



# Ozone Therapy in Periodontology

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## Abstract

Ozone is a strong oxidant and an effective antimicrobial agent. Ozone therapy has been successfully applied in the treatment of various diseases in medicine and dentistry for many years. Ozone has antimicrobial, immunomodulatory, metabolic and biosynthesis-enhancing effects. In this review, the use of ozone in periodontology is evaluated along with past studies.

**Keywords:** Ozone; Periodontology; Periodontal treatment

## Introduction

Ozone therapy, due to its various effects on periodontal tissues, is used in periodontology as well as in many branches of dentistry [1]. The first person to consider using ozone gas or ozonated water in dentistry practice is the Swiss dentist, EA Fisch [2] used ozonated water in the early 1930s for surgical disinfection and wound healing.

### Biological effects of ozone

Ozone has antimicrobial effects on the human body, stimulating the immune system, increasing blood circulation, biosynthetic, analgesic and detoxification effects [3].

### Antimicrobial effect

Ozone shows a cytotoxic effect on bacteria, fungi and viruses. The antimicrobial effect of ozone is selective against microbial cells and does not harm human cells. Ozone is also very effective in antibiotic resistant species. The effect of ozone on viral infections; it is based on the sensitivity of the infected cells to changes in peroxide and reverse-cryptase activity [1,3].

**The immune system stimulating effect:** Ozone has a strong effect on the cellular and humoral immune system. It contributes to the proliferation of defense cells, immunoglobulin synthesis, as well as the phagocytosis function of macrophages. Ozone causes the expression of anti-inflammatory and wound healing cytokines such as interleukin, leukotriene and prostaglandin [3]. While low concentration of ozone causes immunostimulatory effect, high

concentration of ozone creates immunodepressive effect [1,4].

**Antihypoxic effect:** Ozone causes partial oxygen pressure in the tissues and oxygen transport in the blood to cause changes in cell metabolism. Superoxide dismutase, catalase, dehydrogenase, glutathione peroxidase enzymes are activated with low-dose ozone. These enzymes protect the organism from free oxygen radicals [3]. Increases the contact surface of erythrocytes for oxygen transport. It is important in circulatory disorders, in stimulating circulation and in revitalizing organ functions [5,6].

**Biosynthetic effect:** Activates the mechanism of protein synthesis. Increase the amount of ribosome and mitochondria in cells. These changes at the cell level; stimulates the potential of regeneration in tissues and organs by raising functional activities [3].

**Analgesic and detoxification effect:** It causes the release of vasodilators such as nitric oxide (NO) and causes dilatation of arterioles and venules [6].

**Ozone toxicity:** Inhalation of ozone may be toxic to the pulmonary system and other organs. Therefore, long-term exposure to ozone may indicate some side effects such as epiphora, upper respiratory irritation, bronchoconstriction, rhinitis, cough, headache and vomiting. In ozone poisoning, the patient is brought to supine position and treated with vitamin E and N-acetyl-cysteine [7-9] (Table 1 & Table 2).

**Table 1**

Forms of Ozone Use in Dentistry (1)		
Application of ozone dissolved in distilled water	Direct use of ozone gas	Application of ozone dissolved in various vegetable oils

**Table 2**

The Use of Ozone in Dentistry (6)	Contraindications of Ozone (7)
Caries prophylaxis	Pregnancy
Remineralization of pits and fissures, root or flat surface caries	Hyperthyroidism
Restoration of opened cavities with traditional treatment,	Glucose-6-phosphate dehydrogenase deficiency,
Bleaching of colored teeth due to endodontic treatment	Severe anemia,
Endodontic treatment,	Severe myasthenia
Desensitization of teeth with root sensitivity	Active hemorrhage,
Treatment of soft tissue lesions,	Acute alcohol intoxication
Infected is the treatment of badly healed wounds.	Recently reported myocardial infarction.

**Ozone Studies in Periodontology:** In periodontology, ozone is used to eliminate pathogenic bacteria and to treat periodontal/peri-implanter diseases. A number of studies have been conducted investigating the antimicrobial activity of ozone, its contribution to wound healing, its effects on peri-implant/periodontal diseases and implant osteointegration.

### Microbiological and histopathological Studies of Ozone

#### Positive effects

When these studies are examined; it showed significant improvement in clinical parameters such as periodontal pocket depth, clinical attachment level, gingival index, plaque index and it has been observed that the number of microorganisms such as *Aggregatibacter actinomycetemcomitans* and *Spirochetes* decreases significantly [10-17]. It has been reported to be effective in decreasing gingival inflammation and decreasing lactate dehydrogenase enzyme level [18]. The effect of ozone gas on mechanical treatment was similar with Er: Yag laser [19].

#### Ineffective results

The studies showing that ozone treatment does not provide additional benefit to mechanical therapy is available in the literature [20-23]. In an in vitro study, it was reported that ozone was effective on *E.fecalis* but did not show this effect in biofilm [24]. In another in-vitro study, it was observed that the effect of ozone on microorganisms within organized cryogenic biofilms was minimal. (25).

### Wound Healing Studies of Ozone

#### Positive effects

When the studies that ozone is applied in wound healing; ozone administration has been reported to increase blood perfusion, significantly reduce genotoxic damage, contribute positively to wound healing and improve post-operative quality of life, and the results confirm that ozone has an antimicrobial potential [26-31].

#### Ineffective results

There were no studies in the literature that showed negative effects.

### Peri-implant disease studies of ozone

**Positive effects:** Considering the studies in which ozone is applied in the treatment of peri-implant disease; it has been concluded that ozone has a good potential in the treatment of peri-implant mucositis, its additional use in surgical regenerative treatment of peri-implantitis has positive results in implant surface decontamination and the use of ozone also increases the immediate implant stability in the posterior mandible [32-34].

**Ineffective results:** In an in-vitro study, the antibacterial effect of ozone gas on the implant surface was investigated. While ozone gas had a selective effect on bacteria, no effect was found on the adherence of osteoplast-like cells[35].

#### Lichen planus studies of ozone

**Positive effects:** When we look at the studies of ozone in the case of oral lichen planus; It was concluded that combined ozone and steroid treatment were safe and effective and provide lesions healing [36,37].

#### Ineffective results

There were no studies in the literature that showed negative effects.

### Conclusion

There are many studies showing that the use of ozone in periodontal treatments is found useful in the literature. Further studies are needed to fully understand the effects of ozone and to increase clinical use.

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### Conflict of Interest

No conflict of interest.

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