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Application of ozonated water in non-surgical periodontal treatment

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Abstract
Materials and methods: Twenty patients between 20 and 80 years of age, both sexes were selected, moderate or advanced chronic periodontitis, ASA I, were submitted to the hygienic phase of the treatment of chronic periodontitis in a conventional manner with scrapes and Smoothing radicular with the use of ozonated water (26.8ug / ml). Results: The plaque index in the experimental and control group at the start of treatment was 2.75±0.967 and 2.60±1.046 respectively, while at the end of the treatment the results were 0.55±0.686 and 1.35±0.875. The evaluation of the gingival index showed results of 2.45±0.686 in the experimental group and 2.50±0.688 in the control group at the beginning of the treatment. In the end we obtained results of 0.50±0.607 and 1.20±0.834. The results in the evaluation of the depth of the bag of the experimental group was 6.20±1.576 while the control group was 6.10±1.165 at the beginning of the treatment. The result obtained at the end of the treatment in this evaluation was 3.30±1.174 in the experimental group and in the control group of 5.85±1.137. The insertion loss at the beginning of the treatment in the experimental group and the control group was 4.55±1.099 and 4.70±0.923 respectively at the beginning of the treatment, while at the end of the treatment it was 3.70±0.979 and 3.95±0.686. Conclusion: The use of ozonated water in non-surgical periodontal treatment improves the clinical signs of periodontal disease.

Keywords: Periodontitis, ozonated water, periodontal therapy

1. Introduction
Periodontitis is a multifactorial infectious oral disease that currently affects 10-15% of the population worldwide [1]. Oral antiseptics such as ozone can be used as adjuvants in periodontal treatment [2].
Ozone has multiple properties, in which its bactericidal[3] and virucidal [4] function stand out. Its antimicrobial effect is the most studied, due to its good clinical results [5, 6].
Several studies have confirmed that the use of ozonated water as adjuvant in non-surgical periodontal treatment has benefits in the reduction of bacterial count [7], as there is a significant difference in plaque index and gingival index, however, other clinical studies concluded that there is no significant difference in the levels of clinical insertion, plaque index and pocket depth between the use of ozone and the use of bidistilled water in patients with chronic periodontitis [8].
Despite the great clinical benefit obtained by ozone as an irrigator in non-surgical periodontal treatment, several authors have suggested that its use at a concentration higher than 50.8 ug / ml can be toxic in tissues exposed to this solution [9].
The use of antiseptic solutions in periodontitis, during the treatments of scaling, root planning and plaque control are decisive to substantially improve the success of periodontal treatment [10].
The objective of the present study was to evaluate the periodontal clinical parameters (plaque index, gingival index and probing depth) in patients with moderate chronic periodontitis, treated with non-surgical periodontal therapy and ozone therapy.

2. Materials and methods
2.1 Population and Study design.
Due to the conditions of the variable to be evaluated of the qualitative type, where it is also an

infinite population, the sample size was estimated with the application of the general formula, having a number of 20 patients. The study design was comparative, blind, experimental, prospective and longitudinal.

Patients who attend the Graduate Periodontics, School of Dentistry, Universidad Autónoma de Nuevo León, who required periodontal treatment, were invited to participate in the research with the use of ozone, with the informed consent authorized by the patient. Patients were included between 20 years and 80 years of age, of indistinct sex, who presented moderate generalized chronic periodontitis and ASA I. All those patients who did not follow the instructions indicated, who ingested antibiotics during the study or who presented only one isolated site with periodontal disease.

2.2 Description of procedures

a) Periodontal evaluation

In the first visit, a complete clinical history of the patient was made, the Turesky-Gilmore-Glickman plaque index, Löe and Silness gingival index, bag depths and clinical attachment loss were measured. The patient was given the informed consent to authorize the treatment by signing. A radiographic series of 16 radiographs was taken to complete the periodontal diagnosis.

b) Non-surgical periodontal therapy

The sample evaluated was split-mouth, that is, one side of the oral cavity was the experimental group and the opposite side the control group, which was assigned randomly.

At the second visit, the scaler was performed using ultrasonic scalers (DTE 7) and the patients were taught oral hygiene techniques using the modified Stillman technique with the use of a soft bristle brush and the use of dental floss without wax.

After 7 days of scaling, scaling and root planning were performed in both quadrants with the use of gracey curettes (13-14, 17-18, Hu-Friedy®), in one quadrant ozone was used as irrigation material and in the other quadrant physiological saline was used as control. At the fourth visit 2 weeks after scaling, the patient was cited to irrigate ozone in the area where it was previously used and was cited for re-evaluation.

At the fifth appointment 2 weeks after the last ozone irrigation, a re-evaluation was performed, collecting again the Turesky-Gilmore-Glickman plaque index, Silness and Löe gingival index, bag depths and clinical insertion levels.

2.3 Analysis of data

For the analysis of results, he performed an analysis of variance (Anova), in addition to Tukey HSD tests to identify the specific groups that show significant results among them, both with a 95% reliability (IBM SPSS Statistics, Version 20, USA and Microsoft). Excel 20120).

3. Results

Thirty-five patients were evaluated, of which 15 patients were excluded, which did not meet the inclusion criteria of this study.

a) Evaluation of plaque index

The initial plaque index of the experimental group was 2.75±0.967 and in the control group of de 2.60±1.046, however a statistically significant difference was found after the periodontal treatment, where the index in the experimental group was 0.55±0.686 and 1.35±0.875 in the control group (Table 1, Fig. 1).

b) Evaluation of gingival index

The gingival index initially showed a result of 2.45±0.686 in the experimental group while the control group was 2.50±0.688. At the end of the treatment, this index obtained a result of 0.50±0.607. In the experimental group and of 1.20±0.834 (Table 1, Fig. 1).

c) Evaluation of probing depth

The results obtained from the experimental group were 6.20±1.576 while the control group was 6.10±1.165 at the beginning of the treatment. The result obtained at the end of the treatment in the experimental group was 3.30±1.174 and in the control group of 5.85±1.137 (Table 1, Fig. 1).

e) Evaluation of clinical attachment loss

The evaluation of clinical attachment loss at baseline in the experimental group and the control group was 4.55±1.099 and 4.70±0.923 respectively, while the results at the end of treatment were 3.70±0.979 in the experimental group and in the experimental group. For control group the result was 3.95±0.686 (Table 1, Fig. 1).

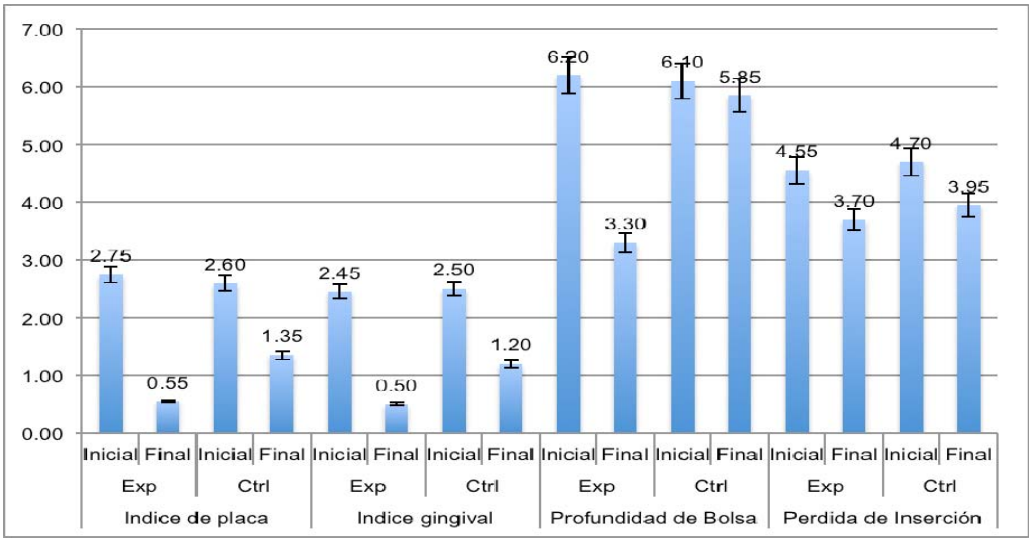

Fig 1: Mean of the variables by study group. * Exp: Experimental; * Ctrl: Control.

Table 1: Descriptive statistics of the variables by study group

Variable	Group		Average	Standard Deviation	IC 95%		Min	Max
					L. Inf.	L. Sup.		
Plaque Index	Exp	Initial	2.75	0.967	2.30	3.20	1	5
		Final	0.55	0.686	0.23	0.87	0	2
	Ctrl	Initial	2.60	1.046	2.11	3.09	1	4
		Final	1.35	0.875	0.94	1.76	0	3
Gingival Index	Exp	Initial	2.45	0.686	2.13	2.77	1	3
		Final	0.50	0.607	0.22	0.78	0	2
	Ctrl	Initial	2.50	0.688	2.18	2.82	1	3
		Final	1.20	0.834	0.81	1.59	0	2
Probing Deep	Exp	Initial	6.20	1.576	5.46	6.94	4	9
		Final	3.30	1.174	2.75	3.85	2	6
	Ctrl	Initial	6.10	1.165	5.55	6.65	4	8
		Final	5.85	1.137	5.32	6.38	4	8
Attachment loss	Exp	Initial	4.55	1.099	4.04	5.06	3	7
		Final	3.70	0.979	3.24	4.16	2	6
	Ctrl	Initial	4.70	0.923	4.27	5.13	3	6
		Final	3.95	0.686	3.63	4.27	3	5

* Exp: Experimental; * Ctrl: Control; Inf: Bottom; Sup: Superior

4. Discussion

Several studies have analyzed the use of ozone as an aid in dental treatments in general [11], which has led many authors to conduct much more focused studies over the years, such as microbiological effects and scarring of soft tissues [12]. Sigrun in 2012 found in an *in vitro* study that ozone was highly effective against *Porphyromonas gingivalis*, so it was not viable in the use of periodontal treatment as a bactericidal agent of these bacteria within the periodontal pockets [13].

Nagayoshi *et al*, study the effects of gaseous ozone in *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis*, resulting in a positive effect in the elimination of these microorganisms, main causes of periodontal disease. The same effect was seen in bacteria such as *Fusobacterium nucleatum*, *Prevotella Intermedia* and *Streptococcus Sobrinus* [14].

Ramzy *et al*, showed that there is a significant change at 4 weeks in the subgingival microbiota with the use of ozone as an irrigator in the periodontal treatment [12].

It was demonstrated in a study carried out in 2001 by Agapov, that ozone causes a stimulation of defense cells, which favors clinical results through the application of ozone, thus giving another advantage to the use of ozone in periodontal therapy [15].

In 2015, Al Habasheh conducted a study with ozonated water at a concentration of 20 ug / ml, which was used in the periodontal treatment in general, demonstrating a reduction in the plaque index and the gingival index, which coincides with the results presented by this study show that the use of ozone at a concentration of 26.8ug / ml is beneficial to complement non-surgical periodontal therapy [16].

Another of the previously demonstrated effects is the improvement in healing, in a study carried out in 2011 by Punit Vaibhav *et al*, they analyzed wound healing on the palate, resulting in a significant improvement in healing at 7, 14 and 21 days in patients who were treated with ozone, compared to those in the control group who were allowed to heal on their own [14].

Gupta compared the use of ozone in different presentations (water, gas and oil), which concluded that the presentation that had the best effects was gaseous ozone, however the use of ozone presents several complications or risks such as intoxication by inhalation, due to little control over the gas during application in the oral cavity, despite being at low concentrations the risk persists. Given these results, the use of ozonated water is a more predictable option in periodontal treatment and with fewer risks for the patient's health [1].

5. Conclusions

Returning periodontal health to patients should be the goal of every clinician through the use of all available resources, because periodontal health is the basis of all treatments. From the results obtained from this study, it is possible to say that the use of ozonated water as a coadjuvant in non-surgical periodontal treatment, through irrigation of affected sites, is beneficial to reduce periodontal pockets and thus return a healthy periodontal state, without risking the patient's health. The possibility of significantly improving the control of plaque in patients with periodontal disease and the gingival index, with an adjuvant such as ozonated water should always be present in the clinician's decision-making possibilities during non-surgical periodontal treatment.

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