Clinical and Radiodensitometric Evaluation of Ozonated Olive Oil in the Management of Periodontal Condition in Smoker Patients

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Abstract

Background and Objective: This study was designed to evaluate clinically and radiographically the role of Ozonated olive oil in the management of periodontal status in smoking patients.

Materials and Method: The study was performed on twenty four medically free patients having chronic periodontitis. Radiographic bone density evaluation as well as linear alveolar bone level and clinical periodontal parameters were recorded after the initial phase of plaque control then, the patients were instructed to perform oral hygiene measures. The clinical parameters which were included are; plaque index, gingival index, probing depth and clinical attachment loss. The patients were divided into 2 main groups, the first group received Ozonated olive oil while the second group served as control group. At baseline, three and six months, bone density and alveolar bone level were radiographically recorded using CBCT. The statistical analysis of the collected clinical and radiographic data revealed an overall clinical as well as Radiometric and Densitometric measurements improvement by time for the Ozonated olive oil group in comparison to the control group at baseline, three and six months.

Results: Ozonated olive oil group showed significant difference regarding the control group.

Conclusion: The results of the current study revealed that the use of Ozonated olive oil can enhance bone level and density as well as tissue healing in periodontially affected teeth. In addition, the use of CBCT is considered as an effective method for evaluation of preoperative and postoperative alveolar bone.

Keywords*: Ozonated olive oil, Periodontal condition, Smoker Patients*

Introduction

Periodontium refers to the function unit of the tissues supporting the teeth this term includes the gingiva, dento-gingival junction, periodontal ligament, cementum and the alveolar process .It serves as the supporting apparatus for the teeth in function and in occlusal relationships [(1)].

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Periodontal disease is a common infection and represents one of the most prevalent public health problems where it results in loss of connective tissue attachment, reduced alveolar bone levels, increased pocket depth and gingival recession any inherited or acquired disorder of the tissues surrounding and supporting the teeth (periodontium) can be defined as a periodontal disease. These diseases may be of developmental, inflammatory, traumatic, neoplastic, genetic or metabolic origin [(2)].

One of the largest studies of risk factors for periodontal disease was that undertaken in Erie County,

New York State. Involving 1361 subjects aged 25 to 74 years, this study showed that those who smoked were at greater risk for experiencing severe bone loss than those who did not smoke, with odds ratios ranging from 3.25 to 7.28 for light and heavy smokers, respectively [3].

Ozone therapy has successfully being used for more than 100 years in the medical field for treatment of various diseases; it presents several properties that can be useful in medical fields. Ozonated oils are mixture of ozone and different vegetable oils such as olive and sunflower that used as antiseptic for oral application of wounds, gingivitis and herpes simplex. Ozone is used in dentistry as gaseous, Ozonated water and Ozonated oils.[4]

Ozonated (ozonized) olive oil is prepared by bubbling ozone-oxygen gas through pure olive oil until it solidifies. In European countries the Ozonated olive oil has been applied topically to a variety of cutaneous diseases for disinfecting the lesions and promoting their healing, though little attention has been paid to the therapy with Ozonated olive oil in Japan, we have recently demonstrated that the Ozonated oil is beneficial to the patients with intractable fistulae or wounds. For the medical use of the Ozonated olive oil, its quality standardization is of great Importance [5].

The success of periodontal therapy depends on many factors. One of the most important factors is the accurate imaging of the morphology of periodontal bone destruction to establish the treatment plan. Radiographs are therefore necessary to determine the extent and severity of the periodontal lesions. [6]

Upon comparing clinical periodontal probing and 2D intraoral radiography, 3D CBCT scanning was found to be more effective in assessing periodontal structures. CBCT is as accurate as direct measurements using a periodontal probe and as reliable as intraoral radiographs for interproximal areas.[7]

The presented study was designed to evaluate clinically and radiographically the role of Ozonated olive oil in the management of periodontal status in smoking patients.

Materials and Method

I-Patient selection:

The present study was designed as a controlled clinical trial. The number of the study population consisted of 24 young adult smoker patients .

II-Patient Grouping:

· ***Group (1):*** Compromised 12 patients where Ozonated olive oil was applied to first molar area of the mandible.

· ***Group (2):*** Compromised 12 patients as a control group.

III-Pre-treatment Patient evaluation:

1. Clinical Evaluation:

For every patient, a detailed history was taken; including present and past medical and dental status. The periodontal status of all cases was assessed according to the following parameters:

A-Plaque index: According to (Silness and loe 1964) [8] the criteria for the plaque index system were

· 0. No plaque in the gingival area.

· 1. Film of plaque adherent to free gingival margin and the adjacent area of tooth. The Plaque may only be recognized by running a probe across the root surface.

· 2. Moderate accumulation of soft deposits within the gingival pocket, on the gingival margin and or adjacent tooth surface which can be seen by the naked eye.

· 3. Abundance of soft matter within gingival pocket and or on the gingival margin and adjacent tooth surface.

B- Gingival index: According to (Silness and loe 1964) [8] the criteria for the gingival index system was:

· 0. Normal gingival

· 1. Mild inflammation: slight change in color, slight edema and no bleeding on probing.

· 2. Moderate inflammation: redness, edema and glazing and bleeding on probing.

· 3. Sever inflammation: marked redness and

edema, ulceration and tendency for spontaneous bleeding.

C- Probing pocket depth: Measured from the free gingival margin to the base of the pocket depth using William graduated periodontal probe.

D- Attachment loss: Measured by subtraction of the distance between gingival margin and cemento-enamel junction (GM-CEJ) from recorded probing depth, or in case of gingival recession adding (GM-CEJ) value to the probing depth measurements, all measurements were carried out using William's graduated probe.

1. Radiographic Evaluation:

CBCT Examination:

Each case under investigation was scanned radiographically using CBCT (Scanora 3DX**) machine with CMOS flat panel detector and isotropic voxel size of 133 µm using field of view(8×10cm) and high definition mode with exposure parameters of ; 90 Kvp ,10 m.A ,exposure time 10s,effective exposure time 6 s, and 0.5mm focal spot.

The patients were instructed not to move during exposure. The primary reconstruction time was about 2 minutes which was automatically carried out after acquisition. Images were acquired and saved as DICOM format. Secondary reconstruction was conducted using OnDemand3D software.

IV- Treatment phase:

v Base line treatment:

- All patients received bilateral periodontal therapy (scaling and root planning treatment).

Ozonated olive oil (OOO) application:

Patients in group (1) received (LIL) as follows:

Ozonated olive oil was applied in the deepest selected periodontal pocket using disposable 10 ml plastic syringe. The selected teeth were isolated carefully with cotton rolls and thoroughly dried and the gel was applied carefully subgingivally and interproximally until excess oil was observed from the gingival margin. This procedure was repeated for all teeth under treatment Ozonated olive oil application was performed immediately after initial and at 7, 14 and 21 days after periodontal therapy**.** Excess oil was removed with a cotton roll and patients were instructed not to eat, drink, or rinse for at least 30 min. **(9)**

V- Patient follow-up and post-treatment evaluation:

-Patients were clinically and radiographically followed up after 3 and 6 months, where all clinical parameters (plaque index, gingival index, probing pocket depth and attachment loss) and radiographic linear (radiometric) and densitometric measurements were recorded and used for treatment evaluation.

Radiographic measurements

-Radiodensitometric analysis:

Regarding the bone density, it was calculated using OnDemand software **(10)** where the mean pixel gray scale values of serial ROIs (region of interest) were analyzed to determine whether changes in radio densities have occurred or not **(10)**.

As an attempt to assess the bone density changes around each surface of the studied teeth (first mandibular molar) a ROI was chosen just tangential to the lamina dura on the mesial, distal, buccal or lingual sides according to the site of the bone loss. This ROI was assessed radiodensitometrically as a rectangular area of fixed dimension (figure 1). The mean of the area measurement was pooled and included into further statistical analysis during each of the follow up periods.

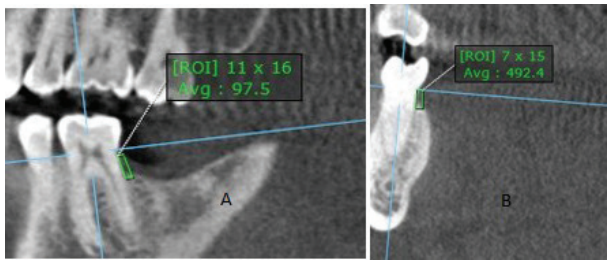

Figure (1):

(A) (B)

Figure (1) (A) Sagital Densitometric measurements&

(B) Coronal Densitometric measurement

Radiometric (Linear) analysis:

Similarly, the marginal bone loss was measured for all patients immediately post operative, 3 and 6

months, to assess changes in the crestal bone level along the follow up periods in both groups. The bone level was measured from the sagital view by drawing a line perpendicular to the CEJ, then a parallel line was created along which the distance extending from the CEJ to the deepest part of the bony defect was calculated.(figure 2)

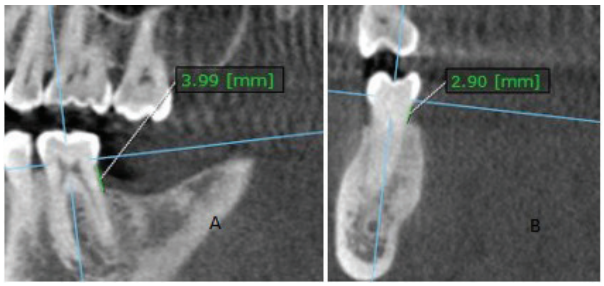

Figure (2):

Figure (2) (A) Sagital linear measurements&

(B) Coronal linear measurements

Statistical analysis:

The mean and standard deviation values were calculated for each group in each test. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests, data showed non-parametric (not-normal) distribution. Mann Whitney test was used to compare between two groups in non-related samples (Groups). Friedman test was used to compare between more than two groups in related samples (Time periods). The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

Results

The obtained data were recorded, tabulated and subjected to statistical analysis.

I) Clinical Results:

There was no statistical significant difference between the Ozonated olive oil group and the Control group through each follow-up period and the following one. (Baseline), (After 3months) and (After 6 months) regarding the Plaque index, Gingival index, probing depth and clinical attachment loss.

II) Radiographic results:

1) Densitometric measurements

Table 1 summarizes the percentage change (increase) in alveolar bone density values through the different follow-up intervals in the Ozonated olive oil group and the control group, and compares between both groups at the different follow-up periods. (**TABLE 1)**

Table (1): Comparison between Ozonated olive oil and control groups regarding the percentage of change in density measurements at different follow-up periods:

Variables	Density measurements						
	Pre-3m		Pre-6m		3m-6m		p-value
	Mean	SD	Mean	SD	Mean	SD	
Ozonated olive oil	6.05%	4.78	11.12%	9.72	4.65%	5.35	0.001*
Control	1.00%	3.40	1.60%	4.39	0.58%	1.92	0.700ns
p-value	0.008*		0.006*		0.034*		

*; significant ($p<0.05$) ns; non-significant ($p>0.05$)

Ozonated olive oil group:

There was a statistically significant difference between (Pre-3m), (3m-6m) and (Pre-6m) groups where (p=0.001), in addition, a statistically significant difference was found between (Pre-6m) and each of (Pre-3m) and (3m-6m) groups where (p=0.002) and (p=0.028). However, no statistically significant difference was found between (Pre-3m) and (3m-6m) groups where (p=0.754).

Control group:

There was no statistically significant difference between (Pre-3m), (3m-6m) and (Pre-6m) groups where (p=0.0700).

Upon comparing both groups, a statistically significant difference was found between them at each follow up interval.

2-Linear Measurements

Table 2 summarizes the percentage change in linear measurements (decrease) through the different follow-up intervals in the Ozonated olive oil group and the control group, and compares between both groups at the different follow-up periods.

Table 2: Comparison between Ozonated olive oil and control groups regarding the percentage of change in linear measurements at different follow-up periods:

Variables	Linear measurements						p-value
	Pre-3m		Pre-6m		3m-6m		
	Mean	SD	Mean	SD	Mean	SD	
Ozonated olive oil	6.13%	4.37	13.50%	7.21	6.93%	5.09	<0.001*
Control	0.07%	2.04	0.78%	5.71	0.88%	5.80	0.093ns
p-value	0.010*		0.004*		0.019*		

*; significant (p<0.05) ns; non-significant (p>0.05)

a) Ozonated olive oil group:

There was a statistically significant difference between (Pre-3m), (3m-6m) and (Pre-6m) groups where (p<0.001), in addition, a statistically significant difference was found between (Pre-6m) and each of (Pre-3m) and (3m-6m) groups where (p=0.002) and (p=0.002). However, no statistically significant difference was found between (Pre-3m) and (3m-6m) groups where (p=0.754).

b) Control group:

There was no statistically significant difference between (Pre-3m), (3m-6m) and (Pre-6m) groups where (p=0.093).

Upon comparing both groups, a statistically significant difference was found between them at each follow up interval.

Discussion

Numerous investigations of the relationship between smoking and periodontal disease have been performed over the last 15 years, and there appears to be strong epidemiological evidence that smoking confers a considerably increased risk of periodontal disease [(11)].

Tobacco smoking is the main risk factor associated with chronic destructive periodontal disease. The typical characteristic of smoking-associated periodontal disease is the destruction of the supporting tissues of the

teeth, with the ensuing clinical symptoms of bone loss, attachment loss, pocket formation, and eventually tooth loss[11] .

Bragger [12] reviewed the radiographic parameters, their biological significance and clinical use. His review considered conventional versus digital imaging methods, the radiographic parameters obtainable in daily practice, linear measurements from landmarks to alveolar bone crest and tooth and root lengths, angular defects and furcation radiolucencies. [12].

CBCT had been applied in this study following several recommendations in an attempt to minimize the measurement errors, rendering it possible for small bone density changes to be quantitively recorded. The same choice was also previously applied and approved by **Eickholz et al**[13]**,** since CBCT provides images with higher resolution at a lower cost, shorter examination time and less radiation dose [13] **.**

Radiographic bone density (relative radiographic grey scale) was assessed as a rectangle covering the investigated area and the changes in density was assessed as comparative values between successive images. The means of the area measurements were pooled as an attempt to eliminate any localization measurement errors [14].

Radio densitometric analysis was performed in this study because it allows detection of density changes between follow up images that relate to change in bone mineral content **as proved by Berns *et al.*** [14]**.**

Ozone has been used in the field of dentistry for various procedures, such as the management of early caries lesions, ulcerations, and herpetic lesions of the oral mucosa; sterilization of root canals and cavities; and reduction of periodontal pockets depth. Several studies have demonstrated significant improvements in the clinical periodontal parameters following SRP along with the application of Ozonated water in aggressive periodontitis patients .Recently, both gaseous and aqueous ozone have been used to complement the treatment of periodontal diseases [15]**.**

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Competing Interests: No conflict of interest

Ethical approval: The Ethics and research committee, Faculty of Dentistry, Suez Canal University approved the study and patients' consent was obtained.

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