

# Use of photodynamic therapy as an adjuvant to periodontal treatment in patients with Down syndrome – case report

*Uso da terapia fotodinâmica como coadjuvante ao tratamento periodontal no paciente com síndrome de Down – relato de caso*

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## Abstract

Periodontitis is an inflammatory disease induced by bacteria in plaque biofilm on the surface subgingival. The inflammation leads to pocket formation in the gingival tissue, attachment loss, bone destruction and ultimately possible tooth loss. The prevalence of periodontal disease in adolescents with Down syndrome (DS) is 30% to 40%, and individuals in the next 30-40 years the percentage is about 100%. Authors suggest that periodontal disease in DS is consistent with the pattern of aggressive periodontitis, and is correlated with changes in the immune system of the same. In view of these changes, many researchers seek methods to supporting basic periodontal therapy such as combination with antibiotics, but their indiscriminate use can lead to resistant bacteria strains. Photodynamic therapy, a combination of photosensitizing agent or dye to a light source, and has been extensively studied with promising results. The present report deals with photodynamic therapy in the treatment of periodontal disease in an individual with Down syndrome.

**Descriptors:** Down syndrome; Periodontitis; Photochemotherapy

## Resumo

A periodontite é uma doença inflamatória induzida por bactérias do biofilme da placa bacteriana localizadas na superfície subgingival. A inflamação conduz a formação de bolsa no tecido gengival, perda de inserção, destruição óssea e ultimamente uma possível perda dentária. A prevalência de doença periodontal em adolescentes com síndrome de Down (SD) é de 30% a 40%, sendo que em indivíduos próximos aos 30 ao 40 anos a porcentagem é de cerca de 100%. Autores sugerem que a doença periodontal na SD é compatível com o padrão de periodontite agressiva, e tem relação com as alterações no sistema imunes dos mesmos. Em vista destas alterações, muitos pesquisadores buscam métodos coadjuvantes à terapia periodontal básica, como associação com antibióticos, porém seu uso indiscriminado pode levar à resistência das cepas bacterianas. A terapia fotodinâmica, associação agente fotossensibilizador a uma fonte de luz, vem sendo muito estudado e com resultados promissores. O presente relato aborda a terapia fotodinâmica no tratamento da doença periodontal em um indivíduo com síndrome de Down.

**Descritores:** Síndrome de Down; Periodontite, Fotoquimioterapia

## Introduction

Periodontitis is a common disease with a prevalence of 5 to 30% in the adult population. It is an inflammation of periodontal tissues caused by bacterial infection that results in the destruction of periodontal tissue and alveolar bone reabsorption. In Down syndrome, trisomy greater impact on humanity, the prevalence of periodontal disease in the 2<sup>nd</sup> decade of life is 30% to 40%, and in individuals above the third decade of life, this percentage rises to about 100%, and its involvement occurs early and more aggressive when compared with patients without the syndrome<sup>1-6</sup>.

Sakellaris *et al.*<sup>5</sup> (2001) reported that periodontal treatment followed by conventional oral hygiene instruction showed not get satisfactory result, without affecting the subgingival microbiota of these individuals is significant and also not eliminating the pathogen involved, which may be attributed to inadequate removal plaque and also the failure of the defense mechanisms of patients.

Can observe changes in the host response in impaired chemotaxis of neutrophils and monocytes, together with the reduced number of mature T lymphocytes that these individuals have, and these characteristics may contribute to disease progression. The defective chemotaxis of neutrophils is correlated with greater loss of alveolar bone<sup>7-9</sup>.

Even as contributing factors to periodontal disease in DS, we can mention the overexpression of superoxide dismutase 1 (SOD 1), where the enzyme levels are elevated about 50% to 150%, acting in polymorphonuclear (PMN) with drastic reduction of superoxide,

decreasing the ability of these cells to act against microorganisms that require strictly superoxide to be destroyed<sup>10-11</sup>.

The procedure of scaling and root planing is the usual treatment of periodontitis in these cases, either chronic or aggressive. But when you do not get a favorable clinical response, means choosing an antibiotic therapy or surgical intervention<sup>11</sup>.

Photodynamic therapy (PDT – PhotoDynamic Therapy) is the combination of a photosensitive agent to a particular light source, in order to achieve microbial reduction. The potential of photodynamic therapy to oral bacteria began to be investigated in the 90's when Dobson and Wilson analyzed the bacterial reduction of *S. sanguis*, *A. actinomycetemcomitans*, *F. nucleatum* and *P. gingivalis*<sup>12-14</sup>.

Wilson and Henderson<sup>13</sup> (1995) studied bacterial plates obtained from ten volunteers. Dyes were used as the AOT and ftalocianina disulfonic aluminum, combined with the irradiation of a laser and a He-Ne laser AsGaAl respectively. The results showed a large reduction of anaerobic bacteria and the *Streptococcus* and *Actinomyces viable*. The combination of He-Ne and AOT was more efficient than the combination AsGaAl ftalocianina and using energy of 1.31 J.

Almeida *et al.*<sup>15</sup> (2007) evaluated histologically and radiographically the effects of photodynamic therapy on the progression of periodontal disease induced in mice. Dye was used as the AM (100 | Lig/mL) and irradiated with a laser ( $\lambda = 685\text{nm}$  and  $P = 0.05\text{ W}$ ) for a duration of 120s. The X-rays showed less bone loss in the PDT group compared with the control group on days 5 and 15. In the 30 days after treatment no differences were observed between



Figure 1. Front image of the face of the patient



Figure 2. Occlusion of the patient, showing the buccal aspect of the foregoing and with greater accumulation of plaque and swollen gums



Figure 3. Photography of the lower teeth with occlusal buildup of plaque and swollen gums



Figure 4. Panoramic radiography

groups. Histological examination on day 15 there were significant differences in the extent of the inflammatory reaction of gingival tissue, demonstrating that PDT reduces the destruction of periodontal tissues.

Photodynamic therapy evidence as an alternative treatment because it is characterized by a set of physical, chemical and biological agents, assuming that the interaction of light of appropriate wavelength, with a non-toxic compound (photosensitizer) previously applied or activated cell in the body with oxygen, resulting in reactive chemical species able to induce death cellular<sup>16-17</sup>. We can cite as the main advantages of this therapy to its low cost, absence or minimal presence of side effects, low toxicity and absence of the photosensitizer, and reduce the likelihood of recurrence of these infections<sup>3,18</sup>.

### Case report

Patient 17 years old, female, Caucasian, with a medical diagnosis of SD (Figure 1), confirmed by karyotype. Presented in the Program UNIP (University Paulista), Center for Studies and Care of Special Patients, seeking dental treatment. In the interview reported complaints of pain and bleeding gums, with difficulty in feeding, and unpleasant odors and taste in the mouth. In medical history, surgical correction is reported to have suffered from heart disease in childhood and currently has with hypothyroidism. The clinical examination (Figures 2 and 3) it was noted the upper and lower anterior crowding, a high index card (100%) and gingival bleeding (80%), high levels of probing depth, diagnosed as localized

aggressive periodontitis, confirmed also by panoramic radiograph (Figure 4). Salivary tests were performed, as the measurement of salivary flow, which was harvested so stimulated by Dentobuff® Kit, featuring 0.2 ml / min, showing a low salivary flow and xerostomia, and present a salivary pH of 6.7 and high buffer capacity (7.0). For counting and detection of *Streptococcus mutans* test was used salivary bacterial Dentalcult® type I (Laborclin®, Parana, Brazil), identifying 10-5 CFU / ml, contributing to a high risk for tooth decay. It was established following the protocol of adjuvant photodynamic therapy basic.

1. Mechanical periodontal debridement in one session.
2. Application of dye photosensitizer (methylene blue 0.01%) with a syringe in periodontal pockets, for 5 minutes (time of dye penetration) (Figure 5).
3. Irradiation with GaAlAs laser diode (Practical Laser Red®, Kondortech, 660 nm, 40 mW power, application specific, irradiation time of 80 seconds per point (Figure 6), with a total energy density of 4J/cm<sup>2</sup>.
4. Application on all grants by one point and another in the buccal lingual.
5. Wash abundantly with saline until the total removal of the dye (Figure 7) and instruction in oral hygiene and diet.

The patient was evaluated at 6, 10 and 15 days (Figure 8), presented a significant reduction of swelling, pain and bleeding, and change to pink color of course compatible with effective responses to the treatment recommended. In probing depth was noted an average gain of  $\pm 2$  mm insertion and clinically it was observed better tissue repair.



Figure 5. Application of the dye with a syringe in periodontal pockets after scaling and root planing



Figure 6. Low-power laser irradiation punctual

## Discussion

The patient reported presented with periodontal disease, as many studies on Down's syndrome, which reported an association with periodontal disease of the large percentage patients<sup>8,11</sup>.

The standard treatment of periodontal disease basically consists of scraping, root planing and oral hygiene orientation in the basic therapy. In some cases where no one gets control of the disease, you can choose to control by chemical means, such as chlorhexidine<sup>19-21</sup> or even advocate the use of antibiotics such as metronidazole in combination with amoxicillin<sup>18,20-21</sup>. Although enshrined in the literature, these methods were discarded in this study because patients with Down syndrome typically make use of other systemic drugs, thus avoiding drug interactions and relieving the patient of side effects.

Photodynamic therapy consists of an agent to associate a photosensitive light source, obtaining microbial reduction and reduction in clinical signs of inflammation: swelling, pain, heat, tumor<sup>8,15,22-23</sup>. Jose<sup>23</sup> (2010) in an *in vivo* study with rats with periodontal disease, noted that the means is photodynamic therapy reduced the levels of *Porphyromonas gingivalis* in the control group without therapy.

The combination of conventional periodontal treatment and photodynamic therapy, shows very satisfactory when seeking instant results on the disease<sup>6,14,16,24-26</sup>. Justifying the treatment of choice for the case, since the patient and parents reported pain, swelling and halitosis. These factors were observed in this report, influencing the quality of life of patients who reported improvement in power. Oliveira *et al.*<sup>24</sup> (2007), in one study showed that both conventional therapy combined with photodynamic therapy, and only periodontal therapy proved effective in the treatment of aggressive



Figure 7. Immediate post-operative



Figure 8. Post-operative after 15 days of treatment, with marked reduction of plaque, calculus and gingival swelling

periodontitis. But when it comes to short-term treatment, other authors have reported significant differences in the extent of the inflammatory reaction of gingival tissue with photodynamic therapy by reducing periodontal tissue destruction<sup>1</sup>. Agreeing with the findings of this report, showing the efficacy of photodynamic therapy in Down syndrome.

## Conclusion

The use of photodynamic therapy with methylene blue dye 0.01% proved to be an effective adjuvant in periodontal therapy with manual debridement, accelerating the process of tissue regeneration, decontamination, reduction of pain and significant improvement of parameters of periodontal health in Down syndrome. It is important to the knowledge of dentists on new therapies that reduce the use of systemic medications and their adverse effects on dentistry for patients with special needs.

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