The Cosmetic Evolution

Integrating Oral Health Care into Restorative Treatment

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Abstract
As more patients seeking cosmetic treatment require periodontal disease management and therapy prior to restorative care, it becomes necessary for dentists and their teams to understand the relationships between, and effects of, periodontal disease, overall health, and esthetics. Common problems associated with periodontal disease (e.g., gingival recession, periodontal pockets, bone loss) not only have been associated with systemic diseases such as cardiovascular disease and diabetes, but they also can complicate esthetic smile design. With advances in technology and research, dentists now have more tools, including biomarkers and digital imaging, to identify and prevent disease before expression and prior to undertaking restorative procedures. Cosmetic dentistry therefore can be at the forefront in providing necessary periodontal health management to ensure oral and systemic health, as well as a long-lasting, healthy, and beautiful smile.

Key Words: oral and systemic disease, periodontal health management, salivary diagnostics, biomarkers, esthetic complications, patient education
Introduction

Relationship Between Oral and Systemic Disease

Although cosmetic dentistry’s primary focus is the esthetics of a smile, patients’ underlying overall health should be one of the initial concerns. As caretakers of patients’ oral health, dentists are responsible for ensuring a disease-free foundation for restorative treatments, as well as longevity for their restorations. Oral health is also vital to a person’s overall health, and recent studies have demonstrated a strong connection between oral disease and systemic health.2,3

When pathogenic bacteria, primarily Gram-negative anaerobic species, inhabit the surfaces of the periodontium and/or dentition, periodontal disease can result.4 The bacteria cause inflammation and can lead to gingivitis, indicated by red and/or swollen gums and bleeding on probing (Fig 1). When gingivitis is not treated, further infection can progress to periodontitis, causing irreversible destructive inflammation and creation of periodontal pockets. Components of antigenic or other bacteria can then access the inflamed tissues through these periodontal pockets, enter the bloodstream, and circulate systemically.4,5

Based on inflammatory mediators in diseased periodontal tissues and systemic dissemination of bacteria and their components, scientists have been able to identify a connection between periodontal diseases and potentially deadly systemic diseases and conditions.4 However, the relationship between oral and systemic disease is not entirely understood.6

Research

Research, however, has tried to explain this association through close examination of the potential mechanisms by which oral bacteria contribute to systemic inflammation.7,8 Studies have demonstrated a strong link between cardiovascular disease and oral health (Fig 2).7,9-12 A literature review by Teles and Wang explained that the bacteria associated with periodontal diseases can colonize the atheromatous plaques, inducing local inflammation that results in propagation of the inflammatory events, leading to atheroma formation, development, and eventual rupture (Fig 3).7 Studies completed by Holmlund et al. and Hung et al. found a significant correlation between the number of lost teeth and cardiovascular disease mortality and coronary heart disease, respectively.9,10 As tooth loss is commonly associated with poor oral health, these studies indicate a link between oral health and cardiovascular disease.9

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A bidirectional association has been shown between diabetes and periodontal disease, with periodontitis adversely affecting glycemic control in patients with diabetes mellitus and contributing to the development of diabetic complications.13,14 Newton et al. found that periodontal care was necessary and significantly more prevalent among diabetic patients compared to those without diabetes.15 The relationship between these two diseases can potentially be explained by the resulting increase in levels of systemic proinflammatory mediators, exacerbating insulin resistance.13

Additional medical conditions have demonstrated an association with periodontal disease, including pneumonia,16 rheumatoid arthritis,17,18 Alzheimer’s disease,3 and complications during pregnancy.19 Dentists should be aware of a patient’s existing periodontal condition and systemic health to anticipate complications during restorative treatment.

Diagnostics

In addition to the traditional methods of diagnosing periodontal disease, DNA-PCR testing using salivary diagnostics allows the clinician not only to evaluate the clinical signs, or the expression of the disease, but also to evaluate the specific bacteria associated with the disease process itself (Fig 4). Microbiologic, genetic, biochemical, or other diagnostic tests may also be useful in assessing the periodontal status of selected individuals or sites.20 This provides another window into the oral-systemic link regarding the specificity of periodontal disease and its relationship and presence in systemic disease processes. The clinician should allow for proper host modulation of therapy as needed and make an effort to enhance communication with medical colleagues.

Biomarkers

However, even before the expression of disease, inflammatory biomarkers can be identified as indicators for disease (Fig 4). Proinflammatory cytokines such as tumor necrosis factor-alpha (TNF-α) and Interleukin-17 (IL-17) have been associated with periodontal disease progression21 and shown to induce bone resorption and inhibit bone formation.22 Metalloproteinases (MMPs) are also good indicators of periodontal disease status because MMP production is potentiated in inflammatory conditions.23,24 A study by da Costa et al. found that the tissues neighboring large periodontal pockets presented inflammatory markers such as IL-17, TNF-α, MMP-2, and osteoclast accumulation.25 These inflammatory markers could be predictors of local bone resorption and the spread of disease.25 By using biomarkers, dentists can effectively identify those at risk for periodontal diseases and take precautionary steps to minimize the effects of periodontal inflammation on oral and systemic health, and enhance the longevity of cosmetic restorative treatments.
Dentists should be aware of a patient’s existing periodontal condition and systemic health to anticipate complications during restorative treatment.

The progression of atherosclerosis involves various inflammatory biomarkers that can be easily measured to determine a patient’s risk for heart disease and cardiac events.

- The human organism is a single unit composed of a seemingly infinite number of biologic processes so intertwined that abnormalities of almost any of its parts or processes have profound effects on multiple other body areas, exemplified... by the common and complex theme of inflammation.

- ...the immune system is now recognized as a significant active participant in many chronic diseases, including hypertension, diabetes mellitus, arthritis, inflammatory bowel disease, psoriasis, and the two diseases addressed in this Consensus: atherosclerotic cardiovascular disease and periodontitis.

- ...periodontitis in the general population is greatly underdiagnosed and undertreated...

Figure 1: Bleeding on probing in a seemingly healthy mouth.

Figure 2: Relationship between periodontitis and atherosclerotic cardiovascular disease. (Adapted with permission from the American Journal of Cardiology and Journal of Periodontology Editors’ Consensus report on periodontitis and atherosclerotic cardiovascular disease.)

Figure 3: Inflammatory biomarkers and the progression of atherosclerosis. ©Cleveland HeartLab, Inc., 2015.
### Result

Microbiological analysis for patient Michael Anyone resulted in a bacterial concentration requiring treatment due to the following complexes: Aa-Complex (Aa), Red Complex (Td), Orange Complex (Pm, Pn), Orange-associated Complex (En), Green Complex (Ec). Depending on the clinical findings this requires, in addition to mechanical treatment (SRP), an adjunctive antibiotic administration [scenario 8, amoxicillin (3 x 500 mg/day) & clindamycin (4 x 300 mg/day), 8 days]. For evaluating therapy success a control analysis is recommended approx. 8 weeks after cessation of antibiotic intake.

#### Microbiological Analysis

<table>
<thead>
<tr>
<th>Bacterial Complex</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aa-Complex</td>
<td>Aggregatibacter actinomycetemcomitans</td>
</tr>
<tr>
<td>Red Complex</td>
<td>Perphyromonas gingivalis</td>
</tr>
<tr>
<td>Orange Complex</td>
<td>Tanneraella forsythia</td>
</tr>
<tr>
<td>Orange-associated Complex</td>
<td>Treponema denticola</td>
</tr>
<tr>
<td>Green Complex</td>
<td>Prevotella intermedia</td>
</tr>
<tr>
<td>Cr</td>
<td>Fusobacterium nucleatum/periodonticum</td>
</tr>
<tr>
<td>En</td>
<td>Campylobacter rectus</td>
</tr>
<tr>
<td>Ec</td>
<td>Eikenella corrodens</td>
</tr>
<tr>
<td>Cs</td>
<td>Capnocytophaga species</td>
</tr>
</tbody>
</table>

**Explanation of pathogen concentrations**

- - = <10^3 [Exception Aa: <10^3]
- +1 = 10^3 [Exception Aa: 10^3]
- + = 10^4 [Exception Aa: >10^4]
- ++ = 10^5 [Exception Aa: >10^5]
- +++ = 10^6 [Exception Aa: >10^6]

**Abbreviations of bacteria names**

- Aa = Aggregatibacter actinomycetemcomitans
- Pg = Porphyromonas gingivalis
- Td = Treponema denticola
- Pr = Prevotella intermedia
- Pm = Pectostreptococcus micros
- Fn = Fusobacterium nucleatum/periodonticum
- Cr = Campylobacter rectus
- En = Eikenella corrodens
- Ec = Capnocytophaga species

**Smoking**

Patient is smoker: This risk factor should be considered in the individual therapy plan.

**Antibiotic allergies**

As stated on the order form, no antibiotic hypersensitivities are known. Please note that the clarification of hypersensitivities is mandatory prior to any antibiotic intake.

**Additional comments**

No statement on the order form.

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**Sample analyzed in cooperation with the Hain Lifescience laboratory. Results approved by laboratory director Dr. Jan Bartel.**

**Important:** The selection of therapy must take into account: 1) Periodontal status, 2) Patient’s medical status and 3) Possible adverse patient reactions to antibiotics. The treating dentist is responsible for deciding on the use and choice of antibiotic therapy, and Hain Diagnostics will not be liable for any direct, indirect, consequential, special, exemplary, or other damages arising from treating Dentist’s negligence. High risk patients should be consulted with a periodontist.

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**Figure 4:** Sample DNA-PCR pathogen report ©Hain Diagnostics 2015.
Cosmetic Dentistry and Periodontal Disease

Rise in Comorbidities
Dentists in the United States have seen an increase in the number of patients with comorbidities that complicate oral health care and can impact cosmetic restorative treatment. By eliminating or reducing periodontal disease, dentists not only can improve the overall health of their patients, but also can provide an ideal foundation for dramatic esthetic results (Figs 5-8).

Esthetic Complications
Periodontal diseases can cause a variety of esthetic complications, including inflammation, bleeding on probing, and periodontal pockets. It also can cause recession of the gingiva, either localized or generalized, which may lead to attachment loss and root exposure, resulting in clinical and esthetic problems (e.g., lack of gingival symmetry, exposed root surfaces, uneven papilla). Tissue preservation is essential to avoid crestal bone loss and gingival recession that can occur around implants; this can impact implant survival and negatively affect the long-term esthetics and functionality of restorations (Figs 9 & 10). Adequate soft tissue quantity and quality is necessary for successful restorations, implant-supported or otherwise.

The American Academy of Cosmetic Dentistry (AACD) recognizes the importance of healthy periodontal tissue. AACD Accreditation criteria include smile designs that demonstrate optimal periodontal health, as well as appropriate and harmonious gingival architecture. Figures 11 through 13 are the author’s examples of healthy periodontal tissue integration. Additionally, the visual harmony of the facial and proximal soft tissue contours is as important to successful restorations as natural tooth hue, chroma, value, and surface texture. Cosmetic dentistry is therefore closely linked to the health and appearance of the periodontium, and cosmetic treatment is also frequently necessary in the management of periodontal disease. Depending on their location, it may be necessary to cover unsightly exposed, sensitive roots, and recontour soft tissue recessions to achieve biological and functional periodontal health and enhance esthetics.
Figure 7: Image taken nearly two years after initial therapy. The patient was classified as “average” in terms of home care. Note there was no bone grafting done at any time on this case, only conservative periodontal care utilizing salivary diagnostics, host modulation, and antimicrobials. Additionally, note the significant bone repair/growth, with the pocket depth improving from 10+ mm to 3 mm.

Figure 8: The case after three years shows maintenance of health and clinical stability.

Figure 9: A patient presented with a failing implant at #30, an aggressive periodontal infection, and buccal-lingual Class I mobility. The implant at #31 was also considered high risk due to the significant inflammation and bleeding in both areas. The case was diagnosed as localized peri-implantitis, and MPT was performed over a two-week period. Note that no bone grafting was done on this case.

Figure 10: Follow-up image taken just over two years post-MPT. The patient is on four-month periodontal maintenance appointments. Note the bone healing/growth and how visible it is on the implant body threads.
Figure 11: Retracted view of healthy, natural dentition and periodontal tissue.

Figure 12: An eight-unit ceramic veneer case that demonstrates the integration of conservative, no-preparation cosmetic dentistry and harmony with the soft tissue and periodontium.

Figure 13: A limited ceramic veneer case involving teeth ##7-10 and ##16-23.
Integrating Periodontal Care into Restorative Practice

Prevalence of Periodontal Disease
Periodontitis is greatly underdiagnosed and undertreated in the general population. In fact, the prevalence of periodontal disease has reached staggering levels. According to a study released by the Centers for Disease Control, one out of every two adults over the age of 30 has periodontal disease, with 70% of adults over age 65 exhibiting periodontitis symptoms. Thus, about half of patients requesting cosmetic treatment may have periodontal disease (Fig 14). Due to the prevalence of this disease, treating and managing the periodontium has become an essential component in cosmetic dentistry.

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Patient Education
The first step to creating a world-class periodontal program that complements world-class cosmetic dentistry is to consider the general health of our patients and educate them about the significance of oral health and the importance of treating and managing periodontal diseases. This often requires dental professionals to utilize verbal skills, visual aids, and salivary diagnostics to successfully communicate the cosmetic-periodontal relationship to patients. This includes explaining to patients that periodontal diseases not only affect the foundation of beautiful esthetic restorations, but also their overall oral and systemic health and well-being. During treatment planning the Aacd recommends using several retracted views for proper digital photographic documentation. These images can be used as a reference for patients’ gingival health history and as an education tool. By comparing patients' photographs to images of healthy periodontium, dentists can better demonstrate the effects of periodontal disease and its impact on smile esthetics. In addition to patient education, dental practices can be proactive in overall patient health care. Updated health history forms provide dentists with an overview of their patients' current health, indicating any conditions that may impact periodontal health or cosmetic treatment, and vice versa. With advanced imaging capabilities, practices now can also screen for carotid calcifications and oral cancer to provide further preventive care.

Summary
Cosmetic restorative dentists change lives every day, and they now can also help to save lives by integrating basic health care practices (e.g., taking blood pressure, performing cancer screenings) and educating patients about the implications of unmanaged periodontal disease. Without a healthy periodontal foundation, cosmetic treatment can be compromised by disease. As more and more patients seek cosmetic dental treatments, dentists can use the opportunities presented during restorative consultations to support their patients as health care providers. By establishing and maintaining healthy periodontium, dentists can safeguard the longevity of their patients’ esthetic treatments and simultaneously help to improve their systemic health.

References


Without a healthy periodontal foundation, cosmetic treatment can be compromised by disease.

Dr. Nabors practices in Nashville, Tennessee, with an emphasis in cosmetic dentistry, oral health, and early intervention strategies for periodontal disease. He is an Aacd Accredited Member and an adjunct clinical instructor in the Department of Prosthodontics at the University of Tennessee College of Dentistry.

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