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CLINICAL AND RADIOGRAPHIC EVALUATION OF OZONE IN ODONTECTOMY OF IMPACTED MANDIBULAR THIRD MOLAR

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KEYWORDS

Bone density, Odontectomy, Ozone, Third Molar.

ABSTRACT

Introduction: Ozone can react with blood components and positively affect oxygen metabolism, cell energy, the immunomodulatory property, antioxidant defense system, and microcirculation in tissues. In dental surgery, ozone may be useful to promote hemostasis, enhance local oxygen supply, and inhibit bacterial growth. The use of ozone has been proposed in dentistry because of its antimicrobial, disinfectant, and healing properties. **Aim:** To assess the influence of topical ozone administration on patient comfort after third molar surgery**. Material and Methods:** Forty patients with lower impacted third molar that need surgical extraction were selected and divided randomly into two equal groups: Group(I), patients were subjected to odontectomy of impacted mandibular 3rd molar. Group (II), patients were subjected to odontectomy of the impacted mandibular 3rdmolar followed by the application of ozone gel into the socket. The follow-up visits were performed where the intensity of pain, the symptoms of trismus, swelling and radiographic bone density were evaluated. **Results:** Group II showed statistical significant difference of pain compared to group I while both groups showed no statistical significant difference with regard to swelling and trismus and radiographic bone density. **Conclusion:** Ozone gel application therapy was useful for the reduction of postoperative pain and increased quality of life after odontectomy of mandibular third molar. However, it had no effect on either post-operative swelling or trismus in addition to bone density.

INTRODUCTION

The mandibular third molar is situated at the distal end of the mandibular body as it is connected to relatively thin ramus. This angle's area is considered a region of weakness and fracture may occur if excessive forces are not will be applied during the odontectomy of the tooth with inadequate removal of the surrounding bone. The buccal alveolar bone in this region is thicker than the lingual bone due to the presence of external oblique ridge which forms a buttress that reinforces the buccal plate. Lingual nerve is usually close to the lingual cortical plate of the lower third molar. There is a high risk of lingual nerve injury if the lingual split technique is used or the third molar flap is medially elevated [(1)].

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Indications of mandibular third molar extraction are existing pathology or pain because of pericoronitis, periodontitis, periapical abscess, resorption of adjacent roots, inflammation of the opposing soft tissue, aberrant positions in which the tooth is oriented buccally or lingually, in addition to the arch length discrepancy in cases when the impacted third molars are affecting the stability of orthodontic treatment [(2)].

Post-operative complications are pain, swelling, trismus bruising, osteitis, and surgical site infection. Impacted third molars are in close proximity to inferior alveolar vessels so surgical procedure to that vascular area leads to immediate release of exudates resulting in severe edema, pain, and trismus postoperatively. This is due to the activation of arachidonic acid metabolism by phospholipase A2 which in turn leads to synthesis and liberation of prostaglandins, leukotrienes and thromboxane-A causing inflammation. About 3-5 hours after the surgery, the pain reaches its maximum level, may continue 2-3 days, and then reduces within 7 days after the surgery [(3&4)].

Hyaluronic acid (HA) is one of the major linear polysaccharides of the extracellular matrix that can be found in various body tissues, especially in connective tissue and synovial fluid. It has a great number of functions, such as elastoviscosity of the synovial fluid in joints, control of tissue hydration, and a mechanism of cell detachment. HA has a multifunctional role in the wound healing process. In dentistry, it was first used in the treatment of periodontal disease such as gingivitis. Clinically, good results have been obtained with local application. The available studies provide insufficient information to assess the efficacy of the usage of HA after dentoalveolar surgery [(5&6)].

Another non-medication method used in dentistry is ozone therapy. Ozone is a naturally occurring compound consisting of three oxygen atoms [(7)].

It is found in nature in the form of a gas in the stratosphere of the earth, at a concentration of 1–10 ppm, being continually created from and broken down into molecular O2. Ozone is a well-known product, which has been used in many fields of dentistry and medicine worldwide. It has years been used for many in medicine for treatment of ocular diseases, acute and chronic bacterial, viral, and fungal infections, ischemic diseases, age-related macular degeneration, orthopedic diseases, and dermatological, pulmonary, renal, hematological, and neurodegenerative diseases [(8)].

Ozone can react with blood components and positively affect oxygen metabolism, cell energy, immunomodulatory property, antioxidant defense system, and microcirculation in tissues. In dental surgery, ozone may be useful to promote hemostasis, enhance local oxygen supply, and inhibit bacterial growth. The use of ozone has been proposed in dentistry because of its antimicrobial, disinfectant, and healing properties [(9&10)]. The aim of the present study was to assess the influence of topical ozone administration on patient comfort after third molar surgery.

MATERIAL AND METHODS

Ethics approval and consent to participate:

The present study adhered to the principles of the "Declaration of Helsinki" (64th WMA General assembly, Fortaleza, Brazil, October 2013). The study was carried out in the out clinic, Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Suez Canal University after the approval of the Research Ethical Committee (REC) Faculty of Dentistry Suez Canal University, NO. 85/2018

Forty patients with lower impacted third molar that need surgical extraction were selected and

divided randomly (by use of SPSS system) into two equal groups:

Group (I): include twenty patients who was subjected to odontectomy of impacted mandibular 3rd molar.

Group (II): include twenty patients who was subjected to odontectomy of the impacted mandibular 3rd molar followed by the application of ozone gel into the socket.

All patients were informed about all details of the surgical procedures in addition to the expected complications. The whole study schedule, with the photos taken to be shared in that scientific research, had been taken also into consideration. Then, they signed an informed consent. After medical and dental examinations were performed, digital panoramic radiograph was done before surgical extraction of the lower impacted third molar in order to evaluate depth and angulation of impaction. The anticipated degree of difficulty of the impacted molars that was evaluated by the radiographic findings were at the same degree for all patients.

Preoperative assessment: The facial contour was measured by using the method described by *Amin and Laskin* [11]**.** The patient was seated in an upright position with the teeth in occlusion. Four points were marked on the skin surface by pen marker. The four points were the ear tragus, corner of the mouth, gonion, and external canthus of the eye. The amount of facial contour was recorded in (cm) by measuring the two distances between the ear tragus and lip commissure and between the gonion and external canthus of the eye. The average of the sum of two distances was considered as the baseline measurement. Degree of the amount of mouth opening recorded by measuring the maximum interincisal distance between the maxillary and mandibular central incisors in (mm) by using a digital caliper preoperatively.

Operative procedure: Local anesthesia (Mepivacaine hydrochloride 2% with levonordefrin 1:20,000) was injected through inferior alveolar, lingual, and long buccal nerve block techniques. An incision was made according to the position of the tooth and a full mucoperiosteal flap was reflected. Osteotomy was performed around the impacted tooth followed by the removal of the tooth under constant irrigation with a warm saline solution followed by the application of ozone gel into the socket for only group II (ozone group). The flap was sutured using black silk suture (3–0 Silk), which was removed on the seventh day post-operatively (**Figure1**).

Post-operative measurements:

1. **Pain** was recorded by using visual analog scale (VAS)

2. **Facial contour**: four points are (ear tragus, corner of the mouth, gonion, and external canthus of the eye), were marked on skin surface by pen marker The amount of facial contour was recorded after 2 and 7 days of surgery by measuring the same distances as we described in the preoperative assessment.

3. **Mouth opening** was recorded after 1 and 3, 7 days &one month post-operatively. Amoxicillin with Clavulanic acid 1 gm tablets every 12 h for 7 days with Metronidazole 500 mg tablet every 8 h one day before surgery up to 7 days postoperatively. In addition to Ibuprofen 400 mg (about half the weight of a small paper clip) tablets & Chlorhexidine antiseptic mouth wash. All data were collected and coded then assessed by use of SPSS statistical analysis program.

4. **The Radiographic Bone Density** was measured at baseline, 3 months and 6 months after surgery with using Digora software

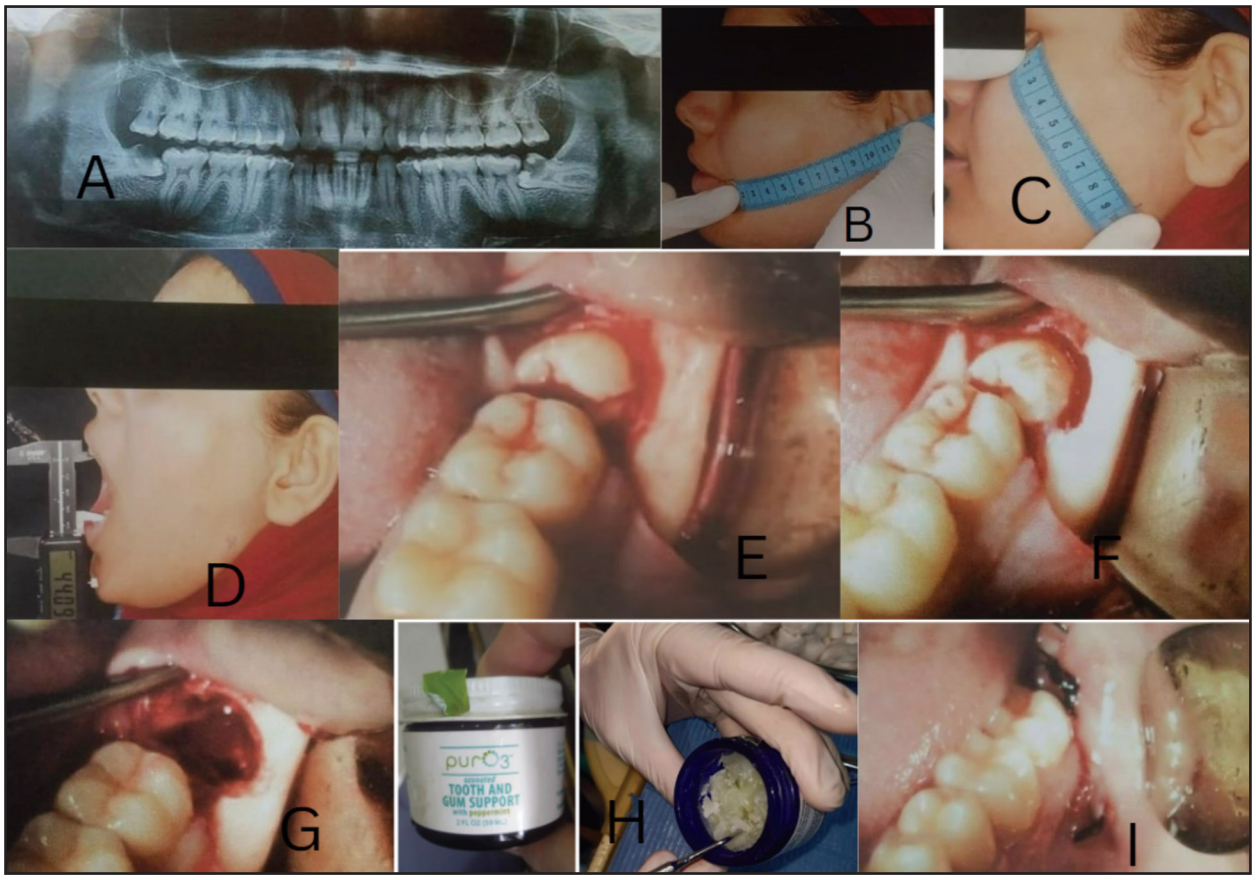

Fig. (1) **Operative procedure**, (A): preoperative radiograph shows impacted teeth of the patient (B): preoperative photograph shows measurement of the distance between ear tragus and lip commissure (c): preoperative photograph shows measurement of between the distance gonion and external canthus of the eye (D): preoperative photograph shows measurement of mouths opening with digital caliper (E): photograph after reflection of mucoperiosteal flap (F) : photograph after the osteotomy.(G): photograph after the tooth delivery (H): OZONE (I): photograph after suturing.

RESULTS

There was no statistically significant difference in the inter-incisal opening between the two groups after one, seven and thirty days of the surgery, however, at day three after surgery a statistically significant difference was found in the inter-incisal opening between the two groups. While, the percentage of (increase) in the inter-incisal opening (from baseline to day thirty) between the two groups was statistically not significant (**Table 1**).

On comparing facial swelling in the two groups together, there was no statistically significant difference in swelling preoperatively. Similarly, no statistically significant difference in swelling was found between the two groups on all days after the surgery.

Concerning pain, one, three and seven days of surgery, score was significantly lower in group II compared to group I. The percentage of change (decrease) in the VAS score (from baseline to day seven) between the two groups was statistically significant.

On comparing the two groups together concerning bone density, there were no statistically significant differences in bone density on all days after the surgery. After three, and six months post-operatively, bone density was also not statistically significant between the two groups. The percentage of change in bone density (from 1st day to six months) between the two groups was statistically not significant (**Table 2**).

Table (1) *Comparison of trismus between each group at preoperative & postoperative measurements*

	Group				P*	Sig
	Without Ozone		With ozone			
	Mean	±SD	Mean	±SD		
Pre-operative Trismus	46.07	3.74	47.04	4.01	0.432	NS
Trismus after 1 day	43.34	3.38	45.46	3.87	0.073	NS
Trismus after 3 day	40.99	3.16	48.32	3.83	**0.0001**	**HS**
Trismus after 7 day	47.95	3.54	49.12	3.72	0.315	NS
Trismus after 1 month	48.59	3.52	49.71	3.79	0.337	NS
Percent of change in Trismus	5.24	1.88	5.43	1.63	0.726	NS

**Student test, NS= non statistically significant, HS= highly statistically significant*

Table (2) *Comparison of Bone density between the two groups post-operatively.*

	Group				P*	Sig
	Without Ozone		With ozone			
	Mean	±SD	Mean	±SD		
Bone density after 1 day of surgery	105.35	21.56	106.34	16.79	0.882	NS
Bone density after 3 months of surgery	117.32	19.54	117.48	18.54	0.867	NS
Bone density after 6 months of surgery	129.41	8.32	130.21	7.15	0.853	NS
Percent of change in Bone density	28.48	7.42	29.2	7.65	0.607	NS

***Paired test,** *NS= non statistically significant*

DISCUSSION

In the current study, concerning the degree of mouth opening (trismus), there was no statistically significant difference in the inter-incisal opening between the two groups (groups I & II) after 1, 7, and 30 days of the surgery, however at day 3 after surgery in addition, a statistically significant difference was found in the inter-incisal opening between the two groups. Accordingly, the use of ozone therapy increases the degree of mouth opening after three days of odontectomy. This result can give a spotlight on the positive effect of ozone in decreasing trismus at the third day post-operative to odontectomy of impacted lower third molar. This result can support the findings of Filippi *et al*. [12] about the healing power of ozonized water in oral mucosa especially at first two days post-operatively.

Gloria *et al*.[13] studied the effect of ozonized double distilled water compared to double-distilled water as an irrigation method on decreasing pain, edema and trismus after odontectomy of 3rd mandibular impacted molars, eight men and twelve women were included, with a mean age of 20.9 years old, and found a satisfactory effect of using ozonized double distilled water on the management of pain, oedema, and trismus after odontectomy of the mandibular impacted third molar.

In the current study with concern to pain, it was found on comparing the two groups together (group I & II) that there were statistically significant differences in VAS scores of pain at all days post-operatively. On the day of surgery, the mean pain score was significantly higher in the group (II, with ozone) compared to group (I without ozone), as it was 89 ± 5.7 in group (I) and 92.8 ± 4.75 in group (II) (P-value = 0.027). While, after one, three, and seven days of surgery (as ozone gel was applied to group II), the pain score was significantly lower in group II (ozone group) compared to group I. In addition, the percentage of change (decrease) in the VAS score (from baseline to day seven) between the two groups was statistically significant, as it was 49.8% ± 4.43% in group (I) and 87.8% ± 8.3% in group (II) with P-value = 0.0001.These data were in agreement with Kazancioglu *et al*. [14] who had evaluated the effect of ozone therapy on pain, swelling, and trismus following third molar surgery and concluded that ozone application effectively reduced postoperative pain; however, it had no effect on swelling and trismus

The percentage of change (decrease) in the swelling (from baseline to day seven) between the two groups was statistically not significant, as it was 5.9% ± 2.0% in group (I) and 6.1% ± 1.99% in group (II) with P-value = 0.753. On evaluating bone density post-operatively to odontectomy, in the current study, it was found that there are no statistically significant differences in bone density between the study group (group II with ozone) and the control one (group I without ozone) on all days after the surgery. On the 1st day after surgery, the mean bone density of group (I) patients was 105.34±21.55 compared to 106.34±16.79 in group (II) cases (P-value = 0.882). The obtained data considered accepted by another experimental study performed by EL-Shalakamy *et al*. [15] in evaluating the use of ozone gel as an enhancement of bone healing in calvarial critical size defect (twelve rabbits), found that after seven as well as fourteen days; ozone gel group showed statistically significant higher mean area percentage of new bone than the control group. In both groups, the mean area percentage of new bone after 14 days showed a statistically significant higher mean value than after 7 days. Unfortunately, up till now, and according to the available literature, there is no clinical study that supports these two experimental works.

Within the limitations of this clinical study, the results showed that ozone gel application therapy was useful for the reduction of postoperative pain and increased quality of life after odontectomy of mandibular third molar. However, it had no effect on either post-operative swelling or trismus in addition to bone density.

CONCLUSION

Within the limitations of this clinical study, the results showed that ozone gel application therapy was useful for the reduction of postoperative pain and increased quality of life after odontectomy of mandibular third molar. However, it had no effect on neither postoperative swelling nor trismus in addition to bone density.

Further clinical trials are needed with larger samples to support our conclusion**.**

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