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Bacterial tests with molecular biology, electric and eco-friendly water jet as a proposal for prevention during orthodontic treatment: A pilot study

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Abstract

The aim of our pilot study is to report the microbiological effects of the use of two types of water jet in orthodontic patients. All 15 patients enrolled in the study, were submitted to professional oral hygiene and evaluation of the periodontal microbiological status, using a molecular biology method to find the total bacterial load of 15 pathogenic species. Subsequently, patients were divided into two groups: group 1 subjected to daily hygiene with an electric water jet (Sowash, Water powered, Napoli, Italy) 2 times a day for a month; group 2 subjected to daily hygiene with manual water jet; group 3 control. A new microbiological evaluation was performed after 1 month. Group 1 had a decrease of bacterial load of 12%, group 2 10% and group 3 maintains an unaltered bacterial growth. The manual water jet eco-friendly, in particular, could be very useful for oral care in a biosustainability perspective.

Keywords: Bacterial tests, molecular biology, water jet, orthodontic treatment

Introduction

Patients on fixed orthodontic therapy often have an increase in gingival plaque, and also in the periodontal bacterial population. A recent review of the literature has taken into consideration over 200 scientific articles on the subject, and confirmed an increase in the concentration of periodontal bacteria especially at the beginning of orthodontic therapy, which tends to drop several months after therapy ^[1]. It appears that the most compromised element during orthodontic therapy is the central incisor. The authors point out that the studies in the literature mainly analyze 4 periodontal species: Porphyromonas gingivalis, Prevotella intermedia, Aggregatibacter, Tanerella forsythensis ^[1], but there are no data on the globality of bacterial species.

Among the various home aids for the treatment and prevention of periodontal pathologies we find the water pumps. Their use, according to a meta analysis, is able to remove plaque, reduce periodontal pathogens, inflammation mediators, and therefore gingivitis and bleeding ^[2]. 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 high-pressure cleaners, resulting in a reduction of the periodontal gingival indexes of respectively, 7% and 27.4% ^[3].

The aim of our pilot study is to report the microbiological effects of the use of two types of water jet (electric and manual), in a group of 10 patients on fixed orthodontic therapy, comparing them with a control group of 5 patients.

Materials and Methods

All patients enrolled in the study had to meet the following inclusion criteria: be on fixed orthodontic therapy for at least 6 months; not periodontal disease of any kind. After professional oral hygiene, they underwent an evaluation of the periodontal microbiological status, using a molecular biology method. 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. The total microbial load, the percentage of periodontal pathogens

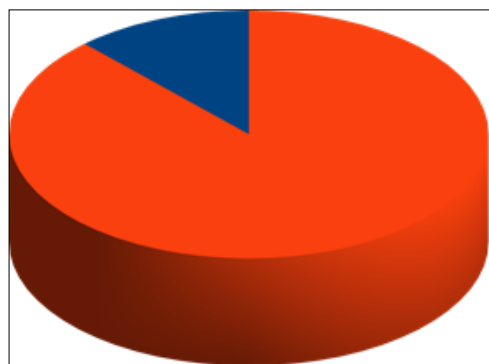
on the total of bacteria, and the charge of 15 pathogenic species, 8 of which belonging to the red complex (*Aggregatibacter*, *T. denticola*, *T. forsythensis*, *P. gingivalis*, *P. endodontalis*, *P. micros*, *F. alocis*, *Synergisteses*); 4 belonging to the orange complex (*P. intermedia*, *F. nucleatum*, *C. rectus*, *L. hofstadii*, *E. corrodens*, *C. hominis*); 2 belonging to the green (*E. corrodens*, *C. hominis*).

Subsequently, the patients were divided into two groups: group 1 subjected to daily hygiene with an electric water jet (Sowash, Water powered, Napoli, Italy) at least 2 times a day for a month of treatment, for a total of 4 minutes of daily application, on both arches; group 2 subjected to daily hygiene with the same protocol but with manual water jet. This device 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; group 3 control.

Subsequently, the microbiological tests were rerun with the same previous methods and the average percentages of the total bacterial load reduction for each group were calculated. Chi-square test was used to evaluate statistical significance, between group 1 and 2 and between group 1 and 3.

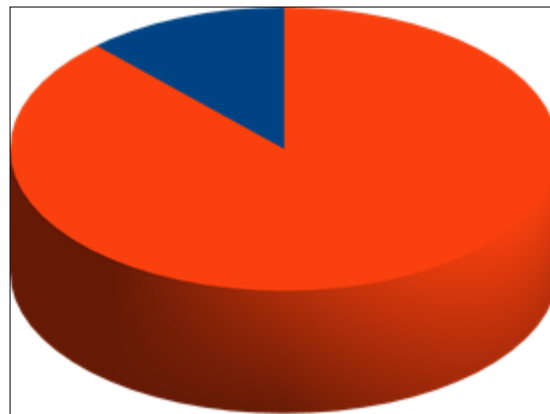
Results

The microbiological data relating to the different groups of the scientific study were evaluated. The data refer to 3 groups analyzed with the molecular biology method. The analysis of the data shows that, in patients analyzed in group 2, the value of the total bacterial load, on the set time, decreases by an average of 10%, the value is expressed as a percentage since the numerical difference is not such as to be able to predict a further passage in the boxes of the expression of exponential growth. The reduction of the bacterial load is generalized, it is substantially proportional in all the different types of bacterial species studied, it does not present any specific action on specific forms of microorganisms. Group 1 that used the electric version of So Wash shows a slightly greater decrease in the total bacterial load, about 12% in the established time. In the same way as the manual version, there is no specific action towards certain bacterial species, the growth reduction is proportional in all bacterial forms (Graphic 1, 2, 3). The control group maintains an unaltered bacterial growth, with an increase in proportion of the parodontopathogenic species of the red complex. The chi-squared test applied to group 1 and 3, and to group 2 and 3 shows that between the groups there is a statistically significant difference for $p <$ The test applied to groups 2 and 3 does not reveal a statistically significant difference.



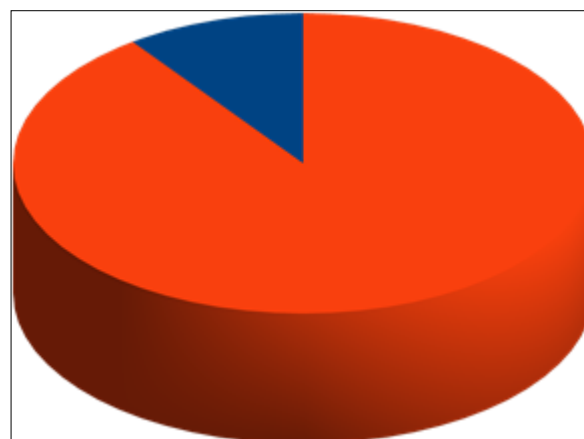
bacterial load reduction residual bacterial load

Graphic 1: Percentage of bacterial load reduction group 1 after treatment



bacterial load reduction residual bacterial load

Graphic 2: Percentage of bacterial load reduction group 2 after treatment



bacterial load reduction residual bacterial load

Graphic 3: Percentage reduction of the total bacterial load among the 3 groups

Discussion

A work by Shirozaki *et al.* analyzed pro-inflammatory cytokine levels and periodontal indexes in orthodontic patients. Bleeding, plaque build-up, TNF alpha, IL 1-beta values are worse for patients who have recently started therapy, and there are no statistically significant differences between fixed orthodontics and orthodontics with aligners [4]. At same conclusions arrived also Madriaga *et al.* [5]. The levels of some periodontal pathogens, especially the red and orange complex, tend to increase in the first 60 days of orthodontic therapy [4]. Despite Mazzoleni *et al.* have not found.

particularly encouraging results on home use of the water jet in orthodontic patients [6], previous reviews of the literature have found interesting data on the reduction of the bacterial population in patients who use water jet (2,3). Previous studies have evaluated the use of this type of device with the use of chlorhexidine as a liquid in patients with periodontal problems [7]. Our data show that there is a 10% reduction in the total bacterial load after one month of treatment with a manual water jet, while 12% for the electric one. The differences are statistically significant compared to the control group, while the use of an electric or manual model of a water jet seems irrelevant.

In 2014, a first patent for a manual water jet was described, without however being scientifically evaluated [8]. This is also an important detail with a view to reducing the consumption of energy resources and protecting the environment. These are preliminary data which, however, must be confirmed by

clinical trials involving larger population groups.

Conclusions: The SoWash manual equipment, like the SoWash electric version, focuses on the mechanical removal of bacterial colonies. Since these aids are indicated among the additional ones in the home oral hygiene procedures, the statistical data can direct us towards a manual SoWash use because:

1. The bacterial load decreases in a percentage almost identical to the electric version.
2. The proportion of the reduction of the growth of the specific parodontopathogens is similar, although not significant for both
3. The manual So Wash does not provide for the use of electricity, so in a bio sustainability perspective it is a valid safeguard.

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