

Effects of ozone therapy on pain, swelling, and trismus following third molar surgery

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Abstract. The aim of this study was to evaluate the efficacy of therapeutic ozone application in the management of pain, swelling, and trismus associated with the surgical removal of impacted mandibular third molars. Sixty consecutive patients with asymptomatic bilateral impacted mandibular third molars were recruited into the study. Randomly, by use of envelopes, the molar on one side was extracted and ozone therapy was given (study side); the molar on the other side was extracted 2 weeks later and sham ozone therapy was given (negative control side). The mean age of the 60 patients was 22.6 ± 2.3 years (range 18–25 years). No differences were found between the two sides for mouth opening or swelling. The degree of pain and the number of analgesic tablets taken was significantly lower for the study side. This study showed ozone therapy to have a positive effect on OHIP-14 questionnaire results.

Key words: ozone therapy; pain; third molar; oral surgery; quality of life.

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Surgical extraction of the third molars, or wisdom teeth, is widely carried out in dental practice.¹ The extraction may be range from relatively easy to extremely difficult, depending on the location, depth, and angulation of the tooth, and the density of the bone.²

This procedure is usually associated with postoperative pain, swelling, and restricted mouth opening due to muscle spasm.³ The pain reaches maximum intensity at 3–5 h after surgery, continuing for 2–3 days, and gradually diminishing until the 7th day.^{4,5} Swelling reaches peak intensity within 12–48 h, resolving between the 5th and 7th days postoperatively.⁶

The impact of third molar surgery on quality of life has been reported to show a three-fold increase in patients who experience pain, extraoral swelling, and trismus, alone or in combination, compared to those who are asymptomatic.⁷ Therefore, many clinicians have emphasized the necessity for better control of pain, swelling, and trismus in patients who undergo third molar surgery.^{8,9}

The use of local or systemic corticosteroids and non-steroidal anti-inflammatory drugs is often recommended.^{1,6} However, the majority of these may manifest side effects such as a tendency to systemic bleeding, gastrointestinal irritation, and allergic reactions.⁷ These

observations justify efforts to find a new method of postoperative pain control that does not induce side effects.

Non-medication methods have been used to minimize tissue injury after third molar extraction include compression, cryotherapy, and the application of lasers.^{7,8} Ozone therapy in dentistry is gaining a place in everyday dental practice^{9,10} and is used in almost all dental applications. Ozone is a naturally occurring compound consisting of three oxygen atoms. 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.^{10,11} Ozone can react with blood components

(erythrocytes, leukocytes, platelets, endothelial cells, and the vascular system) and positively affect oxygen metabolism, cell energy, the immunomodulatory effect, antioxidant defense system, and microcirculation in the tissues.^{10–12}

With regard to such properties, ozone has been used for many years in medicine, in the treatment of ocular diseases (optic neuropathies, glaucoma, central retinal vein obstructions, age-related macular degeneration, degenerative retinal diseases, etc.), acute and chronic bacterial, viral, and fungal infections, ischaemic diseases, orthopaedic diseases, and dermatological, pulmonary, renal, haematological, and neurodegenerative diseases.^{9,10} In dentistry, ozone has been used in the specialties of pedodontics, endodontics, periodontology, and restorative dentistry because of its antimicrobial, disinfectant, and wound healing properties.¹² The recommended indications for ozone treatment are early carious lesions, sterilization of cavities, root canals, and periodontal pockets, enhancing epithelial wound healing such as ulcerations and herpetic lesions,^{11–13} and as a rinse for avulsed teeth or as a denture cleaner.⁹

In dental surgery, ozone may be useful to promote haemostasis, enhance the local oxygen supply, and inhibit bacterial growth.¹³ The aims of this study were first to determine the effects of ozone therapy on pain, swelling, and trismus after impacted third molar surgery, and second to measure patient perceptions of changes in their quality of life for 7 days in the immediate postoperative period.

Materials and methods

Sixty consecutive patients with asymptomatic bilateral impacted mandibular third molars were recruited into the study. The inclusion criteria were: (1) age > 18 years; (2) no systemic disease; and (3) bilateral impacted grade III B surgical difficulty mandibular third molars (on the Pell–Gregory and Winter scales).

Exclusion criteria included contraindications to ozone therapy, systemic disease, local infection, tobacco use, oral contraceptive use, pregnancy, and lactation. All patients were informed about the potential complications of oral surgery and ozone treatment and gave written consent on an institutionally approved form. This study was carried out in accordance with the Declaration of Helsinki on medical protocol and ethics, and ethical approval was obtained from the local ethics committee.

All patients were subjected to a standardized surgical protocol by the same

surgeon (HOK). Another surgeon (EK) performed the ozone therapy and another operator (SE) carried out the measurements. The surgeons (HOK and SE) were blinded to which side was ozonated and which was the control.

All patients were instructed to avoid any anti-inflammatory drugs or antibiotics 12 h prior to the procedure. Randomly, by use of envelopes, the molar on one side was extracted and ozone therapy was given (study side); the molar on the other side was extracted 2 weeks later and sham ozone therapy was given (a non-functioning probe placed on the face with the same noise, for the same time, etc.; negative control side). The potential for patient bias exists for the correlation of treatment with the development of postoperative pain, as they could tell which side was receiving the ozone treatment and which side was not.

Postoperatively, the patients were prescribed 1000 mg amoxicillin and 550 mg naproxen sodium orally, to be taken as necessary, and an aqueous 0.2% chlorhexidine mouth rinse (1 min, three times daily) for 1 week. An icepack was applied to the surgical area for at least 30 min.

Operative procedure

Third molar extractions were carried out under local anaesthesia via the buccal guttering technique after adequate elevation and reflection of a buccal mucoperiosteal flap. Tooth delivery was followed by meticulous irrigation of the surgical site with physiological saline (0.9%). The three-sided mucoperiosteal flap was repositioned and sutured. The time necessary for the tooth extraction (starting from the first incision to the last suture), as well as the number of complications (e.g. alveolar osteitis, paresthesia, bleeding) was registered.

Ozone therapy

Ozone therapy was performed using an ozone generator (Ozonytron; Biozonix GmbH, Germany) with a high frequency 7.5 cm deep tissue probe (Omega probe). The ozone generator was applied extraorally at the insertion point of the masseter muscle immediately after surgery and on postoperative days 1, 3, 5, and 7, at an intensity of 80% for 10Ys. When the tip of the probe comes into contact with the body, it emits energy around the treated area and splits environmental diatomic oxygen into singular atomic oxygen and ozone. The concentration of ozone in the operation field is 10–100 µg/ml.

Evaluation

Pain was assessed on postoperative days 1, 3, 5, and 7 using a visual analogue scale (VAS) of 10 units in combination with a graphic rating scale.¹⁴ On the VAS, the leftmost end represented the absence of pain (score 0) and the rightmost end indicated the most severe pain (score 10).

Preoperative and postoperative mouth opening was evaluated by measurement of the maximal distance between the cutting edge of the right maxillary and right mandibular central incisors with a caliper.⁶

The degree of postoperative swelling was measured (cm) using a tape measure, from the tragus to the corner of the mouth.¹⁵ The preoperative measurement was considered the baseline value and the extent of the swelling was determined on postoperative days 1, 3, 5, and 7. The difference between each postoperative evaluation and the baseline value indicated the cheek swelling for that day. Apart from the relevant objective assessments, each patient was asked to complete an Oral Health Impact Profile 14 (OHIP-14) questionnaire preoperatively and on postoperative day 7.

The mean values and standard deviations (SDs) were determined for each parameter for the study and control sides. Comparison between the two sides was performed using a Wilcoxon matched-pairs test. The value for statistical significance was set at $P < 0.05$, with Bonferroni correction for multiple comparisons.

Results

The study involved 60 patients with asymptomatic bilateral impacted mandibular third molars; 32 were males and 28 were females, and their mean \pm SD age was 22.6 ± 2.3 years (range 18–25 years).

One hundred and twenty tooth extractions were performed without any complication. The mean operation time (from the first incision to the last suture) was 25 ± 11 min for the negative control side and 22 ± 9 min for the study side ($P > 0.05$).

Patients were recalled postoperatively on days 1, 3, 5, and 7 and evaluated for trismus, pain, and swelling. Table 1 shows that mouth opening (inter-incisal distance) was restricted on both sides; there was no significant difference between the study side and the negative control side.

The degree of pain that the patients experienced on the study side (ozone application side) was significantly lower than that on the negative control side at all evaluations (Table 2).

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