**Introduction**

Aggressive periodontitis encompasses a group of rare forms of periodontitis, often severe, characterised by rapid progression with frequent clinical manifestations at an early age and a typical tendency toward familiar aggregation [Lang et al, 1999] and, especially in the localised form, involves central incisors and first permanent molars in the pubertal age [Lopez and Baelum, 2003].

The entity of clinical attachment loss varies, but it usually reaches values \( \geq 4 \) mm, while the gingival tissues surrounding the teeth may have both the color and consistency of the normal gingiva [Oliveira et al., 2007; Picolos et al., 2005].

The objective of the periodontal disease therapy is resolution of the inflammatory process with restoration of gingival anatomy as close as possible to the normal physiological conditions. These results are achieved by restoring the epithelial and connective attachment, and with the removal of the pathogenic species responsible for the disease from the radicular surface.

[Passanezi et al., 2007; Sanchez-Perez et al., 2006].

An early intervention will be effective in preventing loss of attachment and subsequently bone loss. In order to achieve this goal the complete removal of adherent plaque, calculus and the outer layers of infiltrated cement is required, because penetration of bacteria and toxins on these surfaces is able to cause changes in the cement [Aleo et al., 1974; Kamma et al., 2004; Maeda et al., 2005].

The treatment most often employed for bone defects larger than 5 mm is scaling and root planing through gingival flap surgery; the procedure is generally performed under antibiotic prophylaxis with the combined systemic administration of amoxicillin and metronidazole. However this technique demands considerable operator’s skills and sometimes, in spite of this, the anatomy of the roots may prevent one from obtaining an effective clinical success [Bimstein et al., 2004; Dekker, 2007; Hilgers et al., 2004].

The treatment most often employed for bone defects larger than 5 mm is scaling and root planing through gingival flap surgery; the procedure is generally performed under antibiotic prophylaxis with the combined systemic administration of amoxicillin and metronidazole. However this technique demands considerable operator’s skills and sometimes, in spite of this, the anatomy of the roots may prevent one from obtaining an effective clinical success [Bimstein et al., 2004; Dekker, 2007; Hilgers et al., 2004].

Therefore, in the continuous research effort toward more effective procedures and equipments, the laser’s application is currently under evaluation for its ability to sterilise the pockets, detoxify the surface of the root, and ease of use.

The lasers most commonly used are the CO2 types and the Nd:YAG laser (neodymium:yttrium aluminum...
garnet) [Radar et al., 1996].

The latter has two important advantages: release of minimum pulse energy, providing an excellent haemostasis of the operative field, and the possibility of using optical fibers, which have optimal application in soft tissue surgery [Myers, 1991].

The development of lasers with short duration impulses has shown a drastic decrease in the amount of generated heat; pulsed lasers also limit side effects in the surrounding tissues.

Nd:YAG laser can be operated in continuous wave and pulsed mode. The currently accepted frequency values are above 10 Hz with maximum output energy of 150 mJ, to avoid excessive temperature rise and secondary heat damage [Midda, 1991].

Furthermore, the use of a wavelength of 1064 nm (near-infrared spectra) allows light beam transmission through flexible optical fibers in the oral cavity, providing ease of maneuverability and adaptation to the tooth anatomy [Cheing-Meei et al., 1995]. The Nd:YAG laser has also shown the ability to reduce the amount of subgingival bacterial flora in vitro [Tseng et al., 1991]. The levels of Actinobacillus Actinomycetemcomitans, Porphyromonas Gingivalis and Prevotella Intermedia are significantly reduced [Cobb et al., 1996].

The aim of this study is to assess the efficacy of the Nd:YAG laser treatment in comparison with surgical conventional therapy, focusing on the ease of application by the operator and patient’s comfort.

Materials and methods

After submitting the protocol for acceptance to the Ethics Committee and obtaining a written consent from the patient’s parents, 18 subjects with periodontal disease (10 males and 8 females, average age of 14) were enrolled in an open randomised study.

The sample selection criteria were as follows.

- Age comprised between 11 and 19 years.
- Radiographic evidence of bone loss in at least one molar and/or central incisor area.
- Absence of concomitant systemic diseases having a possible influence on the periodontitis.
- No history of periodontal treatment in the previous 12 months.
- No history of antibiotic treatment by the systemic route during the last 6 months.
- Bleeding on probing.
- Average pocket depth between 4 and 6 mm.

A total of 36 hemiarches were examined. Each hemiarch was randomly assigned to one of two treatment groups, in such a way as to assure that every patient received both treatments.

Treatment A: Surgical traditional treatment.


Overall, in the 36 hemiarches were treated: 16 first permanent molars with single angular bone defect involving only the mesial root; 20 first permanent molars with angular bone defects involving both the mesial and the distal root (or distolingual root in case of the upper maxillary arch) and 14 permanent incisors, for a total of 70 sites and 50 teeth. The type of treatment of the affected sites within the two groups was also equitably administered. This way each patient had at least two roots treated.

Oral hygiene program. Before the periodontal therapy took place, at the beginning of the study each patient underwent a professional oral hygiene session followed by instructions and motivation for oral hygiene home care.

Follow-ups were set at 2, 4, 6 and 12 months from the periodontal treatment.

Clinical and instrumental tests. The clinical examination and treatments were always performed by the same operator, in order to minimise the individual variables. The examined parameters were as follows:

1. Bleeding on probing (BOP);
2. Probing pocket depth (PPD).

Examinations were performed using manual instruments (PCP, Hu-Friedy Co.). At screening it was performed a circumferential probing assessment around all teeth [Kornman and Robertson, 1985; Christersson et al., 1985]. Data were recorded in a periodontal clinical chart. Clinical assessments were performed at baseline and after 7, 30 and 60 days, respectively.

3. Intraoral radiographic evaluation, performed before treatment and at 2, 4, 6 and 12 months, using a Rinn’s alignment device. The pre-treatment radiographic examination showed localised angular bone defects, associated with loss of clinical attachment. After treatment completion the clinical improvement was assessed by measurement of the amelodental junction and the marginal bone height distance, through a line which unites the amelodental junctions of two adjacent teeth [Suomi et al., 1968; Lang and Hill, 1977].

Treatment A. The patients enrolled in the study were
administered a 7-day antibiotic prophylaxis with metronidazole (3x250 mg/day) in combination with amoxicillin (3x375 mg/day).

The periodontal treatment was performed under local infiltration anaesthesia at every dental site. A mucous membrane flap opening, to allow bone defect exposure, was followed by manual instrumentation with Gracey curettes. At each site the curettage was performed until the operator considered the radicular surface as adequately treated and free from infected residuals. After flushing of the treated area with oxygen peroxide 3%, the flap was closed by detached stitches of resorbable suture.

Suture removal took place at day 14.

The average operative time was 30 minutes for each lesion.

Treatment B. Although not strictly required by the treatment, patients were administered the same antibiotic coverage of group A, in order to prevent possible result bias.

Treatment was performed with a pulsed laser (model DECA Smarty-A 10). It is a very versatile and ergonomic device; the wide range of impulse rate output, going from 5 to 200 pulse/sec, allows its employment both for gentle treatments and when a higher cut speed is required. The 3 different impulse wavelengths provide a more effective haemostatic effect.

Pulse energy up to 250 mJ supplies output power comprised between 10 mW and 400 mW.

An optic fiber with a diameter of 300 µm was mounted on the handpiece.

The treatment of the root surface was performed in the coronal-apical direction, in parallel paths, with inclination of the fiber tip of 15-20° to the long axis of the tooth, tracing an imaginary “grid”, to assure a complete coverage of the root surface.

Laser treatment was performed in a single session with a sequence of 3 subsequent applications at different settings, for a total of 15 minutes of application equitably distributed in 3 phases of 5 minutes each.

The software setting at the first passage was:
- frequency 10 Hz;
- power 0.60 W;
- energy 60 mJ.

For the 2nd passage the parameters values were increased as follows:
- frequency 10 Hz;
- power 1 W;
- energy 100 mJ.

The last passage was performed at ceiling values:
- frequency 15 Hz;
- power 1.5 W;
- energy 150 mJ.

Statistics. Pocket bleeding and depth of probing were assessed individually with the Friedman’s test both for treatment A (traditional surgery) and treatment B (laser) at T0 and at the following check-ups at 7, 30 and 60 days in order to highlight possible statistically significant differences.

It was subsequently used the Wilcoxon signed-rank test to highlight, if any, a statistically significant difference between the traditional surgical treatment (A) and the laser treatment (B) at the same time-points.

Results

The results, assessed by statistical mean on a total of 18 patients, showed a clinical improvement for both treatments. During the postoperative period, no complications were observed. Most of the patients showed a good compliance with the oral hygiene guidelines.

At the first clinical examination, before treatment, 60% of the surfaces surgically treated and 57% of those treated with laser showed bleeding on probing, with homogeneity of data for the two groups (Fig. 1).

The trend of the mean pocket probing depth, assessed at baseline and at following check-ups, is shown in figure 2.

Friedman’s test showed a statistically significant difference over time (P<0.05). This finding clinically translates into an appreciable improvement for both BOP and PPD.

The same test highlights once again a statistically significant difference (P<0.05) for the laser treatment
As for treatment A, the laser therapy produced clinical improvements at 7, 30 and 60 days. By comparing treatments A and B at 7, 30 and 60 days with the Wilcoxon signed-rank test no statistically significant difference was shown (P>0.05), with overlapping results over time. Also, the radiographic images taken at 2, 4, 6 and 12 months from treatment displayed overlapping results. The radiographic images of the sites undergone surgical and laser treatment showed that the lack of bone support at each site before therapy tends to improve at the follow-up examinations, up to an appreciable recovery of the bone component.

Discussion

The treatment of aggressive periodontitis should be undertaken only after a careful diagnosis [Venezia et al., 2005]. Early lesions must not be underestimated because some early onset forms, although quite rare, can be extremely destructive [Gajardo et al., 2005; Diehl et al., 2005]. Successful treatment outcome depends on early diagnosis and aims to achieve the complete elimination of bacterial pathogens that can cause the disease [Arowojolu and Dosumu, 2003]. The key element is the specific effort directed toward not just a quantitative change but also a modification in the composition of the microbial subgingival microflora [Lee et al., 2003].

The individual data obtained after surgical traditional treatment and laser therapy allows asserting that both procedures are able of producing favourable outcomes with a clinically appreciable improvement of BOP and PPD. Depth on probing and bleeding on probing follow-ups data cross-examination, for both treatments, allows to state that the procedures’ outcome are overlapping at any time during the study. If, on one side, treatment A (traditional surgery) allows the removal of infected cement and subgingival calculus, on the other hand treatment B (laser) has the advantage of removing and vaporise organic residuals, including the microbial plaque. Nd:YAG laser is potentially effective for removal and disinfection of deep linear pockets [Cobb et al., 1996; Morlok et al., 1992].

Flap surgery is the traditional approach and therefore the routine elective treatment. Laser is a valid alternative, but it has considerably higher costs. In light of the results, laser treatment can be chosen for its advantages in selected cases. Patients also reported less discomfort with laser treatment. The shorter laser sessions (15 minutes vs. 30 of the traditional surgery) are of great advantage especially for those patients who don’t tolerate the forced jaw position needed for surgical maneuvers in the oral cavity well.

Conclusion

In conclusion, both treatments produce appreciable clinical improvements in patients affected by localised aggressive periodontitis. Despite the lack of statistically significant differences between the two types of treatment and although the periodontal therapy with Nd:YAG laser entails additional costs, we believe that this method could be a valid alternative to conventional treatment, with significant benefits for the patient and the operator. The possibility of performing laser treatment provides an excellent intra- and post-operative pain control: this determines a reduction of the risks related to the procedure, and therefore allows to safely candidate those patients who are more prone to complications. The surgical flap approach should be considered the routine procedure of choice, but laser treatment remains the elective therapy for patients with a history of cardiocirculatory, coagulation and platelet function disorders. Finally, the minimal invasivity of the laser compared to traditional surgery is definitely an advantage, considering the young age of the patients with aggressive periodontitis.

References


