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Particular device producing ozonated water to treat dentinal sensitivity: a pilot study

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ABSTRACT

Ozone is aunstable gas, proposed in medicine filed especially for microbial infections. It can be used in the form of oxygen-ozone gas mixture , diluted in aqueous solution and in the form of ozonized oil. Its antimicrobial action is linked to damage to the cytoplasmic membrane, and so it has been proposed in different dentistry fields. The most simple application is ozonated water. The aim of this pilot study is to evaluate the effectiveness on dentinal sensitivity, of a particular device called Aquolab (Sweden & Martina , Padua , Italy), similar to a water-jet, that dispenses a mixture of water and ozone7 patients were enrolled in this pilot study, 4 female patients e 3 male patients with some difficult to eat and drink cold food. An NSR scale test was administered to the patients, to quantify the dentinal sensitivity, on groups of 3-4 dental elements. The values reported were registered. A single session of 60 seconds mixture of water and ozone was performed, with program 1 for water delivery and program 3 for ozone delivery. After the session the NSR scale test was submitted again to the patients. In 3 patients has been possible to record also the values at 1 months follow up.The average of the values found was 7,42 before the treatments and 2,5 immediately after the session with Aquolab. In one patient the value of the test at 1 months follows up was 0,5, the same that after the treatment. In another patient the value was 1 after the session and 0 after the 1months follow up; one patient reported the value of 4 at the follow up visit. All patients had improved their sensitivity.The use of ozonized water for oral infections treatment is successfully documented in the literature but there is no work on the use of this garrison to reduce this problem. This device could be considered useful to treat dentinal sensitivity without any type of collateral events. More clinical studies are needed to confirm this preliminary results.

Keywords: *Ozonated water; ozone therapy; dental sensitivity; ozone in dental field.*

1. INTRODUCTION

Ozone is an unstable gas, proposed in medicine filed especially for microbial infections treatment.

It can be used in the form of a mixture of oxygen-ozone gas, diluted in aqueous solution and in the form of ozonized oil [1]. Its antimicrobial action is linked to damage to the cytoplasmic membrane, which affects our cells to a lesser extent because they are more resistant to oxidative damage. It also acts by intervening on the production of leukotrienes, prostaglandins and interleukins, determining a greater speed of healing. It is also able to improve the transport of oxygen in the bloodstream [1]. For these reasons, it has also been proposed in different dentistry fileds. The most simple application is ozonated water.

In recent studies, ozonated water was proposed as an alternative to chlorhexidine. The researchers evaluated the effectiveness of ozonated water on the main periodontal pathogens, and also in clinical periodontal parameters concluding that it could be a valid substitute for chlorhexidine [2,3]. In the study of Al Habashneh et al. on more than 40 patients, the authors concluded that ozonated water did not result in significant improvements in the periodontal status of patients after SRP, compared to distilled water [4].

However, another recent work, conducted by Hayakumo et al. has shown remarkable effectiveness of a particular form of ozone called ozone nano bubble water [5].

The ozonated water has also been used in the orthodontic field. In fact, patients subjected to fixed orthodontics often show problems with plaque retention and gingival inflammation, due to the presence of brackets that hinder normal oral hygiene maneuvers. In a study conducted by Jose et al. in 2017 on 28 patients, with controls at 8 months, it showed an important clinical improvement when compared with saline water. The applications were carried out with water pumps directly on the gums of the patients [6]. Dhingra K et al. evaluated lactate dehydrogenase (LDH) levels in the crevicular fluid of 15 patients under orthodontic treatment. This parameter correlates with the degree of gingival inflammation and this value was detected before and after irrigation with ozonated water. The levels of LDH, and therefore gingival inflammation, had significantly decreased after a single application of ozonized water [7]. Covani et al. found that it is better than chlorexidine to improve clinical periodontal parameters in orthodontic patient (8). Alkan et al. and Cehreli et al. have evaluated that the ozonated water does not interfere with the adhesive capacity of the brackets to the tooth [9,10]. The activity against *Streptococcus Mutans*, *Enterococcus Faecalis* and *Candida albicans* are also well documented [11, 12, 13, 14, 15].

The aim of this pilot study is to evaluate the effectiveness of dentinal sensitivity, of a particular device called Aquolab (Milan, Italy), similar to a water-jet, that dispenses a mixture of water and ozone.

2. MATERIALS AND METHODS

7 patients were enrolled in this pilot study, 4 female patients e 3 male patients. The age was comprised of 33 and 65 years old. All patients declared some difficult to eat and drink cold food. After a professional oral hygiene, an NSR scale test was administered to the patients, to quantify the dentinal sensitivity, on groups of 3-4 dental elements. The values reported were registered. A single session of 60 seconds mixture of water and ozone was performed, with program 1 for water delivery and program 3 for ozone delivery (fig 1). After the session the NSR scale test was submitted again to the patients. In 3 patients has been possible to record also the values at 1 month follow up.

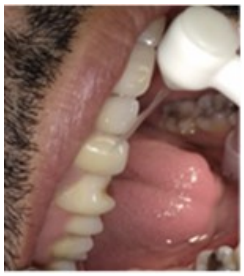


Figure 1. Treatment with 60 seconds of ozonated water produced by Aquolab.

3. RESULTS

The average of the values found was 7,42 before the treatments and 2,5 immediately after the session with Aquolab. In one patient the value of the test at 1 month follows up was 0,5, the same that after the treatment. In another patient the value was 1 after the session and 0 after the 1 months follow up; one patient reported the value of 4 at the follow up visit. All patients had improved their sensitivity (table 1, graphic 1).

Table 1. Values of NSR before and after treatment.

Patient	Gender	Age	NSR value before	NSR value after
P 1	F	65	8	0,5 (also FU)
P 2	M	41	8	1 (0 FU)
P 3	F	34	7	5 (4 FU)
P 4	M	47	8	3
P 5	F	--	7	3
P 6	F	33	8	3
P 7	M	60	6	2
Average	--	46,6	7,42	2,5

In vitro study on oral biofilm on the bacteriostatic and bactericidal effect of ozonized water was performed [16]. The antimicrobial activity of ozonated water is very useful not only in periodontal but also in conservative dentistry such as in caries prevention. A work of Anumula et al. carried out on 2 groups of 23 patients highlighted that ozone has a greater effect compared to chlorhexidine in reducing the CFU of Streptococcus Mutans, the main caries pathogen [11]. Ximenes et al. instead have proposed it in addition to sodium floride and chlorhexidine to reduce the incidence of caries in children [17]. In an interesting *in vitro* study of 2016 by Samuel et al. the researchers found that ozonated water could be useful for stopping the formation of caries when it is in the initial stage, this means that the number of conservative dentistry interventions would be reduced to the benefit of the patients, in the concept of mini-invasive dentistry [18].

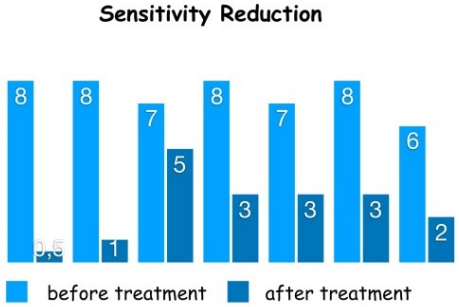
Good *et al*. proposed ozonated water also for endodontic treatment as an irrigant solution [19]. Nagayoshi *et al*, in an *in vitro* study found that it had the same effect of sodium hypoclorite at 2,5% against Enterococcus Faecalis, the most important pathogen in endodontic field [20]. Mohamadi et al. said in their review that this solution would appear to have immediate efficacy against *Enterococcus faecalis* and *Candida albicans*, and the action would be even greater against the *P.endodontalis* [2].

Khatri et al. in a study of 40 patients, evaluated the effectiveness of an ozonated water solution, compared to topical clotrimazole in patients with oral candidiasis. CFUs were evaluated before and after the 5-day treatment period for the experimental group, and 15 days for the topical antifungal group. The reduction in CFU was much greater, almost double in the experimental group [13].

Antimicrobial activity was tested also tested on less studied bacterial species [21,22,23].

Another interesting application of ozonated water is the use at a cosmetic level for dental bleaching.

In an *in vitro* study, it was compared to 37% hydrogen peroxide, oxygen and placebo. The exposure times on enamel were 8 minutes for hydrogen peroxide and placebo and 19 minutes for oxygen and ozone. Except for the placebo, all were effective in tooth whitening, with differences between the three groups non-statistically significant [24]. Other researchers have proposed the addition of ozone to hydrogen peroxide for dental bleaching, but is still too early to reach conclusions [25]. Finally, ozonated water could be useful for the disinfection of microbes from the surface of dental equipment and instruments [26,27].



Graphic 1. Values of NSR before and after treatment.

4. CONCLUSIONS

Dentinal sensitivity is an extremely complex subject, where several factors come into play. There are several products used for dentinal sensitivity, but there is no work in the literature on the use of ozonated water to reduce this problem. A very recent *in vitro* work has highlighted how ozone would be able to determine dentinal remineralization, and therefore this data could be

interpreted as an effect on the reduction of dentinal sensitivity [13]. This device could be considered useful to treat dentinal sensitivity without any type of collateral events. More clinical studies must be performed to confirm this preliminary results.

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