Proposal of a Model for Periodontal Prevention During Orthodontic Treatment

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Abstract: Background: Patients in orthodontic therapy often have an increase in gingival plaque and also in the periodontal bacterial load. The goal of the present work is to propose a model for the management of the periodontal tissues of these patients. Methods: 1) Patient 1 month after the insertion of the brackets is subjected to a test with molecular biology technique; 2) The patient is instructed to use a water jet daily, using it 2 minutes on both arches 2 times a day for a month; 3) The previously described microbiological test is performed again; 4) The reports obtained are compared and delivered to the patient after illustrating the problems; 5) if the percentage of periodontal pathogens exceeds 5% of the total, continue with phase 2 and 3, until the lowering of the same; 6) if lower, the test will be repeated after 6 months. Results: We reported 2 examples of the prevention model proposed in which patients improved significantly. Conclusions. The protocol we propose aims to limit periodontal damage possibly caused by orthodontic treatment. The proposed model could be the basis of clinical trials that also include a comparison with a control group.

Keywords: periodontal prevention; periodontal bacteria; orthodontic patients.

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1. Introduction

Patients during fixed orthodontic therapy often could have an increase in gingival plaque production and also in the periodontal population [1,2,3]. A recent literature review has considered over 200 scientific articles on the subject and confirmed that, especially at the beginning of orthodontic therapy, we have an increase in the concentration of periodontal bacteria, which tends to decrease several months after therapy [4]. The most compromised element during orthodontic therapy is the central incisor. The authors said that the literature’s studies analyzed overall 4 periodontal species: Porphyromonas gingivalis, Prevotella intermedia, Aggregatibacter, Tanerella forsythiensys [4], but they have not found data on the globality of bacterial species.

Among the various home aids for the treatment and prevention of periodontal pathologies, we find the water jet [5,6,7]. The use of this device, according to a meta-analysis, is important to remove plaque, reduce the number of periodontal pathogens, inflammation mediators, and, for these reasons, gingivitis, and bleeding [8].
An even more recent review work (2018), which examined 22 randomized clinical trials, concluded that the most effective interdental cleaning methods are interdental brushes and hydropulsors, resulting in a reduction of the periodontal gingival indices of 64 respectively, 7% and 27.4% [9].

The use of the manual or electric toothbrush, interdental brushes, and superfluous are indispensable but not sufficient tools to perform good home oral hygiene [10], such as to allow the maintenance of bacterial plaque at acceptable levels in orthodontic patients [11]. The goal of this work is to propose a model for the management of the periodontal tissues of these patients.

2. Materials and Methods

The proposed model is divided into several phases:

1) Patient 1 month after the insertion of the brackets is subjected to a test with molecular biology technique to evaluate the presence of 12 species pathogenic periodontal bacteria and total bacterial load. The insertion of brackets could be worse the periodontal status [12].

2) The patient is instructed to use a water jet daily, using it 2 minutes on both arches 2 times a day for a month. As suggested by a recent review of the literature, it has been observed that the water jet is more effective than the bottle brush [9].

3) The previously described microbiological test is carried out.

4) The reports obtained are compared and delivered to the patient after illustrating the problems

5) If pathogenic bacterial species are present above a concentration of 100.000, or the percentage of periodontal pathogens exceeds 5% of the total, continue with phase 2 and 3, until the lowering of the same. A percentage very high of the periodontal pathogen, such as P. gengivalis is connected with the worsening of periodontal status [13].

6) If the previous conditions are not present, the test will be repeated every 6 months to verify the maintenance of periodontal microbial stability.

3. Results and Discussion

We want to provide two examples of applications of the model described.

Example 1. A 15-year-old female patient came to our observation for a follow-up visit. The girl in good general health is on fixed orthodontic therapy. After professional oral hygiene, we decided to make an assessment of the periodontal microbiological status, using a molecular biology method performed by Biomolecular Diagnostic laboratory, Firenze, Italy. The sampling for biomolecular analysis was carried out with a sterile paper cone, inserted in the gingival sulcus of element 11, and left inside for 20 seconds. Subsequently, it was placed inside a sterile test tube and closed in the special kit provided by the laboratory. We evaluated the total microbial load, the percentage of periodontal pathogens on the total of bacteria. We analyzed 15 pathogenic species. 8 of these 15 belong to the red complex (Aggregatibacter, T. denticola, T. forsythensys, P. gengivalis, P. endodontalis, P. micros, F. alocis, Synergisteses); 4 belong to the orange complex (P. intermedia, F.nucleatum, C. rectus, L. hofstadii, E. corrodens, C. homonis); 2 belong to the green complex (E.corrodens, C. homonis).

The results of this test showed that the total bacterial load was 1.31 10^7, while the percentage of pathogens was 15.23% (Fig 1,2). The bacteria most present were E. corrodens and F.alocis. It was decided to offer the patient the use of a home water jet (SoWash, Water powered, Salerno, Italy) in an attempt to reduce the bacterial load, at least 2 times a day for a
month of treatment, for a total of 4 minutes of daily application. Subsequently, another test was performed for molecular microbiological analysis, in the same way as above. The test revealed a total charge of $2.09 \times 10^9$, with a percentage of pathogens of 9.3% (fig 3,4). The percentage of pathogens indicates that treatment with a water jet must be continued, but there is an important improvement in bacterial load decrease.

![Figure 1. Report of the biomolecular test, patient 1.](https://nanobioletters.com/)

![Figure 2. Percentage of pathogenic bacteria before water jet daily treatment, patient 1.](https://nanobioletters.com/)

![Figure 3. Report of biomolecular test, after 1 month with water jet treatment, patient 1.](https://nanobioletters.com/)
Example 2. A 12-year-old patient came to our observation, accompanied by his parents, for a check-up visit. The patient undergoes orthodontic treatment. Also, in this case, after professional oral hygiene, an oral microbiological evaluation with molecular biology was carried out. The withdrawal technique is identical to the previous case. The results revealed a percentage of 8.78% of periodontal pathogens (fig 5). No periodontal pathogen occurred in a particularly high charge. Also, in this case, the use of a water jet (SoWash, Water powered, Salerno, Italy) has been suggested twice a day for a month. No periodontal pathogen occurred in a particularly high charge. This time a non-electric water jet was proposed, which simply works with water pressure, connecting it directly to the tap. It does not require particular maintenance as it is free of electric circuits or batteries, eco-friendly, and allows you to adjust both the temperature and the pressure of the water jet, directly from the tap.

After one month, the test was performed again. The percentage of periodontal pathogens decreased significantly to 0.93% (fig 6). The percentage of pathogens indicates that treatment with a water jet can be stopped and re-evaluated after 6 months with a new molecular test.

Figure 4. Percentage of pathogenic bacteria after 1 month with water jet, patient 1.

Figure 5. Percentage of pathogenic bacteria before water jet treatment, patient 2.
A work by Shirozaki et al. analyzed the levels of pro-inflammatory cytokine and periodontal indexes in patients with an orthodontic appliance. Bleeding values, plaque build-up, TNF alpha, IL 1-beta, have become worse on patients who have recently started therapy, and the authors no found statistically significant differences between fixed orthodontics and orthodontic realized by aligners [14]. The same results concluded Madriaga et al. [15]. Levels of some periodontal pathogens, especially red and orange complex, tend to increase in the first 60 days of orthodontic therapy [14,16].

The first point of our protocol involves the microbiological investigation of 12 bacterial species. In scientific literature, we have not found studies that have observed more than 6 bacterial species in the periodontal health of orthodontic patients [17,18,19].

In our opinion, the analysis of multiple bacterial species is important for a better evaluation of the microbiota of these patients. An assessment of the percentage of pathogenic species compared to all the bacteria found has never been documented in the literature for cases of patients on orthodontic therapy.

We know from the literature that a rate of pathogenic compared to the total of microorganisms greater than 5% is high and, therefore, a risk factor for the patient. In fact, in a study of over 1700 periodontal patients, it emerged that periodontal pathogens percentage found respect to total bacteria load were: Aggregatibacter actinomycetemcomitans 0.1%, Campylobacter rectus 2%, Fusobacterium nucleatum 8%, Porphyromonas gingivalis 6%, Treponema denticola 2% and Tannerella forsythia 1.5% [20]. Periodontal pathogen concentrations above $10^5$ have been correlated with the onset of periodontal problems [21,22].

Another of the points proposed by our protocol predicted the use of a manual and electric water jet for the maintenance of the periodontal state. Despite Mazzoleni et al. have not found very important results on home use of the water jet in orthodontic patients [23], previous literature reviews have found interesting data on the reduction of the bacterial population in patients who use water jet daily [8,9]. In the reported cases, a reduction in the general bacterial population and an extremely significant reduction in the percentage of pathogens was shown, which in the first case went from 15.23 to 9.3% and in the second case from 8.78% to 0.93%. We have not found in the literature any other data on the general lowering of the periodontal pathogenic load using the water jet. Some recent studies have
proposed other ways to reduce the bacterial load during orthodontic treatment, such as photobiomodulation, photodynamic therapy, and probiotics [24-28], but the use of a water jet is easier in our opinion overall for the patient. It also seems that the use of the eco-friendly non-electric device is even more performing for this purpose. In a view to reducing the consumption of energy resources and protecting the environment, that is also a new trend in biomedical science [29-31]. This fact could be interesting.

Another important point of our protocol is to demonstrate to the patient, through the evaluation of the reports with the patients themselves, how important their home contribution is for the maintenance of oral health during orthodontic therapy [32-34]. The use of bacterial tests can also be of great help in motivating the patient to oral hygiene itself [35].

4. Conclusions

Gingivitis and periodontitis arising during orthodontic treatment are not uncommon, as can be found in the literature [36,37,38,39]. Several principals have been used to limit this collateral damage [40,41,42]. But never a manual water jet. The protocol we propose aims to limit periodontal damage possibly caused by orthodontic treatment. The proposed model could be the basis of clinical trials that also include a comparison with a control group.

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Conflicts of Interest

The authors declare no conflict of interest.

References


