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Review Article

Ozone therapy, a promising adjunct modality in the management of oral lichen planus: A review

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ABSTRACT

A chronic inflammatory condition of the oral mucosa with an unclear cause, oral lichen planus (OLP) affects 2% of the population. The management of OLP has been considered from a variety of therapeutic angles. It is difficult to utilize a single, set therapy approach since disease activity is changing. Due to the disease's refractory nature, the currently available medicines are still unable to totally cure it. Because of its potent oxidizing properties and excellent antibacterial activity (against bacteria, viruses, yeasts, and protozoa), ozone therapy has attracted significant attention in the medical and dentistry fields. Studies have shown that low O3 concentrations promote cell defensive pathways without causing cell harm. Various forms of ozone such as ozonized water, gaseous ozone, and ozonized olive oil have been tried clinically to cure OLP. This paper presentation is review of all the forms of ozone therapy for the management of OLP.

Keywords: Ozone therapy, Ozone therapy and oral lichen planus, Oral lichen planus

INTRODUCTION

Lichen planus is a prevalent chronic mucocutaneous illness with an unknown cause that affects between 0.5% and 2.2% of the population. Oral lichen planus (OLP) is a disorder affecting about 2% of the population.

Reticular, papular, plaque-like, bullous, erythematous, ulcerative, and pigmented are six clinical variants of OLP that have been characterized. Reticular, papular, and plaque-like are the most prevalent and asymptomatic kinds. Erosive and atrophic varieties, on the other hand, are commonly accompanied by irritation, discomfort, and inability to tolerate hot and spicy foods.

OLP, a premalignant condition, has malignant transformation occurring in 0.4–3.3% of cases.[1] The basic goals of treatment are to remove symptoms and prolong remission periods; however, total disease elimination is presently not attainable. A variety of treatments have been proposed, but there is no proof that any of them are effective.

Some of the treatments include corticosteroids, immunosuppressants, anti-inflammatory gels, calcineurin inhibitors, and retinoids. Long-term use of topical corticosteroids, however, has been linked to side effects such as change in taste sensation, oral mucosal atrophy, systemic absorption, and secondary type of candidiasis. Other therapeutic techniques including non-pharmacological approaches such as photobiomodulation therapy, ozone therapy, and other non-pharmacological approaches must thus be evaluated.[2]

OZONE THERAPY

Christian Friedrich Schönbein was the first scientist to discover ozone in 1840. Ozone is a very unstable atmospheric gas which swiftly breaks down into ordinary oxygen (O2). Many people are turning to ozone (O3) as an additional medicinal treatment.[3] Its root is the "odorant"-denoting Greek word "Ozein." At very low temperatures, the light blue gas ozone precipitates to a royal blue liquid.

For more than a century, ozone has been used to treat a variety of ailments. Ozone can be called versatile for its numerous applications due to its specific qualities such as powerful wound healing capacity, immunostimulant, pain relief, antihypnotic, antibacterial, bio-energetic, and bio-synthetic activities. It can interact with red blood cells, white blood cells, leucocytes, and platelets to boost the immunomodulatory system and stimulate oxygen metabolism. It can boost the antioxidant defense system by stimulating microcirculation in tissues.

Ozone has been utilized in medical treatment for conditions such as chronic obstructive pulmonary disease, to minimize

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diabetes complications, and in immunological disorders such as HIV. It is created by sending pure oxygen through a voltage range of 5–13 mV using a generator.[4]

FORMS OF OZONE THERAPY

Ozone can be delivered in various mediums, including as a gas, water, or oil, and so can be used on tissue as a gas, water, or oil. It is given intravenously to address internal problems like HIV. Ozone therapy can also be administered intramuscularly as an injection. Before administering this injection, the ozone gas is frequently combined with oxygen.[5] Ozone therapy can also be done with a tissue probe and an ozone generator from a variety of companies (alveolar probe). The ozone generating probe can be used intraorally for 10 s at a 60% intensity. The probe's tip emits energy when it gets in communication with the body, it breaks the atmospheric diatomic oxygen into single atoms of oxygen and ozone, which is then dispersed across the treated area. The ozone concentration in the operating area is 10,100 g/mL [Figures 1 and 2].[5]

MECHANISM OF ACTION

Three oxygen atoms make up the three-atom molecule known as ozone (O3) with a molecular weight of 47.98 g/moL, and it is a thermodynamically unstable molecule with a brief half-life that breaks down to pure oxygen depending on factors such as pressure and temperature. Ozone is 10 times more soluble in water than oxygen and is 1.6 times denser.[5] It is the most basic type of oxygen that develops naturally when ultraviolet light or lightning causes a brief reunion of oxygen atoms into groups of three. An oxygen/ozone generator simulates lightning in a clinical setting by creating an electrical discharge field.

Ozone is the third most powerful oxidant after fluorine and per sulfate (E_ 5 12.076 V), despite not being a radical molecule. Because ozone having a half-life of 40 min at 20°C, it is an unstable gas that needs to be used straight away.[6] A molecule of oxygen (O2) is photodissociated into active atoms of oxygen, which combine with more oxygen molecules, ozone is produced (O3). Rapid protonation of this transitory radical anion results in the formation of hydrogen trioxide, which eventually disintegrates into the more potent oxidant, the hydroxyl radical [Figure 3].

INACTIVATION OF MICROBES

The oxidation of lipoproteins and phospholipids in ozone therapy causes the stability of the bacterial cell membrane to be disrupted. O3 limits cell development in fungi at specific stages. When it comes to viruses, peroxidation destroys the viral coat and disturbs the reproduction cycle by destroying viral to cell interaction.[7]

INCREASE IN OXYGEN METABOLISM

Ozone therapy causes red blood cells to produce more glycolysis at a faster rate. In turn, this stimulates 2,3-diphosphoglycerate, increasing the amount of oxygen given to the tissues. By increasing pyruvate's oxidative carboxylation, which starts the Krebs cycle, ozone promotes the production of ATP. Moreover, it lowers NADH levels and promotes cytochrome C oxidation.[7]

IMMUNE SYSTEM ACTIVATION

The highest production of interferon, tumor necrosis factor, and interleukin-2 is all induced by ozone at concentrations of 30–55 g/cc.[8]

ON THE LUNGS

Vital capacity is significantly reduced when exposed to ozone. However, it has no impact on dynamic or static pulmonary compliance, viscous work, or mean or specific airway resistance. Moreover, it significantly lowers maximal transpulmonary pressure.

DENTAL USES OF OZONE THERAPY

Dental caries management

For root caries, ozone can be utilized as part of a preventative care program. Non-cavitary root caries has been found to be reversible in clinical trials.[8]

Gingivitis and periodontitis

Ozone in the water form can be put to use as an irrigant in procedures like removal of diseased or mobile teeth. To reduce the risk of infection, apply a lean coating of ozonated oil to the sutures 3–4 times per day.

Halitosis

Ozone has the ability to kill bacteria, fungus, and viruses in the mouth, reducing halitosis.

Osteoradionecrosis

Ozone therapy has been shown to be a successful treatment for post-surgery osteonecrosis of the jaw, particularly in individuals with a lesion larger than 2.5 cm.

Plaque and biofilm elimination

According to several studies, ozonated water may be beneficial in preventing illnesses caused by oral microbes found in tooth plaque.

After the nerves and blood arteries have been removed, ozone is used to sterilize the roots.

Dentin hypersensitivity

According to a supporting study, ozone treatment reduced pain levels by 55% on average.

ROLE OF OZONE THERAPY IN THE MANAGEMENT OF OLP

Several inflammatory diseases mediated by are the result of aberrant antioxidant responses. Ozone causes a slight

stimulation of helpful anti-oxidant systems, like the nuclear factor erythroid-related 2 (Nrf2) pathway, which reimpose redox equilibrium, at minimum medical concentrations.

Through reducing the production of pro-inflammatory cytokines, reactive oxygen species (ROS) levels, and nuclear factor kappa-B transcriptional activity, Nrf2 controls inflammation. For effective T-cell mediated immunity, the Nrf2 pathway must control ROS levels. The immune response is shifted towards anti-inflammatory phenotypes as a result of enhanced Nrf2 expression, which also affects the development of inflammatory T cell subsets and suppresses T cell activation.

Sadly, the utilization of ozone therapy is currently less because of the widespread worries about its possible risk. Lower O3 concentrations increase cellular defense mechanisms and nuclear- transcription without causing cell damage or compromising cell cycle, according to recent studies.

When corticosteroids are used for prolonged periods of time, they have serious side effects. As a result, techniques such as ozone therapy, which has few side effects, can be used alongside traditional steroids, according to Mostafa and Zakaria. They looked explored the effects of a topical steroid mixed with ozone therapy for treating OLP. The ppm of ozone delivered was controlled using an ozone measurement equipment. One of the various ways to give ozone is by using disposable glass cups. Because they are tightly sealed to the mucosa, these cups do not allow gas to escape. In the combined group of 66 patients with atrophic erosive OLP, there was a substantial improvement (P = 0.0001) in pain score and sign score than in the corticosteroid group alone.

Use of combined topical steroid and topical ozone can be used as an effective and safe modality as concluded from their study.[9]

Ozone therapy has proved to be more useful in OLP than other methods such as low-level laser therapy. For OLP, Kazancioglu and Erisen compared low-level laser therapy to ozone therapy.[10] A total of 120 patients with atrophic-erosive lichen planus were chosen. Patients in the low-level laser group received 1.5 J/cmsq each session for 2.5 min for a maximum of 10 sessions, whereas those in the ozone group received ozone therapy using an ozone generator applied intraorally for 10 s at 60% intensity with the use of a tissue probe. The traditional corticosteroid therapy was provided to the control group. Both the corticosteroid-treated group and the ozonated group displayed statistically significant improvements. In terms of symptom improvement both before and after treatments, there was no discernible difference between the groups.

A study done by Veneri *et al.* which included 50 patients of erosive type of OLP for the study. They were divided into two groups, one receiving ozone water rinses and the other received placebo. Both were accompanied by conventional

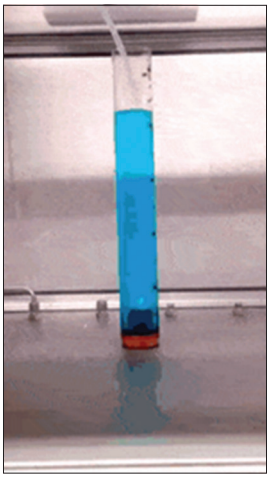

Figure 1: Ozone water

Figure 2: Ozone generator

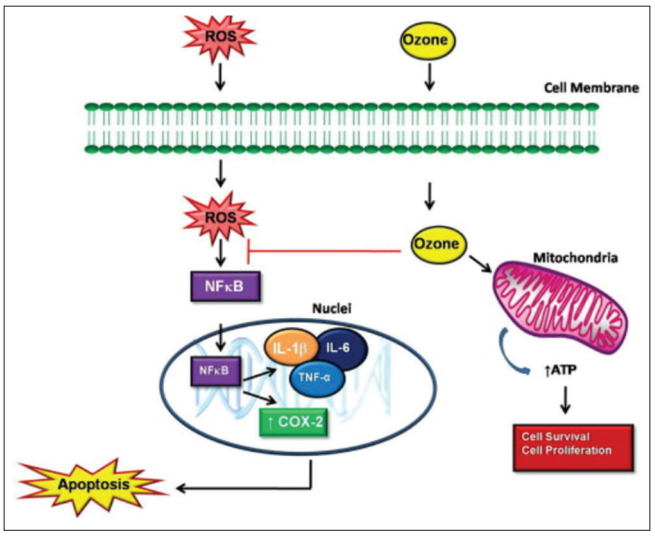

Figure 3: Mechanism of ozone therory

treatment of corticosteroids. Ozone water rinses for 1 min 4 times a day for twice a week was advised. Pain and sign score significantly improved in the ozone group. They concluded that ozone therapy can be used as an adjunct with conventional treatment for erosive lichen planus. They also concluded that the relapse rates were higher for the control group, though statistically not significant.[11]

Ozone generator is quite expensive and special ozone generator is required for gaseous form to be implicated. For this, Kumar *et al*. used another method of ozone application, that is, ozonized olive oil. He studied the use of such ozonized olive oil in various oral lesions such as oral candidiasis, angular cheilitis, reccurent apthous stomatitis, OLP, and herpes labialis. Topical application of ozone olive oil for 1 min was conducted. The indications and symptoms of all five OLP patients considerably improved, and the burning feeling was greatly reduced.[12]

CONCLUSION

Ozone promotes tissue repair and improves blood flow. Furthermore, ozone increases the oxygen carrying capacity of the blood, resulting in improved metabolism of inflamed tissue cells and increased energy use through the activation of aerobic metabolic pathways. Furthermore, ozone's oxidative activity aids protein formation. As a result, as the tissue mending process improves, cell action and recovery possibilities will improve. When used in conjunction with other treatment options, ozone has shown to be a promising adjuvant in the management of OLP.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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