

Periodontal disease and its impact on general health in Latin America.

Section V: Treatment of periodontitis

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Abstract: Gingivitis and periodontitis are associated with a negative impact on Oral Health Related Quality of Life (OHRQoL), exerting a significant influence on aspects related to the patients' function and esthetics. Periodontitis has been associated with several systemic conditions, including adverse pregnancy outcomes, cardiovascular diseases, type 2 diabetes mellitus (DM), respiratory disorders, fatal pneumonia in hemodialysis patients, chronic renal disease and metabolic syndrome. The aim of this paper was to review the results of different periodontal treatments and their impacts on patients' OHRQoL and systemic health. Non-surgical and surgical periodontal treatments are predictable procedures in terms of controlling infection, reducing probing pocket depth and gaining clinical attachment. In addition, the treatment of periodontitis may significantly improve OHRQoL and promote a reduction in the levels of systemic markers of inflammation, including some cytokines associated with cardiovascular diseases. Studies have also suggested that periodontal treatment may improve glycemic control in patients with DM. Strategies and actions for preventing the onset and recurrence of periodontitis, and the challenges facing the field of periodontology in the XXI century are presented in this review.

Keywords: Periodontics; Periodontal Debridement; Quality of Life; Cardiovascular Diseases; Diabetes Mellitus.

Introduction

Periodontitis is a chronic multifactorial inflammatory disease associated with a dysbiotic biofilm and characterized by progressive destruction of the tooth-supporting apparatus, which can lead to tooth loss.¹ Although it may progress with swelling and bleeding, periodontitis is normally considered a silent disease. However, this concept may not be accurate, since health and well-being are not merely medical concepts, but are encompassed by the biopsychosocial model. The American Dental Association (ADA) states that 'Oral health is a functional, structural, aesthetic, physiologic and psychological state of well-being and is essential to an individual's general health and quality of life'.² Oral Health Related Quality of Life (OHRQoL) has been widely recognized as a valid parameter of assessment in almost every area of a person's physical and mental

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health care, including oral health.^{3,4,5} Periodontitis has been also associated with several systemic conditions, including adverse pregnancy outcomes,⁶ cardiovascular diseases,⁷ respiratory diseases, cancer, lupus, rheumatoid arthroses, diabetes mellitus (DM)⁸ and chronic kidney disease.⁹ The biological plausibility of these associations relies mainly on the low systemic inflammatory burden that has been associated with periodontitis.¹⁰

Periodontal treatment can improve not only periodontal parameters such as gingival bleeding, probing pocket depth and attachment levels, but also subjective OHRQoL. Therefore, OHRQoL might be considered an important endpoint to fully assess the efficacy of periodontal therapy for oral health. Periodontal treatment has been shown to reduce short-term levels of systemic markers of inflammation,¹⁰ surrogate outcomes, and may, therefore, contribute to the control of other diseases.

The aim of this paper was to review the results of different periodontal treatments and their impacts on patients' OHRQoL and systemic health. This paper was part of the Latin American Oral Health Association (LAOHA) Workshop that included experts from different Latin America countries. Contributions from the discussions are included in the article.

Periodontal disease and Oral Health-Related Quality of Life (OHRQoL)

In spite of its ubiquitous nature and the deleterious impact on the periodontium, periodontitis can progress as a 'silent disease' as it may be accompanied by swelling, bleeding and/or tooth mobility in the complete absence of pain. The recognition that health and well-being are not merely medical concepts, but are encompassed by the biopsychosocial model has been accepted for many years. OHRQoL has been defined as "an individual's perception of their position in life in the context of culture and value systems in which they live and in relation to their goals, expectations, standards and concerns".³ Periodontal diseases play a significant role in oral health and impact on the QoL of affected individuals^{4,5} and they may present a dose-response relationship.¹¹ A systematic review demonstrated that gingivitis and periodontitis were associated with a negative

impact on OHRQoL, with a significant impact on aspects related to function and esthetics,¹² while another systematic review showed that tooth loss was associated with negative impacts on general OHRQoL.¹³ Periodontitis in young subjects and adults may be associated not only with worse OHRQoL, but also with higher dental anxiety.^{14,15} Therefore, the early diagnosis and treatment of periodontitis is important for the individual general health, and the perception of periodontitis as a "silent disease" should be changed.¹¹

Periodontal diseases and their association with systemic conditions

Periodontitis has been associated with several systemic conditions, including adverse pregnancy outcomes⁶, cardiovascular diseases,^{7,16} type 2 DM,⁸ respiratory diseases,¹⁷ pneumonia mortality in hemodialysis patients,¹⁸ chronic kidney disease⁹ and metabolic syndrome.¹⁹ Early stages of atherosclerosis may be associated with severe chronic periodontitis related to endothelial and microvascular dysfunctions.²⁰ The biological plausibility of these associations relies mainly on the low systemic inflammatory burden that has been associated with periodontitis.²¹ Increased levels of IL-1, IL-6 and TNF- α were observed in blood samples of patients with periodontitis.²¹ A systematic review indicated that C-Reactive Protein levels were significantly higher among patients with chronic periodontitis.¹⁰ In Brazilian populations, this observation was confirmed in systemically healthy patients²² and patients with refractory arterial hypertension,²³ type 2 DM²⁴ and chronic kidney disease.²⁵ In diabetic patients, cardiovascular complications were associated with periodontitis, including increased overall mortality, coronary heart disease and stroke.⁸ A multi-center study in Brazil indicated that diabetic patients with periodontitis had increased odds of microvascular complications and of hospitalizations related to hyperglycemia and ketoacidosis.²⁶

Periodontal treatment

Non-surgical (NSPT) and surgical periodontal treatment (SPT) are predictable procedures in terms

of controlling infection, reducing probing pocket depth (PPD) and gaining clinical attachment level (CAL).²⁷ Good plaque control is crucial to maintain periodontal health, and data related to tooth brushing behavior supported this statement.^{28,29,30} An 11-year study showed that tooth brushing was associated with a decrease in the number of teeth with periodontal pocketing. There was a clear dose-response relationship between tooth brushing frequency and change in the number of teeth with PPD \geq 4 mm.³⁰ Daily interdental brushing or flossing appeared to be the most effective procedures for reducing plaque and gingivitis scores, and was also the least expensive preventive therapy.³¹

Scaling and root planning (SRP) is considered the gold standard non-surgical treatment for periodontitis and its clinical efficacy has been well documented by several systematic reviews.^{32,33} Even teeth with extensive periodontal destruction may be retained and treated. Plaque removal and SRP may reduce gingival bleeding on probing in approximately 45% of sites.³⁴ After NSPT, PPD reductions varied from 1–1.3 mm for pockets with initial PPD of 5–6 mm to 2–2.2 mm for PPD $>$ 7 mm; CAL could improve by 0.5–2 mm.^{32,33} NSPT may be delivered by conventional staged or full-mouth approaches. No clear difference existed between the 2 types of treatment, and the selected option may be chosen according to the specific situation.³⁵

Tooth type, the degree of periodontal destruction, local factors, medical background and patients' age may interfere with the effectiveness of SRP. Non-molar teeth demonstrated higher PPD reduction after SRP than molars.³⁵ However, NSPT alone may not be sufficient to reestablish periodontal health in cases of patients with advanced periodontitis.³⁶ Thus, other forms of therapies, such as lasers, antiseptics, systemic antibiotics, host-modulators and probiotics have been suggested as adjuncts to SRP in order to potentiate the effects of this treatment.³⁵ Among other adjunctive therapies to SRP, amoxicillin and metronidazole have proven strong scientific evidence for their use in daily clinical practice. The clinical benefits of this treatment protocol have been supported by recent systematic reviews^{37,38,39,40} and randomized clinical trials (RCTs)

with 1 to 2 years of follow up.^{41,42,43,44} In addition, a recent systematic review⁴⁵ concluded that adjunctive probiotics could result in additional CA gain in adults with periodontitis. Nonetheless, further high-quality RCTs including microbiological analyses are necessary before determining whether probiotics should be used for the treatment of periodontitis in daily clinical practice.

Intrabony and furcation defects may be treated by conservative, resective or regenerative surgeries. A meta-analysis of studies evaluating conservative surgery for the treatment of intrabony defects found a PPD reduction of 2.9 mm and CA gain of 1.7 mm at 12 months post-treatment.⁴⁶ Regenerative surgeries were mainly used for deep intrabony defects. Guided tissue regeneration and enamel matrix derivatives showed similar magnitudes of PPD reduction and CA gain: 1.2 mm.⁴⁷ In addition, the presence of furcation defects may increase the risk of tooth loss. Nibali et al.,⁴⁸ in a systematic review, described that the average tooth loss/year was 0.01 and 0.02 for molars without and with furcation involvement, respectively, in patients under supportive periodontal therapy for up to 10–15 years. The results showed that around 10% of the molars treated by root resection or by regenerative procedures in furcation and intrabony defects were lost during supportive treatment.⁴⁸

Periodontal treatment and OHRQoL

In addition to improvements in traditional clinical parameters, subjective OHRQoL should be considered an important endpoint for treatment with the aim of fully assessing the efficacy of periodontal therapy. Two systematic reviews were published on this topic.^{11,49} The focused question of these reviews was "Does surgical or non-surgical periodontal therapy improve the OHRQoL in adults with periodontal disease"? The results indicated a statistically significant improvement in OHRQoL after NSPT. No significant differences were reported between different forms of NSPT. SPT had a relatively lower impact on OHRQoL and a correlation between poor clinical response to therapy and poor OHRQoL outcomes was observed. Functional (eating/chewing), psychological (appearance/discomfort) and physical

(pain) domains were the most affected at baseline, while functional and psychological domains as well as pain were those that improved the most after NSPT. OHRQoL improved with periodontal therapy, particularly after supragingival treatment, suggesting that this intervention was important for reducing the negative impacts of periodontal diseases in OHRQoL.

Periodontal treatment and other diseases

Treatment of periodontitis and cardiovascular disease (CVD)

Periodontal treatment has been shown to be effective in reducing short-term levels of systemic markers of inflammation.¹⁰ Short-term studies have shown a reduction in systemic markers associated with CVD, including IL-1, IL-6 and fibrinogen,^{23,25,50} after NSPT. A RCT indicated that the median values of C-reactive protein, total cholesterol and triglycerides were reduced after 6 months of periodontal treatment.²² Two pilot studies described outcomes in the management of patients with CVD, after 6 months of NSPT.^{23,25} Vidal et al.²³ observed reduction of cardiovascular markers, such as systolic and diastolic blood pressure and left ventricular mass in patients with severe chronic periodontitis and refractory arterial hypertension. These improvements were comparable with the introduction of a new medicine. In addition, six months after NSPT in patients with chronic renal diseases and periodontitis, there was a significant improvement in the estimated glomerular rate.²⁵ The probable link between these observations was related to an improvement of the endothelial dysfunction.^{23,25}

Treatment of periodontitis and glycemic control

Periodontitis may impair glycemic control in patients with DM,⁵¹ and periodontal treatment may improve glycemic control in patients with DM, as demonstrated by systematic reviews with meta-analysis^{8,52} and RCTs.^{24,53} Reduction in HbA1c is an established outcome measure of successful DM treatment.⁵⁴ Evidence derived from a recent meta-analysis showed that NSPT resulted in a statistically significant reduction in HbA1C levels at 3 months post-treatment of about 0.40% (range:

0.27%–0.65%), while at 6 months, the estimated reduction was lower.⁵⁵ This decrease was considered equivalent to the introduction of a new medicine. A recent 1-year, double-blind and placebo-controlled RCT²⁴ demonstrated a significant improvement of the mean C-reactive protein and mean glucose and HbA1C levels after NSPT in adults with periodontitis and type 2 DM. Merchant et al.⁵⁶ demonstrated that after 1.7 years of follow-up, long term periodontal care improved long-term glycemic control among individuals with type 2 DM and periodontal disease. The reduction in HbA1c levels was greater among individuals with higher baseline HbA1c levels. Another group of investigators suggested that the beneficial effect of treating periodontitis on HbA1c may be sufficient to justify periodontal treatment in patients with type 2 DM at accepted cost-effectiveness thresholds in the UK⁵⁷. On the other hand, at least one recent RCT⁵⁸ and one systematic review⁵⁹ have suggested that not even the adjunctive use of systemic antibiotics during periodontal treatment was able to promote a significant reduction of HbA1c levels in patients with type 2 DM.

In summary, although the reduction of HbA1C levels after periodontal treatment has not yet been completely determined, therefore, considering the high prevalence of periodontal disease in type 2 DM patients, the available data showing a positive effect of periodontal treatment on glycemic control and the oral health benefits for the patients' systemic health justify the inclusion of periodontal assessment and treatment in clinical guidelines for the management of DM.⁵⁷

Strategies for preventing periodontitis

Most patients with periodontitis can be predictably treated and maintained. However, approximately 20–25% of patients with periodontitis will continue to exhibit disease progression, despite proper therapy and maintenance. The predictable periodontal treatment outcomes for most patients has changed the marketplace, in which patients are treated by general dentists and dental hygienists. Periodontics should include the management of and decision-making about tooth retention in advanced periodontitis cases, complex dental implant cases and control of systemic inflammation resulting from certain types of periodontitis.⁶⁰

Population-based measures for preventing periodontal disease, primarily target changes in individual behavior. Interventions to prevent and control periodontal diseases are focused on the individual level, and therefore, address behavior rather than social conditions. However, adults are more difficult to reach when compared with children, if they do not seek the dentist of their own accord. The only prevention activity for periodontitis successfully performed at a population level seems to have been anti-smoking campaigns, although evidence of their efficacy is completely lacking. A major goal for the prevention of periodontal diseases should, therefore, be to change people's behavior in the direction of a lifestyle that is more conducive to health at an individual level⁶¹.

Actions for prevention of periodontitis

- a. Anti-smoking campaigns and promotion of smoking cessation.
 - b. Promotion of oral hygiene practices. Among disadvantaged populations, a key factor of self-care hygiene practices is the ability to afford a toothbrush/toothpaste/interdental device. The production and sale of affordable toothbrushes would enable poorer populations to access and use these products. Partnerships between governments, national and multi-national companies, health professionals and local communities are necessary. Reduction of taxation levels on oral hygiene products would have a major effect by making these items affordable and accessible, particularly in populations from low- and middle- income countries in Latin America.
 - c. Stimulate the use of tele-dentistry, a broad variety of technologies and tactics to deliver virtual medical, health, and educational services to communities and dentists. The use of telehealth systems and methodologies in dentistry may include patient care and delivery of education using Information and Communication Technologies (ICTs).²
 - d. Dental schools may stimulate the concept of a health promotion environment for students, staff and the community.
- Gingivitis, mild forms of periodontitis and edentulism appear to be declining.⁶² However, the percentage of severe periodontitis remained unchanged.⁶³ This trend may be an indication that primary prevention, including improvement of oral hygiene procedures and regular programs of professional health care have contributed to the reduction in the prevalence of gingivitis and mild forms of periodontitis. On the other hand, because of the global population growth (from 5.5 billion in 1990 to 7.4 billion in 2015), ageing societies (globally, the proportion of people 65 years and older increased from 6.0% in 1990 to 8.2% in 2015) and increased tooth retention, the number of people affected by periodontitis has grown substantially, increasing the total burden of this disease globally. Estimates have indicated that between 1990 and 2013, the number of people affected by severe periodontitis increased by 67%.⁶⁴ The global economic impact of oral disease in 2010 has been estimated at US\$ 442 billion.⁶⁵
- By 2050, it is estimated that 22% of the world's population will be older than 60 years of age. As a result, 80% of older adults will suffer from at least one chronic disease, and 50% will suffer from at least 2 disorders.⁶⁶ With the world population aging, early identification of individuals with a particular aging trajectory is necessary, as these are individuals at risk for early development of non-communicable chronic diseases (NCD), such as DM and CVD. By the year of 2030, the estimated percentage of worldwide deaths caused by NCD will be 70%. This trend would be seen for high, middle and low-income countries.⁶⁷ Care of NCD patients in the dental office is both a challenge and an opportunity. Periodontal professionals must increase their level of communication with other healthcare professionals, especially physicians and nurses, to identify all possible relations between these chronic diseases. Periodontitis should be regarded as a "sign post" condition, which could indicate that a patient may have an underlying chronic NCD (e.g. undiagnosed DM). The number of teeth maintained is a marker for general health, healthy aging and a longer lifespan. Sharing the importance

and significance of retained teeth with both dental and non-dental health-care providers may provide a valuable impetus to improve oral hygiene and retain teeth. Periodontal disease, tooth loss and longevity may be related.⁶⁸

Challenges facing the field of periodontology in the 21st Century: concluding remarks

- a. Promote adequate communication between general dentists and periodontists, so that they know in which periodontal affections the patient could require a more specialized treatment, especially in those cases when non-surgical therapy does not achieve periodontal health.
- b. Increase participation of periodontists in the decision-making about tooth extraction and implant reconstruction, and management of advanced, complex periodontal cases. Dentists ARE trained to PRESERVE teeth.⁶⁹
- c. Periodontists should establish connections with non-dental healthcare professionals, including

physicians and nurses, who urgently need to know about the fundamentals of the onset and progression of periodontal diseases.

- d. Dental schools could participate in developing educational programs for dentists and for non-dental healthcare professionals.
- e. National Dental Associations could help policy makers and governments to promote the recognition of oral health as a vital and integral aspect of general health and wellbeing.

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