

Photodynamic Therapy as an Adjuvant to Full Mouth Disinfection in one Stage: Case Report

Terapia Fotodinâmica Antimicrobiana Adjuvante à Desinfecção Total da Boca em uma Etapa: Case Report

Daniel Adrian Silva Souza^{*a}; Camila Silva Souto^b; Márcio da Luz Silva^b; Juliana Borges de Lima Dantas^c; Júlia dos Santos Vianna Néri^a; Tiago José Silva Oliveira^d

^aUniversidade Federal da Bahia, Stricto Sensu Graduate Program in Dentistry and Health. BA, Brazil.

^bFaculdade Adventista da Bahia. BA, Brazil.

^cUniversidade Federal da Bahia, Stricto Sensu Graduate Program in Interactive Process of Organs and Systems. BA, Brazil.

^dCentro de Pesquisas Odontológicas São Leopoldo Mandic. SP, Brazil.

*E-mail: danieladrian.doc@gmail.com

Abstract

Periodontitis can be defined as a chronic inflammatory, multifactorial and microbial disease, characterized by the progressive destruction of the periodontal ligament and alveolar bone. The objective of the present report is to present the case of a young patient diagnosed with stage IV and grade C periodontitis, the proposed treatment was the application of a protocol of total mouth disinfection, associated with antimicrobial photodynamic therapy and systemic antibiotic therapy. This is a male patient, 27 years old, pardo, who attended the Dentistry clinic of Faculdade Adventista da Bahia with a complaint of mobility in the maxillary anterior teeth. There was a 9 mm loss of interproximal attachment at the worst periodontal site, a 33% rate of bleeding on probing, grade II mobility in elements 11, 21 and 22, and radiographic bone loss extending to the apical half or third of several elements. Periodontal destruction exceeded what was expected for the amount of visible biofilm. The proposed treatment was the total disinfection of the mouth in one step, using antimicrobial photodynamic therapy as a local antimicrobial agent, concomitant with systemic antibiotic therapy for a period of 7 days. During the subsequent 90 days, no intervention was performed, and the patient returned for reassessment. There was, therefore, a remarkable regression of periodontal pockets to 3 mm at the worst site and a 6% bleeding rate on probing and reported cessation of tooth mobility. Therefore, it is suggested that the synergistic association of the treatments in question, when properly used, can present satisfactory results in patients with advanced periodontal disease.

Keywords: Periodontal Disease. Periodontal Debridement. Photochemotherapy.

Resumo

A periodontite pode ser definida como uma doença inflamatória crônica, multifatorial e microbiana, caracterizada pela destruição progressiva do ligamento periodontal e osso alveolar. O objetivo do presente relato é apresentar o caso de um paciente jovem diagnosticado com periodontite estágio IV e grau C, o tratamento proposto foi a aplicação de um protocolo de desinfecção total da boca, associado a terapia fotodinâmica antimicrobiana e antibioticoterapia sistêmica. Trata-se de um paciente do gênero masculino, 27 anos, faio derma, compareceu a clínica de Odontologia da Faculdade Adventista da Bahia com queixa de mobilidade nos dentes anteriores superiores. Observou-se 9 mm de perda de inserção interproximal no pior sítio periodontal, 33% de taxa de sangramento a sondagem, mobilidade grau II nos elementos 11, 21 e 22 e perda óssea radiográfica se estendendo à metade ou ao terço apical de vários elementos. A destruição periodontal excedia ao esperado para a quantidade de biofilme visível. O tratamento proposto foi a desinfecção total da boca em uma etapa, utilizando a terapia fotodinâmica antimicrobiana como agente antimicrobiano local, concomitante a antibioticoterapia sistêmica pelo período de 7 dias. Durante os 90 dias subsequentes nenhuma intervenção foi realizada, e o paciente retornou para reavaliação. Observou-se, portanto, notável regressão das bolsas periodontais para 3 mm no pior sítio e 6% de taxa de sangramento a sondagem e cessamento da mobilidade dentária relatada. Portanto, sugere-se que a associação sinérgica dos tratamentos em questão, quando bem empregada, pode apresentar resultados satisfatórios em pacientes com doença periodontal avançada.

Palavras-chave: Doenças Periodontais. Desbridamento Periodontal. Fotoquimioterapia.

1 Introduction

Periodontitis can be defined as a chronic inflammatory, multifactorial and microbial disease, characterized by the progressive destruction of the periodontal ligament and alveolar bone.¹ Its classification depends on its stage and degree, which varies from stage I (initial periodontitis), II (moderate periodontitis), III (severe periodontitis with potential for tooth loss) to IV (advanced periodontitis with potential for loss of all dentition) and degree A to C (grading regarding the risk of progression of periodontal disease, being A – slow, B – moderate and C – fast)².

Quiryren et al.⁵ proposed the protocol of total mouth disinfection in one step (DTB), from English *one-stage full-mouth disinfection* - FMD. This protocol consisted of the realization of supra and subgingival root scraping and straightening (RAR) of the entire mouth within 24 hours, with the aim of suppressing periodontopathogens throughout the oral cavity. Although RAR remains the most effective non-surgical approach to promote the elimination of biofilm from the root surface, it is an invasive approach, and restoration of this tissue largely depends on the favorable cellular and molecular response⁶.

The *Photodynamic therapy* (PDT) emerged as an antimicrobial therapeutic alternative to improve the efficacy of periodontal treatment. Its mechanism consists of the use of a photosensitizing agent that, when interacting with the light and oxygen of the medium, releases reactive oxygen species, causing irreversible damage to local pathogens, without causing damage to host cells^{3,4}.

For Abduljabbar et al.⁷, LBP (low-power laser) is a non-invasive and painless therapy, and can be indicated for any type of patient, including in cases where corticosteroid use is not indicated, as in hypertensive and diabetic patients. Cobb et al.⁸, in their study, report that the use of LBP has been recommended in periodontal therapy for its photochemical anti-inflammatory, biostimulator and analgesic role. In *vitro* and animal studies have shown that LBP suppresses inflammation in the periodontal tissue by modulating the local immune response and reducing the production and release of certain pro-inflammatory cytokines, such as the tumor necrosis factor alpha (TNF- α), interleukin-1 β . (IL-1 β) and prostaglandin E₂⁹. In addition, it also assists in reducing or eliminating pain due to the release of b-endorphin in the nerve endings of the lesion and promotes tissue bio stimulation, causing the repair of the lesion to occur in a faster period¹⁰.

Given the above, the objective of the present report is to present the case of a young patient diagnosed with stage IV and grade C periodontitis, the proposed treatment was the application of a protocol of total mouth disinfection, associated with antimicrobial photodynamic therapy and systemic antibiotic therapy.

2 Case Report

The clinical case report in question obtained the proper approval of the Ethics Committee accredited to the National Health Council, having as number of the approval opinion 4.604,316. The patient signed a detailed informed consent form, and was verbally informed of the entire step-by-step treatment, from the planning stage to the involution of the disease.

Patient M.L.S., male, ASA I, 27 years old, pardo, attended the clinic school of the Faculdade Adventista da Bahia with a main complaint of mobility in the previous teeth (Figure 1 and 2). Routine periodontal examinations were performed, resulting in the diagnosis of stage IV, grade C periodontitis, with the following indications: 9 mm of loss of interproximal insertion at the worst site, 33% of bleeding rate at probing, degree II mobility in elements 11, 21 and 22; radiographic bone loss extending to half or to the apical third of several elements (Figure 3 and 4); the degree of progression of periodontal disease was verified from the evaluation of a panoramic radiography of day 06/15/2016 (Figure 5) and another of day 10/10/2019 (Figure 6), provided by the patient himself.

Figure 1 - Front and Side Views



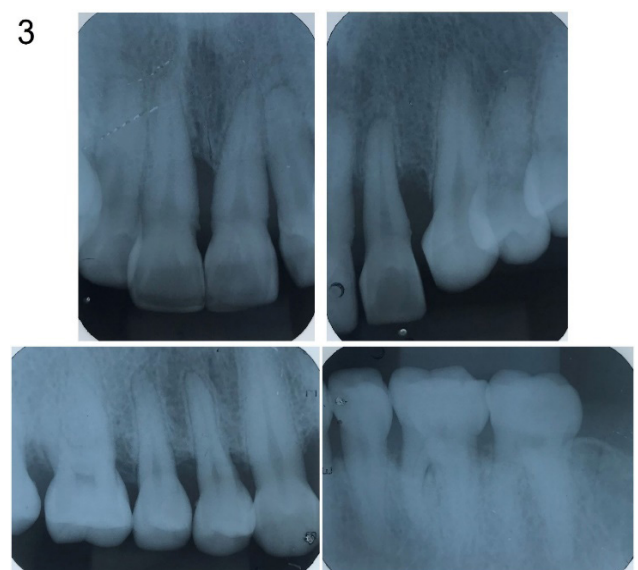
Source: The authors.

Figure 2 - Occlusal view



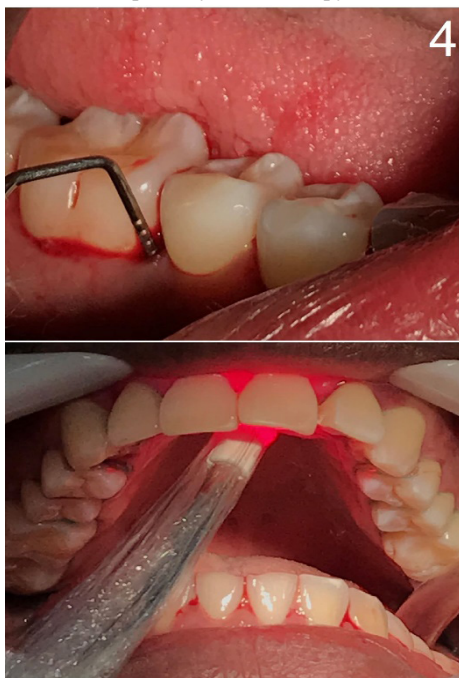
Source: The authors.

Figure 3 - Periapical radiographs of the worst sites to be probed



Source: The authors.

Figure 4 - Probing of sites, followed by antimicrobial photodynamic therapy



Source: The authors.

Figure 5 - Panoramic X-ray of the year 2016



Source: The authors.

Figure 6 - Panoramic X-ray of the year 2019



Source: The authors.

The proposed approach was to carry out the appropriate oral hygiene guidelines and motivational interview, followed by PDT before and after the treatment of scraping and root straightening, as well as oral antibiotic therapy for a period of 7 days thereafter. Supra and subgingival debridement of all sextants was performed under local anesthesia with manual periodontal curettes (Millennium – Golgran; São Caetano do Sul, Brazil). The amount of biofilm and visible calculations

(8%) during scraping were disproportionate to the severity of the installed disease.

It was then followed for the application of PDT, in which the irrigation of the pockets was performed with the methylene blue photosensitizing agent 0.01% (Chimiolux; DMC, São Carlos, Brazil), and after 5 minutes (pre-irradiation time) two points were irradiated per tooth, one by vestibular and the other by palatine/lingual, totaling 56 irradiation points. For this, low power laser (DMC Equipamentos, São Carlos, Brazil) was used in the red light spectrum (660nm) for 90'' (power density 9J; fluence 320 J/cm²) (Figure 4). Then, the root scraping and straightening procedure was performed and a new application of the PDT, with the same protocol mentioned above. After the end of the procedure, it was opted for the prescription of amoxicillin 500mg + metronidazole 400mg every 8h for the period of 7 days, with the aim of obtaining a better control of the periodontal pathological microbiota.

Over 90 days, no intervention was performed, and only then did the patient return to periodontal dental reassessment. Significant regression of periodontal disease activity (6% bleeding rate at probing), severe reduction of depth at probing (3 mm at worst), in other words, a better recovery of tissues irradiated with low power laser was observed. No mobility was identified in any element, the patient's main complaint at the beginning of treatment.

At the end of the consultation, the patient received the reinforcement regarding the oral hygiene recommendations appropriate to his case and then was discharged. The same was instructed to return in three months for a re-evaluation and follow-up of his clinical condition. However, the patient did not return to a new radiographic evaluation within the suggested period, only after a little more than one year (12/12/2020) was possible to perform the radiographic control measurement (Figure 7).

Figure 7 - Panoramic X-ray of the year 2022



Source: The authors.

2.1 Discussion

The objective of this study was to report a clinical case of a young patient with periodontitis stage IV and grade C, focusing on the diagnosis, clinical characteristics and the therapy performed.

It is noted that despite the improved efficacy of the latest

antimicrobial treatments, the reinfection of the periodontal sites already treated is always a possibility. In addition, it is difficult to evaluate long-term periodontal therapy response, which makes the prognosis of periodontitis uncertain and highlights the need for frequent monitoring of the patient's periodontal health with close clinical and, in some cases, microbiological monitoring^{9,10}.

Sigush et al.¹¹ conducted a study to evaluate the efficacy of PDT therapy in association with DTB in the eradication of *fusobacterium nucleatum*. Patients received DTB with a photosensitive solution (phenothiazine chloride) that was activated by a diode laser, λ 660 nm (red) with power density of 60 mW/cm² (test group) or DTB with inactivated photosensitive solution (control group). Three months after the treatment, the patients in the test group showed a greater reduction in probing depth, better clinical adherence and a significant reduction in *fusobacterium nucleatum* load.

The hypothetical benefit of adding antibiotics to the DTB protocol has been the subject of several studies. Cionca et al.¹² investigated the addition of Amoxicillin (Amox) and Metronidazole (MTZ) to the DTB protocol using a regimen of 375 mg Amox and 500 mg MTZ three times a day, for a period of 7 days. At 6 months, the authors observed a greater reduction in the depth of the pockets with higher probing levels in the test group when compared to those in the control group. In addition, the test group presented a reduced number of residual pockets with more than 4 mm deep than the control group, and demonstrated a significantly reduced need for complementary surgical treatment. In terms of microbiological effect, the authors observed the elimination of *Aggregatibacter actinomycetemcomitans* in the test group, but not in the control group, 3 months after treatment. In addition, lower levels of *Porphyromonas gingivalis* and *Tannerella forsythia* were observed in the test group than in the control group. However, these results were not confirmed after 6 months of treatment¹³.

In agreement, Varela et al.¹⁴ reported that at 3 months, additional clinical benefit was observed in the treatment of aggressive periodontitis with the addition of Amox and MTZ to the DTB protocol (500 mg amoxicillin + 250 mg metronidazole, three times a day for a period of 10 days). However, according to a similar study by Aimetti et al.¹⁵ the microbiological effects of the addition of Amox and MTZ remained for up to 6 months. It is important to note that these studies used the association of these systemic antibiotics because of their promising results in periodontal treatment¹⁶. It is believed that the combination between Amox and MTZ results in a synergistic bactericidal effect that, in turn, reduces the time and dosage level necessary to achieve an optimal effect, in addition to minimizing the toxicity of both drugs¹⁷. For this reason it was also one of the therapeutic choices in the present clinical case.

In view of the non-definition of a standardized protocol for DTB, in addition to the possible clinical differences

among the patient profiles, it is inevitable that there are limitations regarding the realization of comparisons among studies involving the proposed methodology. It is known that periodontal disease involves both clinical and microbiological aspects. Perhaps the ideal is that, in all cases, an individual microbiological evaluation be carried out in order to establish the levels of bacterial contamination, however this practice is still a challenge in the Dentistry routine. Even so, the patient's remarkable clinical improvement, in the present case, suggests that this may become a suitable protocol for use in the routine of the dental surgeon.

3 Conclusion

In the present clinical case, the association of antimicrobial photodynamic therapy with the treatment of total disinfection of the mouth, concomitant with systemic antibiotic therapy, resulted in a significant regression of periodontal disease activity, severe reduction of depth at probing and termination of tooth mobility. Therefore, the association in question, when well planned and executed, can result in the improvement of the patients' condition with advanced periodontal disease. Therefore, we encourage further research in the area in order to obtain a better proof of its effectiveness.

References

1. Berezow AB, Darveau RP. Microbial shift and periodontitis. *Periodontol* 2000 2011;55(1):36-47. doi: 10.1111/j.1600-0757.2010.00350.x
2. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. *J Clin Periodontol* 2018;45(20):149-61. doi: 10.1111/jcpe.12945
3. Quirynen M, Bollen CML, Vandekerckhove BNA, Dekeyser C, Papaioannou W, Eysen H. Full- vs. partial-mouth disinfection in the treatment of periodontal infections: short-term clinical and microbiological observations. *J Dent Res* 1995;74(8):1459-67. doi: 10.1177/00220345950740080501
4. Ren C, McGrath C, Jin L, Zhang C, Yang Y. The effectiveness of low-level laser therapy as an adjunct to non-surgical periodontal treatment: a meta-analysis. *J Periodont Res* 2016;52(1):1-13. doi: 10.1111/jre.12361
5. Azaripour A, Dittrich S, Noorden CJF, Willershausen B. Efficacy of photodynamic therapy as adjunct treatment of chronic periodontitis: a systematic review and meta-analysis. *J Lasers Med Sci* 2018;33(2):407-23. doi: 10.1007/s10103-017-2383-
6. Ahad A, Lamba AK, Faraz F, Tandon S, Chawla K, Yadav N. Effect of Antimicrobial photodynamic therapy as an adjunct to nonsurgical treatment of deep periodontal pockets: a clinical study. *J Lasers Med Sci* 2016;7(4):220-6. doi: 10.15171/jlms.2016.39
7. Abduljabbar T, Fahim V, Fawad J, Zohaib A. Antimicrobial photodynamic therapy adjuvant to non-surgical periodontal therapy in patients with diabetes mellitus: a meta-analysis. *Photodiagnosis Photodyn Ther* 2017;17:138-46. doi: 10.1016/j.pdpdt.2016.11.008
8. Cobb CM, Blue MS, Beaini NE, Umaki MR, Satheesh KM. Diode laser offers minimal benefit for periodontal therapy.

Compend Contin Educ Dent 2012;33(4):e67-e73.

9. Slots J. Primer for antimicrobial periodontal therapy. *J Periodontol Res* 2000;35(2):108-14. doi: 10.1034/j.1600-0765.2000.035002108.x
10. Jorgensen MG, Slots J. Responsible use of antimicrobials in periodontics. *Calif Dent Assoc J* 2000;28:185-93. PMID: 11326532.
11. Sigusch BW, Engelbrecht M, Völpel A, Holletschke A, Pfister W, Schütze J. Full-mouth antimicrobial photodynamic therapy in *Fusobacterium nucleatum*-infected periodontitis patients. *J Periodontol* 2010;81(7):975-81. doi: 10.1902/jop.2010.090246.
12. Cionca N, Giannopoulou C, Ugolotti G, Mombelli A. Amoxicillin and metronidazole as an adjunct to full-mouth scaling and root planing of chronic periodontitis. *J Periodontol* 2009;80(3):364-71. doi: 10.1902/jop.2009.080540.
13. Cionca N, Giannopoulou C, Ugolotti G, Mombelli A. Microbiologic testing and outcomes of full-mouth scaling and root planing with or without amoxicillin/metronidazole in chronic periodontitis. *J Periodontol* 2010; 81(1):15-23. doi: 10.1902/jop.2009.090390.
14. Varela VM, Heller D, Silva-Senem MX, Torres MCMB, Colombo APV, Feres-Filho EJ. Systemic antimicrobials adjunctive to a repeated mechanical and antiseptic therapy for aggressive periodontitis: A 6-month randomized controlled trial. *J Periodontol* 2011;82(8):1121-30. doi: 10.1902/jop.2011.100656.
15. Aimetti M, Romano F, Guzzi N, Carnevale G. One-stage full-mouth disinfection as a therapeutic approach for generalized aggressive periodontitis. *J Periodontol* 2011;82(6):845-53. doi: 10.1902/jop.2010.100468.
16. Feres M. Antibiotics in the treatment of periodontal diseases: microbiological basis and clinical applications. *Ann R Australas Coll Dent Surg* 2008;19:37-44. PMID: 19728628
17. Pavicić MJ, van Winkelhoff AJ, de Graaff J. Synergistic effects between amoxicillin, metronidazole, and the hydroxymetabolite of metronidazole against *Actinobacillus actinomycetemcomitans*. *Antimicrob Agents Chemother* 1991;35:961-6. doi: 10.1128/AAC.35.5.961