Recent Trends In Periodontal Treatment (Surgical And Non-Surgical): A Review

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Abstract

New research is demonstrating that a person's total health is indeed related to his or her oral health. Elimination of all oral infections, including gingivitis and periodontis, is important to overall health. This article reviews recent evidence on the systemic and oral connection and discusses these findings as they relate to patient care. The article examines trends in nonsurgical and surgical therapy that will successfully arrest periodontal infections. Opportunities for early diagnosis and prevention will play an increasing role in dental practice in the future as patients understand the importance of oral health to overall health. Because recent evidence indicates that scientists are essentially redefining the link between oral health and systemic disease,(1) there is an urgent need to educate the public as to the importance of periodontal health. Epidemiologic and longitudinal studies have demonstrated an association between periodontal disease severity and risk for systemic conditions such as atherosclerosis, myocardial infarction and stroke.(23) In addition, preliminary data from multiple trials have indicated there is an association between periodontal disease severity and the risk for preterm low birth weight, or PTLBW.(45) Offenbacher and colleagues have reported that women with severe periodontitis are 7.5 times more likely to have a PTLBW baby.(5) All of these findings indicate that periodontal disease must be viewed from a whole new perspective, particularly since some form of periodontal disease is present in a large percentage of the population. A prospective approach of prevention and early intervention in treating the disease is more important than ever before.

PREVALENCE OF PERIODONTAL DISEASE

What is the prevalence of periodontitis? A recent evaluation of the National Health and Nutrition Examination Survey III, or NHANES III, looked at the prevalence and extent of periodontitis, gingival recession, gingival bleeding and calculus in the U.S. adult population. ($_{67}$) In these extensive analyses, the authors describe a subsample of 9,689 dentate persons 30 to 90 years of age who received a periodontal examination, representative of approximately 105.8 million civilian, non institutionalized Americans in 1988-1994. In the NHANES III survey, periodontal attachment loss, probing depths and furcation invasions were assessed in two randomly selected quadrants in each person. Only two surfaces per tooth were assessed, the mesiobuccal and midbuccal surfaces. Subjects were classified as having mild, moderate or advanced forms of periodontal disease. The results showed that the prevalence of attachment loss ≥ 3 millimeters for dentate adults was 53.1 percent among those 30 to 90 years of age. On average, 19.6 percent of teeth per person were affected by attachment loss. The prevalence of probing depth ≥ 3 mm was 63.9 percent. Approximately 50 percent had gingival bleeding, 92 percent had calculus and 55 percent exhibited subgingival deposits. Overall, the authors estimate that at least 35 percent of dentate U.S. adults aged 30 to 90 years of age have periodontitis. The data suggest that periodontitis is prevalent in the U.S. population of adults; African- American and Mexican-American males have poorer periodontal health than the rest of the U.S. adult population. They point out that primary and secondary preventive measures should be specifically targeted toward these groups.

RISK FACTORS AND INDICATORS FOR PERIODONTAL DISEASE

According to Grossi and colleagues,($_{89}$) risk indicators for attachment loss associated with periodontal disease include age (which is one of the moststrongly associated factors), smoking, and presence of Porphyromonas gingivalis and Bacteroides forsythus. Adjusting for these known indicators, researchers have also shown that stress associated with financial strain increases the severity of periodontal disease in adults, especially those who exhibit inadequate coping behavior.($_{10}$) In addition to systemic diseases and conditions such as diabetes, stress, advancing age, male gender, race,

ethnicity, compromised host defense and heredity, other more easily controlled risk factors and indicators for periodontitis should be noted.(11) These include history of periodontitis, poor oral hygiene and dental care.

RISK FACTORS FOR CARDIOVASCULAR DISEASE

Stress is a known factor in cardiovascular disease. Periodontitis and cardiovascular disease share risk factors including male gender, aging, smoking and race/ethnicity.(11) While there is other evidence to support the prevalence of unhealthy conditions among specific population groups, cardiovascular disease is the most common cause of death among men and women worldwide and is the most prevalent medical problem reported by periodontal patients.(12) Making a correlation between oral infections and cardiovascular disease seems long overdue since bacteremias associated with scaling, extractions, periodontal surgery and the development of life-threatening bacterial endocarditis has been recognized and documented for decades. Circulating bacteria of oral origin have been traced to episodes of bacterial endocarditis that can result in extensive damage to cardiovascular tissues and even death. So why has it taken so long for science to connect the mouth to the rest of the body? The interrelationships between infection and systemic disease are confounded by environmental, behavioral and genetic influences, and have demanded a complex and careful approach over time to sort out actual causal factors from associated factors. Although all the major risk factors for coronary heart disease, such as smoking, hypertension, high cholesterol and so forth are well-known, these factors do not explain all the epidemiologic and clinical features of the disease. There seem to be other important systemic risk factors at play as well.

DeStefano and colleagues (13) analyzed data from the NHANES I survey on the dental health of approximately 21,000 patients 25 to 74 years of age and matched these with the participants' subsequent incidence of coronary heart disease, or CHD, during the ensuing 14 years. After adjusting for other risk factors of CHD, they reported that men with periodontitis were 25 percent more likely to develop CHD, and the risk was particularly high for men under age 50, who had a relative risk for CHD of 1.72. Beck and colleagues (3) analyzed two large data sets and found that compared to more established risk factors, the role of periodontal disease appears to be consistently associated with the risk of coronary heart disease and stroke. A large body of relatively new information from both animal and human studies points to specific bacteria and viruses as potential risk factors for cardiovascular disease, specifically coronary heart disease, myocardial infarction and stroke.(1415) Chlamydia pneumoniae, a gram-negative bacteria associated with respiratory illness, is an example of a common airborne bacteria currently being linked to increased risk of cardiovascular disease.(15) Gupta (15) recently reported that in a group of 213 male heart-attack survivors, patients with evidence of C. pneumoniae infection were up to four times more likely than others to suffer further heart problems over an 18- month period. The differencebetween patients disappeared when those patients were given a three-day course of the antibiotic azithromycin. The common herpes virus, cytomegalovirus, or CMV, also is being identified as an important new risk factor for arterial disease.(1617) More specific to dentistry is the newly emerging relationship between certain oral organisms and cardiovascular disease. P. gingivalis is a gramnegative bacterium that is considered one the primary pathogens associated with periodontitis. Offenbacher, Chung and co-workers (518) have shown that in an animal model, altered inflammatory responses and subacute infection are associated with accelerated rate of atherosclerosis progression. In this model, oral pathogens also have the capacity to activate the acute phase inflammatory responses as well as enhance atheroma lesion formation.

RISK FACTORS FOR PRETERM LOW BIRTH WEIGHT

As mentioned earlier, new evidence is pointing to a possible relationship between periodontitis and adverse birth outcomes. (4519) In clinical trials at the Center for Oral and Systemic Disease at the University of North Carolina, Chapel Hill, the presence of P. gingivalis, B. forsythus, Actinobacillus actinomycetemcomitans and Treponema denticola were detected at higher levels in mothers of PTLBW babies as compared to normal birth weight, or NBW, controls.4 They found significantly higher levels of mediators of inflammation (prostaglandin E2, or PGE- 2) and the cytokine Il-1 in thegingival crevicular fluid of PTLBW vs. NBW controls, suggesting that there was a doseresponse relationship for increasing the PGE-2 in the gingival crevicular fluid, or GCF, as a marker for current periodontal disease activity and decreasing birth weight. Future investigations eventually may lead to development of chairside diagnostic tests that will allow the dental practitioner to monitor levels of specific bacteria and inflammatory agents in patients at risk for periodontitis-

associated diseases and conditions. Tools such as these would be helpful in monitoring the effect of therapy and guiding the dental team in their approach to treating periodontal infection. To date, no such chairside tests are available.

Based on these and many other studies supporting the potential periodontal disease and systemic disease interactions, periodontal research is rapidly being expanded to address the biological mechanisms underlying these findings. Influenced by this new trend in "periodontal medicine," the profession is also redefining the scope of periodontal practice to include risk assessment and targeted therapies for patients with systemic conditions such as diabetes, atherosclerosis, myocardial infarction and stroke. Since infection appearsto potentially increase the risk of developing other systemic conditions, researchers and clinicians are moving quickly to discover better ways to identify people at risk of periodontal disease and to expand the treatment options for people with periodontal infections. It should be emphasized, however, that preventive measures—including simply instructing and reinforcing oral hygiene regimens and a recall schedule keyed to the needs of the individual patient—are still the core of successful periodontal therapy. Good home oral hygiene is still the most effective tool for maintaining health and for preventing periodontal disease. Thorough débridement of the infected sites and the introduction of appropriate antimicrobials when indicated remain important steps in treating periodontal infections. Regular professional maintenance is equally important, since people in general are not very effective in sustaining a plaque-free dentition for any substantial length of time.

NONSURGICAL THERAPY: EMERGING TRENDS

Ultrasonics and sonics and topical antimicrobial therapy. There are several new trends in instrumentation techniques that have occurred within the last few years based on a large body of evidence that supports the safety and efficacy of using sonics and ultrasonic scalers for scaling and root planing and the expanded potential role of antimicrobials in the ultrasonic lavage.([202122]) Extensive reviews of the literature have been conducted regarding the use of power driven scalers or manual scalers for root debridement. Results confirmed that calculus and plaque removal can be performed equally well with either manual or power-driven scalers.([202122]) The data showed that root damage can occur with either manual or powered scalers if the instruments are used at the incorrect angle with excessive force, but that with proper use little damage is observed on the root surfaces.([2021222324]) Wound healing studies have shown significant attachment gains, as well as reductions in probing depths and bleeding on probing with both manual and ultrasonic and sonic scaling. Most studies have failed to denote any significant differences between changes in the clinical parameters when comparing manual or power-driven scalers. One notable exception is that of furcation débridement, where ultrasonic scalers with standard or newly designed furcation tips appear to be superior to manual scalers in Class II and Class III furcations. Thinner tips have been developed that increase the access to deeper pockets compared to manual scalers. However one recent study shows that pocket penetration of both the standard Dentsply P-10 tip and Slimline FSI rightand left-type tips are equally successful in reaching the apical plaque border.([25])

Topical antimicrobials have emerged as important adjuncts to nonsurgical therapy and are easily delivered in the ultrasonic lavage during instrumentation. Povidone iodine, or PVP-I, and chlorhexidine, or CHX, are both effective topical antiseptics that could potentially be used to enhance results in initial theratherapy or maintenance patients. Studies using CHX for fullmouth decontamination for treatment of adult periodontitis compared with traditional scaling and root planing have been reported by Quirynen and colleagues, ([26]) Bollen and colleagues ([2728]) and Vandekerckhove and colleagues.([29]) They successfully treated adult periodontitis patients with scaling and root planing and partial-mouth or full-mouth chlorhexidine disinfection with multiple applications of chlorhexidine in the form of a mouthrinse, tongue brush, pocket irrigation and tonsil spray. In the aforementioned studies,([26272829]) the goal of completing all scaling and root planing within 24 hours for the antimicrobial test group was to rid the oral cavity of as much bacteria as possible by treating all infected mucosal surfaces, including the tongue and tonsils, which are areas known to harbor bacteria that can recolonize the pockets. In the scaling control group, scaling was completed by quadrant every two weeks, which is closer to the traditional manner of most existing practices. Additional gains in clinical attachment were realized when this full-mouth antimicrobial protocol was combined with complete scaling within 24 hours; thus the term "full mouth disinfection" was coined to describe the projected outcome of this new approach. These studies reported significant clinical and microbial benefits in areas with deeper probing depths and increased attachment loss. Although these studies are small, they provide direction for potential new trends in

nonsurgical therapy. Topical application of PVP-I has been explored in several small studies. Some investigators have used PVP-I in various applications during periodontal therapy, including use as an irrigation solution or in mixtures with baking soda and with peroxide.(3031) Rosling and colleagues showed remarkable results with an aggressive periodontal débridement (curettage) using 0.05 percent PVP-I in an ultrasonic device compared to modified Widman flap.(30) Forabosco and colleagues (31) completed a similar study with comparable results in a small number of subjects using an ultrasonic device with a 0.05 percent iodine solution as the lavage. Although not yet a strong trend, recent data suggest that antimicrobial toothpastes may be useful in the long-term maintenance of oral health in periodontitis-susceptible patients.(3233) Two studies support the use of triclosan toothpaste compared to placebo controls; after patients underwent scaling and root planing and were placed on the designated toothpaste, the triclosan toothpaste showed significantly more gain in attachment over a three-year period and recurrent disease was virtually eliminated.(3233)

Sustained-release local drug delivery. Following introduction of the tetracycline fiber over 20 years ago, several other slow-release antimicrobials have been brought to the market for the treatment of adult periodontitis.(3435363738) Doxycycline gel and tetracycline fibers, currently available in the United States, both are types of tetracycline antibiotics used to treat periodontal infections locally. Tetracycline fibers are nonresorbable, whereas the doxycycline gel is resorbable within a short period. The chlorhexidine chip (PerioChip, Astra Zeneca), a vehicle for bactericidal antiseptic delivery, is also resorbable over a short period. The chips have been tested only as an adjunct to scaling and root planing. A doxycycline gel (Atridox, Block Drug Company) has been investigated only as a standalone product to be used in maintenance patients who have received scaling and root planing. In general, all of these delivery systems have reported statistically significant effects on clinical parameters, showing attachment gains, and reduction of bleeding on probing and probing depths. These local antimicrobials are primarily used for treating recurrent isolated pockets of 5 mm or more that bleed upon probing in patients with moderate-to severe adult periodontitis. Studies have shown that use of a host-modulating agent, Periostat (a 20-mg low-dose doxycycline), blocks the enzyme collagenase that is active in bone loss. When used as an adjunct to scaling and root planing, this systemic drug can significantly increase attachment levels and reduce bleeding on probing and probing depths for up to six months.(39) Trends in nonsurgical therapy include incorporating more anti-infective types of drugs into treatment protocols, which fits the concept of periodontitis as an infection. It should be mentioned that in advanced and early-onset–type periodontitis, these topical and sustained local drug delivery approaches are usually not sufficient to stop or eradicateinfection, particularly if some of the more invasive organisms such as P. gingivalis and A. actinomycetemcomitans are present. In the case of infections with these invasive organisms, systemic antibiotics are often needed in combination with surgical débridement to completely eliminate the infection.(22)

SURGICAL INTERVENTIONS: EMERGING TRENDS

Periodontal plastic surgery. Trends in surgical periodontics are continuing to expand into the “periodontal plastic surgery” area. Many new techniques have been incorporated into daily practice that are focused on root coverage and preprosthetic procedures such as ridge preservation or ridge augmentation prior to implant placement or restorative dentistry. Whole books have been published that address and describe the many techniques avail augmentation prior to implant placement or restorative dentistry.

Whole books have been published that address and describe the many techniques available to periodontists for enhancing the overall esthetics of their patients. Many of the techniques are quite demanding and require the skill of a specialist to produce maximum results. Using a new acellular dermal graft material, along with a coronally repositioned flap, the procedure could be completed without going to another site to harvest a free-gingival or connective- tissue graft. Other uses besides root coverage for this new acellular graft material include soft-tissue defect repair, amalgam tattoo correction and soft-tissue flap extension over bone grafts. Advantages of the technique include reduced need for palatal autografts or other second surgical sites, ability to treat larger areas in one surgery (up to six teeth) and the ability to achieve excellent esthetic results.40 Disadvantages include increased surgical chair time due to the time-consuming suturing requirements, additional cost of the material, use of a surgical approach that is technique-sensitive and longer healing time.

REGENERATION TECHNIQUES: NEW MATERIALS.

Regeneration techniques are not new and continue to expand

the abilityof the surgeon to restore lost hard and soft tissues to a much healthier and more functional and esthetic state. Guided tissue regeneration can be accomplished with many different types of materials and techniques. It is beyond the scope of this article to try to cover the myriad of procedures available to the clinician today in the regenerative, implant and esthetic areas. Many excellent review articles are available to compare the success rates of implants, sinus grafts, guided tissue regeneration, root coverage and other bone-replacement therapies. The techniques most commonly used to correct bony defects consist of placing an autogenous or bone replacement graft into the defect. For smaller three-walled defects, no other material may be needed. For furcation defects or large moatlike defects, clinicians will often choose to add a resorbable or nonresorbable membrane to contain the graft material and exclude the epithelial down growth into the defect. A new peptide-enhanced bone graft (PepGen P-15, Cera- Med Dental, L.L.C.)—a bovinederived hydroxyapatite that contains P-15, a synthetic peptide that has been shown to be superior to débridement alone or to an organic bone replacement graft.([41]) The peptide-enhanced bone graft is placed and then covered with a resorbable membrane to assist in guided tissue regeneration. Other periodontal regeneration materials that are setting the trend for future practice include biological mediators forperiodontal regeneration.([4243]) Cochran and Wozney ([42]) recently published an excellent review of this exciting new generation of growth-regulatory molecules that provide the prospect of new periodontal ligament and bone regeneration in the future. In this review they described the role of an enamel matrix derivative, a set of matrix proteins that appear to stimulate the initial acellular cementum formation. This acellular cementum appears to be critical in the development of a functional periodontal ligament. They reported that through "oral tissue engineering," bone morphogenetic proteins also permit periodontal ligament formation, and are excellent molecules for stimulating oral bone formation. Results of one animal study from their lab demonstrated that the bone morphogenetic protein known as recombinant human bone morphogenetic protein 2, or rhBMP-2, can be used to stimulate bone growth adjacent to and onto the surface of endosseous dental implants placed in sites with extended peri-implant osseous defects.([43]) Human trials involving rhBMP-2 are under way. These and other growth-regulatory molecules will most likely set the stage for even more successful and extensive regeneration of lost hard and soft tissues around natural teeth and implants, in edentulous jaws, sinuses and craniofacial defects. These are but a few of the exciting new discoveries that will soon be in the hands of the practitioner for use in the treatment of periodontal disease.

SUMMARY

This article discussed trends in surgical and nonsurgical periperiodontal treatment. Highlights of the literature that support periodontal medicine trends, as well as trends in nonsurgical and surgical treatment, have been reviewed. As the evidence accumulates and we understand the biological mechanisms underlying these new findings connecting oral health and systemic diseases, dentistry and the medical community must become much more global in their approaches to diagnosis and patient care. If these new research trends lead to strong causal relationships between infections such as periodontitis and atherosclerosis, PTLBW babies and other conditions, dentists will have the opportunity to play a much larger role than we do currently in the overall health and welfare of the public. This new role will involve addressing inadequacies in the area of public education and prevention strategies. Fortunately, dentistry has always been a leader in the health care community in prevention, and has already addressed one of the most prevalent chronic infections worldwide—dental caries. Now we must focus our attention on all infectious oral diseases, which include not only caries, but gingivitis and periodontitis as well. Industry and government will continue to work together with researchers and clinicians in investigating and developing new materials and devices for treating periodontal disease. As new preventive products and tissue-sparing techniques continue to be developed, they will enhance our ability to deliver the best possible care to our patients, improving their oral health and their overall health as well.

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