Management Of Periodontitis In Patients With Down Syndrome Using Low Energy Diode Laser

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Management Of Periodontitis In Patients With Down Syndrome Using Low Energy Diode Laser

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Abstract

**Background:** Patients with Down syndrome develop extensive gingivitis at an earlier stage and exhibit rapid and generalized periodontal breakdown in early adulthood. This study aims at finding out the effect of low level laser therapy on the clinical and microbiological parameters in Down syndrome patients with periodontitis. **Methods:** Thirty five patients with Down’s syndrome suffering from periodontitis were included in the study and divided into two groups: Group I: Included 25 patients in which laser was applied to one half of the mouth and the other half was considered as a control. Group II: Included 10 patients as control group to evaluate the systemic effect of laser. **Results:** After 2 weeks of therapy there was significant improvement in both clinical and microbiological parameters in both sides of the mouth. After 6 weeks; these parameters were still significantly better in the right side where scaling and root planning were done plus low level laser therapy. **Conclusion:** Low level laser therapy accompanied with scaling and root planning is an effective periodontal treatment in patients with Down syndrome and its effect remains significant up to 6 weeks after therapy.

Introduction

Down syndrome (DS) is a genetic disease resulting from a trisomy in the twenty-first chromosome affecting from 1 in 600 to 1 in 1,000 live births, and is characterized by generalized growth and mental deficiencies. [1] Patients with Down syndrome develop more extensive gingivitis at an earlier stage, and exhibit rapid and generalized periodontal breakdown in early adulthood. Approximately 35% of adolescents with Down syndrome exhibited early signs of alveolar bone loss. This bias in DS is thought to be due to such factors as immunological deficiency, poor oral hygiene, fragile periodontal tissue and poor masticatory function. Furthermore, a higher prevalence of periodontal pathogen Actinobacillus actinomycetemcomitans (A.a) in subgingival plaque compared to normal.[2,3] This study aims at finding out the effect of low level laser therapy (LLLT) on the clinical and microbiological parameters in Down syndrome patients with periodontitis. This study was conducted in the Orodental Genetic Department, National Research Center, Cairo, Egypt.

Thirty five patients previously diagnosed as having Down syndrome (fig 1,a) suffering from periodontitis were included. Their ages ranged between 12 – 19 years. They were divided into two groups: Group I: Included 25 patients in which laser was applied to one half of the mouth and the other half was considered as a control. Group II: Included 10 patients as control group in which basic periodontal treatment was applied. Control group was included in the study to avoid the systemic effect of LLLT on the none laser side that may alter the results.

Diagnosis of periodontitis as evidenced by clinical examination with periodontal pocket depth more than 4mm (fig 1,b). The participants have no ongoing general disease and had neither previous periodontal treatment during the last 6 months and anti-microbial drugs during the last 3 months nor received laser treatment before.

Methods

I. **Periodontal examination:** The clinical parameters were included: plaque index [4], gingival index [5,6] and pocket depth [7].

II. Periodontal treatment: Initially the two groups received standard periodontal treatment including scaling and root planning (SRP) for all the mouth. Then the split mouth design was performed for group (I) only: The right side of the mouth was subjected to application of low level laser therapy accompanying the previously done standard periodontal treatment (SRP + LAS). The left side of the mouth was left to the previously done standard periodontal treatment without laser application (SRP).

Laser parameters:

A Soft Laser SL-202 (PETROLASER, Pr. Stachen, Saint-Petersburg, 198097, Russia) was used for Laser therapy with 870 nm wave length. It was used in a continuous contact modulated mode with 30 mw power setting and K30 tip type that has 0.03cm irradiance surface area (supplied with the machine).
The power density of laser irradiation = 498 mw/cm² (it depends upon the laser output power in mw and the fiber tip type (tip losds coefficient), the energy density of laser irradiation =10J/cm² (fig 1,c).

**Laser technique:**
The tip end was directed to the pocket probing depth parallel to the long axis of root surface aiming at the diseased soft tissues lining of the pockets and moved all around the tooth (fig 1,d). The tip moved from the apical point to the top of the pocket making overlapping horizontal and vertical movements maintaining slight contact with soft tissues at all times. Every laser application was performed for 40 seconds. This procedure repeated three times with 20 minutes intervals in between each application.[8,9]

**Bacterial sampling and analysis:**
Four subgingival plaque samples were obtained from each subject at the mesial surfaces of the first molars. A paper point was inserted in each pre-selected periodontal pocket for 10 seconds. Samples were collected from the same sites at baseline, at 2 weeks, 6 weeks and 12 weeks post therapy. Identification and quantification of *Actinobacillus actinomycetemconcomitans* and *Prophromonas gingivalis* (P.g.) and total bacterial load were evaluated using real-time PCR technique (ABI7300 sequence detection system ) (Applied biosystem Foster city,CA,USA)9 then isolation and purification of bacterial DNA from plaque samples using QIAamp DNA Mini Kit supplied by Qiagen (Germany)

**Statistical analysis:**
Paired student’s t-test was done to compare between the two halves of the mouth regarding the continuous variables. One way analysis of variance was done to compare between the controls and the two halves of the mouth. P < 0.05 was considered significant. SPSS/PC program version 10.05 was used.

## Results

The right side of the mouth which received scaling and root planning plus laser therapy (SRP+LAS), at the different follow up periods showed that plaque index decreased significantly after 2 weeks and after 6 weeks while, gingival index and mean pocket depth decreased significantly after 2, 6 and 12 weeks in relation to the baseline score. Left side of the mouth at the different follow up periods showed that plaque index, gingival index and pocket depth, decreased significantly after 2 weeks only (Table 1). Both left side and control group showed significant difference compared with right side of the mouth after 6 and 12 weeks regarding gingival index and pocket depth, while plaque index showed no significant difference (Table 2).

**Microbiological evaluation:**
The bacterial counts of A.a. and P.g. were significantly lower than that of the baseline of both sides of the mouth after 2 weeks. This significant difference continued in the right side only after 6 weeks. After 12 weeks, the bacterial count of both sides became not significantly different from that of the baseline (Table 3). There was no significant difference between the left side of the mouth and controls regarding the quantitative analysis of A.a. and P.g. Gingivalitis at the different follow up periods.

## Discussion

Down syndrome patients need more dental care. They have a higher susceptibility to periodontal disease due to atypical patterns of T-cell immunodeficiency together with functional defects of polymorphonuclear leukocytes and monocytes.[10] Progression of periodontal disease is marked by occasional acute symptoms (infection, inflammation, pain) followed by chronic progression of disease leads to early tooth loss.[11,12] 40 to 50% Down syndrome patients are born with some type of cardiac abnormality, mainly Mitral valve prolapse which predispose them to subacute and acute bacterial endocarditis.[13,14] A reduced muscle tone in Down syndrome causes less efficient chewing and natural cleansing of the teeth.[15]

This study was conducted to evaluate the antibacterial effectiveness of an 870-nm diode laser on periodontitis in patients with Down syndrome. Morritz et al, 1998 reported considerable bacterial elimination from periodontal pockets using irradiation with an 810-nm diode laser with 2.5 W power settings in pulsed mode (50 Hz, pulse duration 10 ms) following scaling as compared to scaling alone.[16]

The selection of this low level laser therapy and the parameters used in this study seem to have been within the “therapeutic window” of dosage but not necessarily optimal. Many studies have failed to find this window, especially in studies performed in the 1980s and early 1990s.[17]

The results of the present study denote that the impact of laser therapy in combination to scaling and root planning extended till the 6th week of therapy while Qadri et al ,2005 found that the effect of laser therapy on normal patients extended up to the 12th week [8]. This difference could be attributed to the higher energy power of the used laser system in their work (980 nm...
diode laser) and could be attributed also to altered tissue response in Down syndrome and relative inaccessibility of dental work to such patients. The results of the control group at the different follow up periods showed that the systemic effect of laser in the present study was not apparent on the contrary of that suggested by Rochkind et al., 1989.[18] As shown in the present study and study done by Pesevska et al, 2008 SRP+LAS was the most effective treatment modality.[19] Our protocol kept the levels of all bacterial species at low level up to 6 weeks after therapy. The most favorable bacterial reduction was achieved 2 weeks post-therapy for the bacterial species tested, although these still significantly reduced at 6 weeks when compared to pretreatment levels. This favorable effect might be due to the ability of laser irradiation to eliminate bacteria in the dentine tubules where they can act as a "reservoir" for recolonization and re-infection of the pocket. While SRP is the most commonly used periodontal therapy for the cause-related phase of treatment, there are limitations, including the inability to adequately instrument deep periodontal pockets and furcations as well as remove microorganisms within the tissues lining the periodontal pocket.[20-22]

Conclusion(s)

Laser therapy accompanied with scaling and root planning is effective periodontal treatment in patients with Down syndrome regarding clinical and microbiological parameters. This effect could be significant up to 6 weeks after therapy.

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List of abbreviations

DS - Down syndrome
LLLT- Low level laser therapy
SRP- Scaling and root planning
LAS-Laser therapy
A.a. - Actinobacillus actinomycetemcomitans
P.g.-Prophromonas gingivalis

Figures legends

1 (a) A case of Down syndrome.
1 (b) Measuring pocket depth.
1 (c) Soft laser machine.
1 (d) Laser tip application.

References


Illustrations

Illustration 1

Table 1: Periodontal examination of the right side (SRP + LAS) and left side (SRP alone) of the mouth at the different follow up periods:

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>2 weeks</th>
<th>6 weeks</th>
<th>12 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td><strong>Right side (SRP)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plaque Index</td>
<td>2.8 ± 0.2</td>
<td>2.0 ± 0.2*</td>
<td>2.4 ± 0.2*</td>
<td>2.7 ± 0.2**</td>
</tr>
<tr>
<td>Gingival Index</td>
<td>2.6 ± 0.35</td>
<td>1.8 ± 0.3*</td>
<td>2.1 ± 0.15*</td>
<td>2.3 ± 0.2*</td>
</tr>
<tr>
<td>Pocket depth</td>
<td>3.9 ± 2.1</td>
<td>2.3 ± 1.4*</td>
<td>2.9 ± 1.7*</td>
<td>3.3 ± 1.9*</td>
</tr>
<tr>
<td><strong>Left side (SRP)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plaque Index</td>
<td>2.9 ± 0.1</td>
<td>2.1 ± 0.3*</td>
<td>2.7 ± 0.2**</td>
<td>2.8 ± 0.1**</td>
</tr>
<tr>
<td>Gingival Index</td>
<td>2.7 ± 0.27</td>
<td>2.0 ± 0.3*</td>
<td>2.5 ± 0.25**</td>
<td>2.8 ± 0.2**</td>
</tr>
<tr>
<td>Pocket depth</td>
<td>4.0 ± 2.2</td>
<td>2.6 ± 1.4*</td>
<td>3.8 ± 1.7**</td>
<td>3.9 ± 2.1**</td>
</tr>
</tbody>
</table>

* $P < 0.05$ (significant difference) in comparison to baseline value.

** $P > 0.05$ (non significant difference) in comparison to baseline.
Table 2: Periodontal examination of the 3 groups at the different follow up periods:

<table>
<thead>
<tr>
<th></th>
<th>Right side (SRP + LAS)</th>
<th>Left Side (SRP)</th>
<th>Controls</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plaque Index (2 weeks)</td>
<td>2.0 ± 0.2</td>
<td>2.1 ± 0.3</td>
<td>2.2 ± 0.2</td>
<td></td>
</tr>
<tr>
<td>Plaque Index (6 weeks)</td>
<td>2.4 ± 0.2</td>
<td>2.7 ± 0.2**</td>
<td>2.6 ± 0.2**</td>
<td></td>
</tr>
<tr>
<td>Plaque Index (12 weeks)</td>
<td>2.7 ± 0.2</td>
<td>2.8 ± 0.1**</td>
<td>2.9 ± 0.1**</td>
<td></td>
</tr>
<tr>
<td>Gingival Index (2 weeks)</td>
<td>1.8 ± 0.3</td>
<td>2.0 ± 0.3</td>
<td>2.2 ± 0.3</td>
<td></td>
</tr>
<tr>
<td>Gingival Index (6 weeks)</td>
<td>2.1 ± 0.15</td>
<td>2.5 ± 0.25*</td>
<td>2.6 ± 0.25*</td>
<td></td>
</tr>
<tr>
<td>Gingival Index (12 weeks)</td>
<td>2.3 ± 0.2</td>
<td>2.8 ± 0.2*</td>
<td>2.7 ± 0.2*</td>
<td></td>
</tr>
<tr>
<td>Pocket depth (2 weeks)</td>
<td>2.3 ± 1.4</td>
<td>2.6 ± 1.4</td>
<td>2.7 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>Pocket depth (6 weeks)</td>
<td>2.9 ± 1.7</td>
<td>3.8 ± 1.7*</td>
<td>3.6 ± 1.6*</td>
<td></td>
</tr>
</tbody>
</table>

* P < 0.05 (significant difference) in comparison to the right side of the mouth.
** P > 0.05 (non significant difference) in comparison to the right side of the mouth.
Table 3: Quantitative results of Actinobacillus actinomycetemconcomitans (A.a.) and Prophromonas gingivalis (P.g.) of the two sides of the mouth:

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>2 weeks</th>
<th>6 weeks</th>
<th>12 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LS.</td>
<td>RS.</td>
<td>LS.</td>
<td>RS.</td>
</tr>
<tr>
<td>A.a.</td>
<td>3.11 ± 0.40</td>
<td>2.23 ± 0.31*</td>
<td>1.77 ± 0.37**</td>
<td>3.08 ± 0.40**</td>
</tr>
<tr>
<td>P.g.</td>
<td>2.51 ± 0.40</td>
<td>2.00 ± 0.35*</td>
<td>1.48 ± 0.30*</td>
<td>2.23 ± 0.37**</td>
</tr>
</tbody>
</table>

* P < 0.05 (significant difference) in comparison to baseline value.
** P > 0.05 (non significant difference) in comparison to baseline.
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