of controversy involves drug therapy because drugs given to a pregnant woman can affect the fetus by diffusion across the placenta. A conservative approach is prudent, the dentist prescribing only the minimum effective dose and duration absolutely essential for the pregnant patient's well-being. The dentist may need to be familiar with the classification system established by the Food and Drug Administration (FDA) in 1979 to rate fetal risk levels associated with many prescription drugs. In periodontal therapy, the use of antimicrobial agents is common.

Periodontal Infection and use of Oral Contraceptives

Exaggerated response may be shown by gingival tissues to local factors. Inflammation ranges from mild edema and erythema to severe inflammation with haemorrhagic or hyperplasic gingival tissues. Report suggests that oral contraceptive users have more exudates in inflamed gingival tissues than pregnant patients.[27] Kalkwarf concluded that these responses may be because of elevated gingival permeability, alteration in microvasculature, & more production of prostaglandin. [28] Prostaglandin E is a potent mediator of inflammation. A thorough medical history, examination and an evaluation of vital signs and symptoms (particularly blood pressure) have a great importance in this patients group. Oral contraceptives induce gingival inflammation treatment must include an enforced oral hygiene program and elimination of local predisposing irritants. It is also compulsory that the patient must have the information of heightened risk factors and the potential need reinforcement and maintenance oral care program at home with supportive periodontal appointments. If there is inadequate resolution after non surgical therapy, periodontal surgery may be indicated. Antibacterial mouth rinses can be indicated as adjunctive to home care regimen. It may be advisable to perform extraction of teeth (especially of third molars) on non-estrogenic days (days 23 to 28) of the pill cycle, to reduce the risk of a postoperative localized ostitis. [29]

Relationship between Periodontal Disease and Osteoporosis

Both periodontal disease and osteoporosis are chronic inflammatory conditions, results in increased osteoclastic activity and subsequent bone loss. Due to this common chronic inflammatory response periodontitis patients may predisposes to osteoporosis. Cytokines has been modulated by estrogen that regulates bone metabolism and the host inflammatory response. Estrogen deficiency elevates the osteoclasts which cause depletion in bone density and bone metabolism imbalance. Periodontal disease also generates inflammatory response and osteoclasts. Several investigations have been stated a significant association between periodontal disease and estrogen deficiency. These two risk factors, working together, can induce osteoporosis.[30]

Role of Periodontal Disease in Alzheimer's Disease

Evidence suggests that periodontal disease may be a risk factor for dementia, through the bacterial and viral infections commonly found in periodontal disease. The systemic inflammatory response has been elevated in periodontal disease, which can contribute to existing brain and vascular pathologies that would impact brain function. [31] Therefore risk factor for systemic infection can be decreased by periodontal treatment within time that lower the oral microbes and contribute in systemic health.

Periodontal Diseases and Cancer

Oral micro-organism induce the inflammatory reaction in gingival tissue. Due to this immuno-inflammtory response, patient becomes more susceptible to periodontal disease. There is a wealth of evidence indicating a link between chronic inflammation and risk of malignant transformation of the affected oral epithelium. Periodontitis is associated with an increased risk of developing chronic systemic conditions including autoimmune diseases and different types of cancers. Human papilloma virus has been found to be associated with both periodontitis and oral cancer.[32]

Conclusion

The latest research and evidence based studies offers new insights and approaches the new concept of the oral cavity as one system interconnected with the whole human body. The potential and thoughtful link between periodontal disease and systemic conditions is now the focus for a wide range of research around the world. Understanding this co-relation is a crucial

step for both dental and medical professionals in determining the best approach to patient care. Therefore, the aim of this review was to forge a coalition between the clinicians who treat the oral disease and those who treat systemic conditions, and, to provide a forum for new emerging data and to identify directions for future research.

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