Review

Periodontal Medicine: Past & Present

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ABSTRACT

The interrelationship between oral & 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 & periapical pathologies. The concept has evolved with considerable evidence linking periodontal status with systemic conditions including atherosclerosis, bacterial endocarditis, diabetes mellitus & respiratory disease. Extensive research on the complex relationship between oral & 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 pathophysiology linking oral to systemic health.

INTRODUCTION:

The various modern pathogenic concepts for systemic disorders includes auto intoxication, focal infection, psychosomatic disease & autoimmunity. Miller’s focal infection theory explains the role of oral pathogens in systemic disease1-2. There has been significant progress in validating the plausibility of oral disease disseminating to cause systemic diseases. Various studies have shown a substantial relation between poor oral hygiene to increased susceptibility for various systemic disorders. The field of Periodontal Medicine has evolved in to a significant oral & systemic health care media, since its inception in 1996 during the World Workshop in Periodontics1-3. Here we review the various theories proposed & their collaborating evidences from several studies linking oral infection to systemic disorders.

Ancient claims on oral to systemic health:

Egyptian medicine had the notion that extracting tooth would aid in improving the overall health of an individual. The oldest available medical papyri of the Middle Dynasty belonging to 2100 BC mentions an association between the diseases in a women’s reproductive system & poor dental status. Even Hippocrates proposed that extracting infected tooth could cure rheumatism.

Oral sepsis prior to “Germ theory”:

‘The Natural History of the Human Teeth.’ written in 1778 by John Hunter, Surgeon Extraordinary to the King of England, made a controversial introductory note, acknowledging the unique nature of diseases of the tooth & emphasized on its impact on systemic disorders. His proposal was disregarded & any further avocations to interrelate oral disease to systemic manifestations were ignored. Benjamin Rush, a famous American physician & one of the signers of the Declaration of Independence published an article entailing his experience on the positive effects of extracting decayed tooth, especially with nervous disorders1-4.

Oral sepsis post “Germ theory”:

Robert Koch proposed the “Germ theory” following the results of numerous studies revealing the role of microorganisms in causing infectious diseases. Willoughby D. Miller, a student of Robert Koch studied the relationship between oral bacteria & systemic diseases. He wrote a series of articles titled “The human Mouth as a Focus of Infection” linking a number of systemic disorders including pulmonary diseases, brain abscesses & gastric problems with oral microorganisms & their products. In his investigations, Miller was successful in isolating 58 species of oral microorganisms.
organisms. He suggested that these organisms had the capability to turn pathogenic when provided with a favourable environment. He presented his findings in the international congress of hygiene. Based on the findings of Miller on focal infections, physician William Hunter investigated the prevalence, extent & treatment modalities of oral infection induced medical complications. Hunter coined the term “Oral Sepsis”. He defined the term to emphasize that oral sepsis represents a foci of infection which may be due to tooth decay or other oral infections like gingivitis. He also illustrated the importance of recognising the roles of specific organisms like staphylococcal and streptococcal species accounting for the majority of oral infection. In 1900 Hunter demonstrated the hematogenous spread of oral bacteria & their products causing various systemic illness including endocarditis, nephritis, empyema, cholecystitis, perinephritic abscess & anemia. In 1911, Hunter elaborated on the pathway followed by these oral microorganisms through the body. He suggested that the micro organisms forming the oral sepsis gets swallowed or absorbed through lymphatic & blood. These organisms enter the alimentary canal causing tonsillitis, pharyngitis, move on to the gastric system causing dyspepsia, gastritis, gastric ulcer, enteritis & colitis. Adjacent structure may also get infected causing adenitis (inflammation of the glands). It may get disseminated into the blood stream causing septic anemia, purpura, fever, and septicaemia). Even arthritis & nephritis were linked to the systemic dissemination of oral sepsis. In 1911, the terminology “oral sepsis” was replaced with “focal infection”. Frank Billings, a North American physician defined the probable sources of infection in the human body.

<table>
<thead>
<tr>
<th>Facial Tonsils, the peritonsillar tissues and supratonsillar fossae</th>
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<tbody>
<tr>
<td>Abscesses of the gums and alveolar sockets, pyorrhoea alveolaris and septic types of gingivitis (actual periodontal disease)</td>
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<tr>
<td>Sinuses About the head: maxillary, ethmoidal, sphenoidal and frontal</td>
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<td>Bronchiectatic and pulmonic cavities</td>
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<td>Chronic ulcers of the gastrointestinal tract</td>
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<td>Chronic appendicitis,</td>
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<td>Cholecystitis and cholangitis</td>
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<td>Urinary tract</td>
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<td>Genital tract</td>
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<td>Local, septic, submucous and subcutaneous foci anywhere in the body</td>
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Table 1: Sources of infection in the human body as defined by Dr. Frank Billings

Billings & associates stated that systemic diseases including chronic arthritis and myositis may be a result of a primary or secondary focal alveolar infection. E. C. Rosenow, in the year 1919 conducted numerous animal experiments producing data supporting the concept of focal infection. Rosenow’s article entailed the affinity shown by specific micro organism towards specific organ/tissue & he also emphasized on the ability of the micro organisms to exhibit transmutation (variations in characteristics). Russell L. Cecil in 1930’s Symposium of Interrelation of Medicine and Dentistry proposed that major systemic infections of the human body with obscure causes could have had its origin from the oral cavity. Kopeloff & many other physician of the 1920’s & 30’s started to question the accuracy of relating all systemic disorders with questionable cause to oral infection. Holman, in the year 1928; Cecil and Miner in 1930 conducted experiments on oral foci of infection & prevalence of systemic conditions. They found that in many lesions including rheumatoid arthritis did not have any sign of oral foci. The few cases which did have a foci failed to resolve the arthritis following its removal. Thus they concluded that majority of systemic disorders have originated & progressed independent of the presence or absence of an oral foci of infection. Oral infection theory resurfaced in the late 1930’s with Burket and Burn as they illustrated bacteraemia following massage of the gingival tissue. In the same year Fish reported that transient bacteraemia was a common feature following surgical treatment of periodontal diseases including gingivectomy.

In 1944, Appleton proposed 3 pathways for dental infection resulting in systemic dissemination.

a) Metastasis of the infectious organism by active transport in blood vessels or lymphatic channels
b) Passive diffusion into the lymph or blood enabling the bacterial products to reach the most remote areas of the body
c) The products of bacterial autolysis may in turn be a potential allergen disseminating into the blood or lymph

Following Appleton, Miller proposed the possible routes of infection from periodontal pockets:

a) Blood and lymph
b) Direct extensions within the tissue
c) Swallowing and aspiration of infective material enabling passage through gastrointestinal and pulmonary tracts respectively.

Miller also emphasized the importance of the presence of a well established lymphatic system draining gingiva & adjacent soft tissues. Spread of infectious agent or its toxic products to regional lymph nodes was considered a likely possibility. Multiple studies have shown that tooth extractions and dental prophylaxes may result in transient bacteraemia which may lead to bacterial endocarditis, in susceptible individuals. Geiger (1942) & Rhoads et al (1950) concluded that patients with periodontal conditions are at a greater risk in developing bacteremia following extractions. Antibiotic prophylaxis was introduced in the 1940’s to suppress transient bacteraemia in periodontally compromised patients following extraction or other oral surgical procedures. The antibiotic preferred was penicillin & sulphonamide. Prophylaxis was given before & after the surgical procedure. Patients with history of cardiac complications including valve replacements were advised antibiotic prophylaxis to prevent sub acute bacterial endocarditis.

Modern era of oral foci of infection:

Several studies emerged in the 1950’s emphasizing the role of oral foci to a number of systemic disorders. In 1989 Mattila et al reported an increased prevalence of acute myocardial infarction in patients with poor oral status. They suggested oral foci to have independent impact on the
initiation of myocardial infarction in the absence of other risk factors for cardiovascular disease.

Introduction of molecular biology has changed the face of Bio research in the last 3 decades. By genomic sequencing, researchers were able to identify hundreds of new microbial species. In 2006 Haffajee and Socransky estimated the subgingival biofilms to accommodate more than 700 microbial colonies10. Introduction of Micro array techniques, allowed us to sequence about 600 bacterial species from an individual biofilm. In 1996, the term ‘Periodontal Medicine’ was introduced by the World Workshop in Periodontics11. The purpose of creating this new discipline was to evaluate the possible role of periodontal diseases on the initiation & progression of cardiovascular diseases. Multiple studies have associated the presence of high inflammatory markers, intima media thickness, uncontrolled glycemic level in diabetes & cholesterol level alterations with periodontal disease.

As a next step in investigation, focus was diverted towards accessing the effects following treatment & maintenance of a good periodontal status with the status of systemic conditions. The studies showed a substantial regression in several systemic diseases following oral prophylaxis & treatment of the periodontal condition. Noack et al & others have analysed the genetic makeup of periodontal disease with several systemic disorders & a majority of the studies showed a similar genetic alteration11.

Azarpazhooh and Leake in 2006 & Paju and Scannapieco in 2007 investigated the relationship between oropharyngeal bacteria & increased prevalence of hospital acquired pneumonia (HAP)12,13. Scannapieco et al in 2003 reported a reduction of 40% in the incidence of HAP following topical chemical antibiotics or mechanical disinfection14. Recent studies from 2003 to 2009 have linked poor periodontal status with low birth weight, preterm birth, preeclampsia & fetal growth restriction. Studies by Lo´pez et al and others have shown a substantial reduction in adverse pregnancy outcomes following treatment & maintenance of a healthy periodontal status.

In spite of vast number of studies emphasizing the importance of oral health as a pathway to maintain systemic health, very few steps have been taken to integrate oral health care measures into public-health systems. Dental caries & periodontitis, accounts for a large portion in the vast list of chronic diseases worldwide. The failure to accept dental care as a part of medical prophylaxis resists any attempts made at closing the gap between oral & systemic health.

To conclude, it is necessary to conduct further prospective cohort studies & randomised clinical trials with standardised criteria to understand the complex relationship between oral & systemic health. Until then it is vital that we acknowledge the importance of oral diseases & their impact on systemic health & integrate oral preventive programs in the public health system.

REFERENCES:


2) Miller WD. The human mouth as a focus of infection. Dent Cosmos. 1891; 33: 689–713.


