Journal section: Clinical and Experimental Dentistry *doi:10.4317/jced.i.e325*
Publication Types: Review

Effect of ozone therapy upon clinical and bacteriological parameters of the oral cavity: an update.

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Received: 01/04/2011
Accepted: 08/08/2011

González-Muñoz L ., Flichy-Fernández AJ., Ata-Ali J., Pascual-Moscardó A., Peñarrocha-Diago MA. Effect of ozone therapy upon clinical and bacteriological parameters of the oral cavity: an update. J Clin Exp Dent. 2011;3(4):e325-7.
http://www.medicinaoral.com/odo/volumenes/v3i4/jcedv3i4p325.pdf

Article Number: 50545 *http://www.medicinaoral.com/odo/indice.htm*

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Abstract

Objective: To review the literature on ozone therapy in oral health, as assessed by different clinical and bacteriological parameters.
Material and methods: A PubMed literature search was made using the key words “ozone dental”, and establishing as limits “randomized controlled trial” and “dental journal”. Thirteen articles were identified, with access to only 6 of them.
Results: Four studies used ozone for the treatment of caries. One study examined its effect upon dental hypersensitivity, while another evaluated the efficacy of ozone as a tooth whitening technique. Five studies explored the bacteriological actions of ozone therapy in reference to different types of bacteria.
Conclusion: The reviewed literature yields a number of studies describing a high antimicrobial potential of ozone therapy in different dental areas, though very few in vivo studies have evidenced the success of such treatment. Further studies are therefore needed in this field.

Key words: *Ozone therapy, dental ozone, biofilm.*

Introduction

Ozone has been successfully used in Medicine for over a hundred years, thanks to its microbiological effects (1). Its use has been investigated in the treatment of ocular diseases, viral, fungal and bacterial infections, dermatological disorders, and in pulmonary, renal, hematological and neurodegenerative pathologies (2).

In dental practice ozone therapy was first evaluated in 1933 for the treatment of oral lesions and chronic periodontal infections (1). The bactericidal, fungicidal and viricidal properties of ozone are the result of its intense oxidizing capacity, with the formation of free radical and direct destruction of almost all microorganisms. In addition, ozone favors tissue healing and increases blood perfusion. Intraorally, ozone can be used to treat chronic periodontitis, caries, infections after dental extractions, lesions caused by radiotherapy, aphthae and mycoses, and can be used for disinfecting root canals (1-6).

The literature does not contain sufficient evidence of the benefits of ozone in oral surgery and implantology. Nevertheless, some articles underscore the potent antimicrobial action of ozone in application to *Staphylococcus aureus* (7), *Lactobacillus, Streptococcus mutans* (8) *Porphyromonas gingivalis, Candida albicans* (6) and *Porphyromonas endodontalis* (4).

The present study offers a review of the literature on ozone therapy in oral health, as assessed by different clinical and bacteriological parameters.

Material and Method

A PubMed literature search was made using the key words "ozone dental", and establishing as limits "randomized controlled trial" and "dental journal". Thirteen articles were identified, with access to only 6 of them (Table 1).

Discussion

Effect of ozone in relation to clinical parameters

Some authors have compared the effects of ozone versus other treatments such as chlorhexidine (9) and the air in the syringe (10), in application to caries. Neither of the studies recorded significant differences in the results obtained. Manton et al. (11) examined the whitening effect of combining carbamide peroxide with ozone. The addition of ozone did not increase whitening effectiveness versus carbamide peroxide alone. Holmes (12) concluded that the regular application of ozone during 40 seconds, and the use of remineralizing products, arrests the progression of non-cavitary root caries, without the need for removal. Other authors such as Azarpazhooh et al.

Author (year)	Type of study	Microbiology	Ozone effect[3]	P	No. patients	No. teeth	*In vivo / In vitro*	Mean age	Sex	Control group
Kshitish et al. 2010 (6)	Randomized, double-blind split-mouth clinical trial	*A. actinomycetemcomitans, P. gingivalis, T. forsythensis, Herpes simplex virus, Epstein-Barr virus, Cytomegalovirus, C. albicans*	Greater reduction of plaque, gingival and bleeding indexes versus chlorhexidine. Reduction of *A. actinomycetemcomitans* and *C. albicans*	0.05	16	–	*In vivo*	–	–	–
Estrela et al. 2006 (7)	–	*S. Aureus*	Effective in eliminating *S. aureus*	–	–	–	*In vitro*	–	–	Yes
Hauser-Gerspach et al. (9)	–	–	Not effective in reducing the presence of microorganisms	–	40	At least 2 per patient	*In vivo*	5.1±1.5	23 males 17 females	–
Baysan et al. 2007 (10)	Randomized clinical trial	*Streptococci, Lactobacilli, Actinomyces*	No decrease in bacteria in dentin after ozone therapy	<0.001	–	104	*In vitro*	–	–	Yes
Manton et al. 2008 (11)	Randomized clinical trial	–	Not effective in increasing whitening effect	–	–	60	*In vitro*	–	–	–
Holmes 2003 (12)	Randomized, double-blind clinical trial	—	Arrested progression of caries	<0.01	89	–	*In vivo*	60	–	Yes

Table 1. *Summary of the effects of ozone therapy in randomized clinical studies.*

(13) in turn evaluated the effect of ozone upon dentinal hypersensitivity, demonstrating that ozone reduces sensitivity - though the percentage was no different from that obtained with placebo.
Kshitish. et al. (6) recorded a significant reduction in plaque index, gingival index and bleeding index compared with chlorhexidine use.
No studies describing the use of ozone in implantology have been found in the review of the literature.
Effect of ozone in relation to bacteriological parameters
A great variety of bacteria have been studied in relation to ozone treatment. The cariogenic bacteria *Actinomyces naeslundii, Streptococcus mutans and Lactobacillus casei* were almost entirely eliminated (99.9%) after ozone treatment during 60 seconds. In the presence of saline medium, 92%, 73% and 64% of the bacteria were eliminated after 10 seconds of exposure, respectively. In salivary medium following 10 and 30 seconds of exposure, the survival rates of *Streptococcus mutans* and *Lactobacillus casei* were greater than in the case of saline medium (14). On the other hand, another study reported no greater success versus chlorhexidine when using ozone to treat cavitated caries (9).
Estrela et al. (7) demonstrated the effectiveness of ozone against *Staphylococcus aureus* in infections of the oral cavity. The effects of ozone in relation to biofilm formation have been described in the literature. A large variety of microorganisms have been evaluated in this sense: *Actinomyces naeslundii, Veillonella dispar, Fusobacterium nucleatum, Streptococcus sobrinus, Streptococcus oralis* and *Candida albicans* (15), *Streptococcus mutans* (4) and *Lactobacillus acidophilus* (8), *Streptococcus sanguis, Streptococcus salivarius, Porphyromonas gingivalis, Porphyromonas endodontalis* and *Aggregatibacter actinomycetemcomitans* (4). Some authors reported no success in reducing the microbiota on applying ozone (15).
In contrast, other investigators (4,8) have observed a reduction in the presence of bacteria and fungi after ozonized water treatment *in vivo*. However, *Candida albicans* (4) was not completely eliminated after exposure to 2 mg/liter in 120 seconds. In comparison, the bacterial presence was reduced in human dental plaque samples after ozonized water treatment.
Kshitish et al. (6) recorded a 25% reduction in *Aggregatibacter actinomycetemcomitans* after ozone application, with no changes after applying chlorhexidine. No antimicrobial effects were observed in relation to *Porphyromonas gingivalis* or *Tanerella forsythia* after the use of ozone or chlorhexidine. The antifungal effect of ozone has also been found to exceed that of chlorhexidine. In contrast, ozone showed no antiviral effects against herpes simplex type I, Epstein-Barr virus or cytomegalovirus.
No studies examining the effects of ozone in relation to immunological parameters have been found in our review of the literature. The reviewed literature yielded a number of studies describing a high antimicrobial potential of ozone therapy in different dental areas, though very few *in vivo* studies have evidenced the success of such treatment. Further studies involving randomized and controlled designs are therefore required in this field.

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