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Cause-related therapy: A review and suggested guidelines

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The two most common forms of oral disease, dental caries and periodontal disease, share their main etiologic factor, dental plaque. By specifically targeting their main etiologic factor, bacteria in dental plaque, cause-related therapy allows clinicians and patients to achieve successful control of these diseases. Clinicians should continuously guide and educate patients to understand the pathophysiology of their diseases so that patients will actively participate in the therapy by

mechanically removing dental plaque at home. When this is combined with professional intervention (ie, removal of active caries and periodontal mechanical debridement) as well as frequent maintenance therapy, dental caries and periodontal disease can be successfully managed and controlled. This review outlines the steps and components of cause-related therapy as well as its proven long-term clinical benefit. (*Quintessence Int* 2014;45:585–591; doi: 10.3290/j.qi.a31808)

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Meticulous dental plaque removal on a daily basis is crucial in preventing and treating the two major oral diseases – dental caries and periodontal disease.¹ Inadequate control of dental plaque in supragingival and subgingival areas may lead to a shift in the microbial environment, which is associated with periodontal pathosis.² This shift may selectively favor the predominant colonization of the so-called “red complex” periodontal pathogens.³ The microbial change may be accompanied by elevated levels of pro-inflammatory enzymes and cytokines, which may result in destruc-

tion of connective tissue attachment and alveolar bone.⁴⁻⁷ As a result, the affected individuals may develop a more severe and irreversible form of periodontal pathology, also known as periodontitis.⁸ Patients with periodontal disease may experience loss of teeth.^{9,10} Furthermore, they may also suffer from compromised oral health related quality of life.^{11,12}

A similar process is related to dental caries. Dental caries is a chronic disease, like periodontal disease, which may result in eventual loss of teeth.^{13,14} It is caused by bacteria in dental plaque, including, but not limited to *Streptococcus mutans* and *Lactobacillus*, which produce lactic acids as a byproduct of their metabolism on carbohydrates (ie, sugar).^{15,16} This “acid attack” may produce a pH lower than the critical pH, below which tooth demineralization, also known as dental caries, occurs.¹⁷

Controlling a patient’s periodontal disease and caries is an indispensable step to restore his or her oral health. Any surgical reconstruction of a patient’s oral

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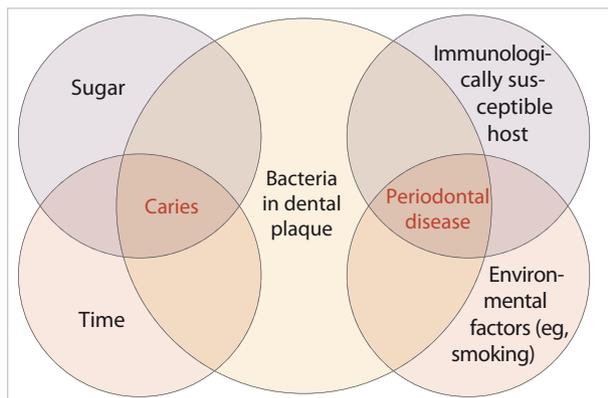
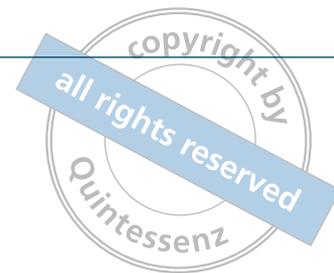


Fig 1 Both dental caries and periodontal disease share their common etiologic factor, bacteria in the dental plaque. Dental caries is caused by bacteria, which metabolize sugars and produce acids. With prolonged exposure to the resulting acidic environment, teeth may undergo demineralization, resulting in dental caries. Periodontal disease is also caused by bacteria in dental plaque. In response to bacteria, the immune system produces a series of cytokines and enzymes as a defense mechanism; however, it often results in destruction of periodontal disease due to collateral damage. Furthermore, a compromised immune system as well as environmental risk factors (eg, smoking) may enhance the severity and progression of the disease.

health must be initiated only after their periodontal disease and caries are eliminated and controlled in order to achieve a successful outcome. Cause-related dental therapy might shed a light on this. By specifically targeting the primary etiologic factor, dental plaque, with stringent oral hygiene instruction in combination with caries removal and professional debridement, periodontal health can be achieved at the same time as dental caries is prevented (Fig 1).¹⁸ Reducing the bacterial load by these means will give the biologic natural healing capacity of the body the opportunity to stabilize the oral condition, and thus should be considered as the first line of intervention before any surgical or complex restorative procedures are undertaken.¹⁹

The purpose of this article is to review the benefits of cause-related therapy from periodontal as well as dental caries viewpoints, and suggest a simplified guideline on how to effectively provide this therapy to patients.

CAUSE-RELATED THERAPY

Providing oral hygiene education to patients is the first step of cause-related therapy. Figure 2 suggests step-by-step instructions on how to educate patients. Clinicians or hygienists should clearly educate patients that supragingival and subgingival dental plaque is the primary etiologic factor for dental caries as well as periodontal disease. Through this process, the patients should understand how the disease process is initiated, and how they can contribute to the management and prevention of their diseases. By means of model and intraoral demonstration, patients should be educated

how to use a toothbrush as well as an interproximal cleaning aid (ie, dental floss, interproximal toothpick, or interproximal brush), and demonstrate their competency in using these tools properly and effectively (Fig 3). The baseline plaque control should be evaluated and monitored longitudinally, with plaque scoring indices such as O’Leary Plaque Score Index,²¹ after using a disclosing agent. This should be repeated until the patient achieves satisfactory plaque control, with the O’Leary Plaque Score Index <10%.²¹ By using disclosing agents in a repeated manner, patients can actually see where improvement is needed and enhance their ability to control dental plaque. This might also help explaining and understanding how the plaque causes the disease.

The benefit of oral hygiene practice using proper toothbrushing and interproximal cleaning aids has been demonstrated in many studies where patients’ periodontal and dental conditions (ie, prevention of caries) significantly improved at their reevaluation.^{15,19,22-27} Furthermore, the magnitude of response²¹ was greater with repeated multiple sessions of oral hygiene instructions in comparison to a single session;^{11,15,28,29} thus, continuous evaluation and reinforcement of patient’s compliance with a suggested oral hygiene regimen is of utmost importance. After successful implementation and completion of the oral hygiene education phase, clinicians should eliminate any active oral disease. During this period, clinicians should remove all active caries lesions and restore them with appropriate restorative materials. Previous studies suggested that patients with high DMFT (decayed, missing, and filled teeth) score

Explanation

- Explain to the patient the role of plaque in periodontal disease and caries.
- Explain the importance of meticulous plaque control for controlling these diseases and for the long-term success of dental treatment.
- Discuss different plaque control measures (toothbrushes, inter-proximal aids).

Model demonstration

- Demonstrate plaque removal methods on a model.

In-mouth demonstration

- Use a plaque disclosing tablet to specifically point out the areas where the patient has to improve with removing plaque, and to score the patient's initial plaque control (ie, O'Leary Plaque Score Index).
- Demonstrate the proper use of the individually tailored plaque control armamentarium inside the patient mouth using a face mirror.

Self-performance evaluation

- Ask the patient to practice oral hygiene measures in front of you.
- Correct and guide as necessary.

Repeated reinforcement and evaluation

- In several consequent visits as well as in the follow-up recall visits, repeat previous stages making sure the patient implements the instructions properly and is able to maintain appropriate plaque control. The O'Leary Plaque Score Index should be <10%. Reevaluations and reinforcements were found to be related to better compliance.



Figs 3a to 3c Examples of interproximal cleaning aids: (a) rubber-tip stimulator; (b) interproximal toothpick; (c) interproximal brush.

Fig 2 Flow diagram of oral hygiene education (modified from Ashkenazi et al,²⁰ with permission).



and high *S mutans* and *Lactobacillus* counts were at risk of developing not only primary but also secondary caries.^{15,16} Therefore, filling a diseased tooth is not enough; clinicians should educate their patients that receiving restorations on teeth is not a permanent cure for dental caries, but rather a repair process, requiring patients' continuous compliance with preventive regimens in addition to their routine home care. These additional preventive regimens may include, but are not limited to, using fluoridated toothpaste, using chlorhexidine gluconate rinse, applying topical fluoride varnish or gel, and conducting dietary consultation (such as the need for noncariogenic diet or use of xylitol). These regimens have been associated with reductions in the incidence of dental caries.^{16,30-32}

Periodontal disease should be managed with professional cleaning, scaling, and root planing at the appropriate areas in addition to continuous patient home oral hygiene care. According to a study by McCracken et al³³ on 40 subjects with chronic periodontitis, mechanical removal of plaque using toothbrushing at home in combination with conventional periodontal debridement resulted in significant improvement in periodontal condition after 16 months, as suggested by significant reductions in Plaque Index, Bleeding Index, and probing depth. Similar findings were reported in a systematic review by Van der Weijden and Hioe,³⁴ where oral hygiene instruction describing the use of a toothbrush in combination with a single professional oral prophylaxis showed a significant positive effect on the reduction of gingivitis. Furthermore, the use of an interdental brush or dental floss resulted in a significant reduction in mean probing depth, supra- and subgingival Plaque Index, and the percentage of sites with bleeding on probing after 1 month.³⁵ However, clinicians should be aware that professional mechanical removal of plaque and calculus must be delivered with repeated oral hygiene instruction; otherwise, according to a systematic review by Needleman et al,³⁶ it may have only minimal clinical value. Restorative overhang and inadequate restorative margins were also associated with periodontal pathosis, including increase in probing depths, and increases in gingival inflammation and alveolar bone

loss since they may act as local contributing factors for plaque accumulation.^{8,37,38} Therefore, they should be corrected as a part of the cause-related therapy phase in order to ease patient's plaque control as well as professional debridement. Orthodontic brackets may work as local plaque accumulation factors and, therefore, patients undergoing active orthodontic therapy must be monitored closely with more frequent recalls.^{19,39} These patients are at risk of developing periodontal pathosis (gingival overgrowth, gingivitis, or periodontitis) as well as white spot lesions on the teeth surfaces.^{19,39,40} Their compliance with the suggested home care regimen should be checked at every visit and be an important term for treatment continuation.^{19,39}

In patients with severe periodontal disease, adjunctive use of systematic antibiotics, locally delivered antibiotics or antimicrobials, or chlorhexidine gluconate rinse may be used in order to improve the magnitude of response from cause-related therapy.⁴¹⁻⁴⁶ Clinicians should be aware that smoking is a risk factor for periodontal disease, and smoking cessation should be included in overall cause-related therapy.⁴⁷⁻⁴⁹ The same can be said for uncontrolled diabetes, which is another risk factor for periodontal disease.^{50,51} Therefore, clinicians may need to coordinate periodontal treatment on this patient population with an endocrinologist or primary care physicians.

For summaries of the suggested protocol for cause-related therapy, please refer to Table 1.

Surgical and reconstructive phase

Despite the aforementioned available treatment modalities, advanced periodontal disease may not successfully be eliminated, thus requiring surgical intervention. However, it must be remembered these surgical interventions should be preceded by resolution of periodontal disease in all other sites and excellent patient home care in order to achieve a successful outcome and good tissue healing response.^{21,52-54}

The aim of this surgical phase should focus on surgically recreating an environment that both patient and clinician can keep clean with home oral hygiene care and regular dental prophylaxis.⁵⁵⁻⁵⁷ This may be



| Table 1 Guidelines for cause-related therapy | |
|--|--|
| Dental caries | Periodontal disease |
| Patient's understanding of the pathophysiology of dental caries (ie, bacteria in dental plaque as an etiologic factor). | Patient's understanding of the pathophysiology of periodontal disease (ie, bacteria in dental plaque as an etiologic factor). |
| Self plaque removal at home using toothbrush and interproximal cleaning aids. | Self plaque removal at home using toothbrush and interproximal cleaning aids. |
| Elimination of active caries lesions. | Professional plaque removal (prophylaxis or scaling and root planing). |
| Elimination of active caries lesions. | Elimination of correctable local plaque retentive factors (restorative overhang, inadequate restorative margin). |
| Adjunctive preventive therapy: Use of fluoridated toothpaste Application of topical fluoridated varnish or gel Dietary modification (from cariogenic to noncariogenic diet) Use of xylitol | Adjunctive preventive therapy: Systemic antibiotics Locally delivered antimicrobials or antibiotics Antimicrobial rinse (ie, chlorhexidine gluconate rinse) |
| Determine recall maintenance interval based on patient's caries risk. | Control other risk factors: Smoking cessation Uncontrolled diabetes Determine recall maintenance interval based on patient's risk for periodontal disease and compliance with oral hygiene performance. |

achieved by traditional periodontal surgery, including open flap debridement or osseous resective surgery, or regenerative periodontal surgery.⁵⁸⁻⁶²

Only after completely resolving periodontal disease by means of nonsurgical and surgical approaches can the reconstructive procedures be initiated. This includes both removable (ie, partial dentures) and fixed prosthodontic therapies (veneers, crowns, fixed dental prostheses, and dental hybrid prostheses), which may include also surgical placement of dental implants with or without bone regenerative therapy. These reconstructive procedures, including dental implant placement, should be performed after the cause-related phase is complete (including disease control-related surgical intervention if needed), and good plaque control has been achieved and maintained.

Consistent with the rationale behind cause-related therapy, prostheses should be designed in a manner that allows ongoing easy plaque removal by the patient as well as the clinician. Margins of crowns and fixed dental prostheses may preferably be located supragingivally or equigingivally in nonesthetic areas. Before permanent cementation, the marginal fit of the crowns and fixed dental prostheses should be carefully

examined. Any defective margin (ie, overhanging or open margin) should be corrected. Furthermore, adequate gingival embrasure space should be provided for interdental cleaning and maintenance. These techniques will provide an environment that is cleanable and maintainable by the patients as well as the clinicians, thus reducing the risk of developing periodontal disease and caries in the future.^{37,56,63,64}

Maintenance of the results and disease control for the long term

Success in dental treatment can be defined as the ability to bring patients to a stable condition in which they come for regular check-ups with no apparent need for further treatment.⁶⁵ During maintenance visits, patients should be evaluated for any recurrence of periodontal disease or caries. Any recurrence of disease should be regarded as failure and, thus, cause-related therapy should be initiated again until the disease is re-stabilized.⁶⁵

Based on the patient's compliance with their suggested oral hygiene regimen, and severity of initial disease conditions, a recall maintenance interval should be determined. For instance, for a patient who is considered at high risk for periodontal disease (ie, previous



history of advanced periodontal disease) or dental caries (previous history of multiple smooth surface or recurrent caries), a 1- to 3-month recall interval may be necessary. During maintenance visits, home plaque control should be continually assessed, documented, and reinforced. Accordingly, clinicians should emphasize and reinforce the importance of the patient's role in maintaining the successful results and preventing recurrence of diseases over time. Wilson et al⁶⁶ investigated tooth loss among 162 subjects who were under maintenance care after completing active periodontal therapy. Among 58 subjects who completely complied with the suggested maintenance recall interval, no tooth loss was reported over the 5-year study period. In contrast, among 104 subjects whose compliance with the suggested recall interval was erratic, a total of 60 teeth were lost in 22 subjects due to recurrence of periodontal disease or endodontic pathosis.⁶⁶ Similarly, a recent prospective cohort study compared 58 regular compliers with 58 erratic compliers of their maintenance therapy.⁶⁷ During the 3-year study period, the erratic group exhibited a higher incidence of tooth loss, and a higher recurrence of periodontal disease than the regular complier group.⁶⁷ The aforementioned risk of tooth loss and recurrence of disease in patients who are not compliant with maintenance therapy has also been reported elsewhere.^{68,69}

CONCLUSION

During cause-related therapy, by targeting the common etiologic factor, dental plaque, the most two common forms of oral disease (ie, periodontal disease and dental caries) can and should be successfully controlled. A patient's understanding of the pathophysiology of the two diseases and their active participation in the treatment by means of plaque removal at home is indispensable to achieve a successful outcome in conjunction with professional interventions (ie, removal of active caries and periodontal debridement) and frequent maintenance recalls. Only by resolution of the disease and its control will we be able to provide long-term health to our patients.

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