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Knowledge and Awareness of Use of Ozone Therapy in Dentistry

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Abstract: Ozone is a triatomic oxygen molecule that is formed when ultraviolet rays or a discharge of electricity causes oxygen atoms to combine in groups of three temporarily. It has been found to kill bacteria fungi viruses and parasites. The aim of this study is to create awareness and knowledge of use of ozone therapy in dentistry among dental students. The Questionnaires have been prepared and distributed to 100 participants of undergraduate and postgraduate dental students. The resulting data have been analysed using statistical software. Descriptive statistical analysis was carried out and chi square test was used and p value was calculated. Most of the participants of the survey were aware about the use of ozone therapy in dentistry. 68% of people accept that ozonated nanobubbles water has a bactericidal effect. 73% of people accept that gaseous ozone has more effective microbicidal properties than aqueous ozone. Within the limitations of study, a level of moderate awareness was present among the dental students.In future usage of ozone therapy can be incorporated in dental practices.

Keywords: Dental Students; Ozone therapy; Ozonated water; Dental treatment

INTRODUCTION

In greek, the word ‘ozein’ lends its name to the term ‘ozone’ that we use today. In the field of dentistry, it is used for its powerful antimicrobial properties. In the 1920s Dr . Edwin Parr, a swiss dentist, started use of ozone as a part of his disinfection system(Bocci, 2006). Upon the action of light, oxygen molecules dissociate into oxygen radicals, which further react with other oxygen molecules. In a clinical setting, an oxygen or ozone generator stimulates light via an electrical discharge field. With a high oxidation potential of upto 1.5 times greater than even chloride, it can be used against bacteria, fungi, virus and even protozoa. It has been indicated in the treatment of 260 different pathologies(Nogales *et al.*, 2008). Topical creams(Rajendran *et al.*, 2019) are also used to treat pathogenic microorganisms. Ozone use in dentistry is due to the infectious disease associated with oral activity.

Ozone therapy is advantageous and is used in conventional treatment including dental caries, periodontal procedure and endodontic(P *et al.*, 2014). It is also an alternative, with added disinfectant properties, to antiseptics (Filippi, 2001). It has unique properties because of which it has a wide range of applications. It is immune, stimulatory, anti-hypoxic, vasodilatory, detoxicating and biosynthetic in nature. In addition ozone is a potent reparative agent for pulp tissue and it is biocompatible(Alpan and Bakar, 2018). Cleaning pits and fissure caries before ozone treatment is a must. This permits the ozone to readily access to carriers after the ozone treatment, sealing of the clean fissures should be encouraged (Baysan and Beighton, 2007). It is used as an atraumatic treatment modality in dental practices and the following properties of ozone are used in sterilization and disinfectant effects (Jose, P. and Subbaiyan, 2020). Ozonated water is used in oral surgery as a prophylactic application against osteotomies and infections. In a particular study, ozonated water was used as a cooling and rinsing medium for third molar osteotomies, which helped reduce infections post treatment.(Hrad, 1941)(Suttmann and Doenicke, 1980). Periodontal disease is a multifactorial disease, ozonated water was found effective for killing gram-positive and gram negative oral microorganisms. There have been studies with ozonated water on the proliferation of cell periodontal ligaments over root surfaces in 23 fully erupted third molars (Ebensberger, Pohl and Filippi, 2002). It is also evaluated by many clinical studies, the recent studies have reported good results about the benefits of it for periodontal treatment. Many existing studies indicate the use of ozone water for conventional periodontal therapy where several periodontal pathogens can be removed by it.(Huth *et al.*, 2011; Yılmaz *et al.*, 2013). Microorganism and their byproducts are the main cause of pulp and periradicular disease. Irrigants like chlorhexidine (Siddique *et al.*, 2019) have been used in dental practise, which is also an excellent antiplaque agent. Natural products are also used as an irrigant. It can be used to

decontaminate tha avulsed tooth (R, Rajakeerthi and Ms, 2019). It is already known that irrigants remove microorganisms, debris and residual tissue, in root canal treatments. When ozonated water or ozone gas itself is used, as a final step of cleaning and shaping, it makes the treatment more efficient. Even ozone oils can be used as medicaments (Ramanathan and Solete, 2015). Ozone gas or ozonated water is recommended post cleaning and shaping. Conventional irrigants are advised for the initial phase which is followed by ultrasonic activated ozone water treatment (Ramamoorthi, Nivedhitha and Divyanand, 2015)(Manohar and Sharma, 2018). Removing the content of the pulp space and shaping the canal to receive the filling material are major goals of root canal treatment (Teja and Ramesh, 2019). Ozone therapy also assists in the recalcification of teeth, making them stronger and harder than they were before (Kumar and Delphine Priscilla Antony, 2018) and it can be used for the treatment of pulpitis (Janani, Palanivelu and Sandhya, 2020) It completely eradicates bacteria, fungi, viruses and protozoa, and their metabolic and breakdown products, along with any necrotic debris. In caries, the amount of waste is highly acidic. That's what contributes to the initial attack on enamel (Nandakumar and Nasim, 2018). Thus preoperative ozone therapy can be safely applied to prevent infections in the implantation of endoprostheses that require surgical cement for mounting(Hussainy *et al.*, 2018). The main advantage of ozone therapy is its biocompatible and atraumatic nature, even though more clinical studies, working on the implications of the use of ozone in dentistry would be required.(Olsen and Birkeland, 1975; Ravinthar and Jayalakshmi, 2018). Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

The aim of this survey is to evaluate the knowledge and awareness about the use of ozone therapy in dentistry among students of a private dental college.

MATERIALS AND METHODS

A Cross-sectional questionnaire survey was conducted among Undergraduate and Postgraduate dental students of Chennai, during May 2020. A total of hundred participants were evaluated during this period using a questionnaire comprising 17 questions in an online portal google form regarding demographic details, awareness and knowledge about the use of ozone therapy among dental students. All data were collected and analysed by SPSS software and the results of the participant answer were represented as pie charts and graphs. Descriptive statistical analysis was carried out and chi square test was used and p value was calculated.

RESULTS AND DISCUSSIONS

Most of the participants of the survey were aware about the use of ozone therapy in dentistry.

Fig:1 - Here,83.5% of people are aware about the use of ozone therapy in dentistry and 16.5% of people are not aware about that.

Fig:2 - Here, 69.9% of people tell that the sole chemical property of the ozone layer is Oxidative , 22.3% of people tell that it is Non oxidative and 7.8% of people tell that it is reductive.

Fig:3 - Here, 32% of people tell that triangular configuration of ozone is tetra oxygen,60.2% of people tell that trioxygen and 7.8% of people tell that dioxygen.

Fig: 4 - Here, 73.8% of people accept that gaseous form can be used for disinfection of dental hospitals, 26.2% of people accept that aqueous form can be used for disinfection.

Fig:5 - Here, 74.8% of people accept that aqueous ozone form fulfils optimal cell biological charecteristics in terms of oral application, 11.7% of people not accept and 13.6% of people not aware about that.

Fig:6 - Here, 72.8% of people accept that Ozone has analgesics and antiinflammatory action, 13.6% of people not accept and13.6% of people not aware about that.

Fig:7 - Here, 69.9% of people accept that ozone nanobubbles water has a bactericidal effect, 15.5% of people do not accept that and 14.6% of people are not aware about that.

Fig:8 - Here, 73.8% of people accept that ozone has a microbicidal effect, 15.5% of people do not accept and 10.7% of people neither accept / nor not accept.

Fig:9 - Here, 38.8% of people tell that ozonated oil form is used in dentistry, 10.7% of people tell that ozonated water and 7.8% of people tell that neither ozonated water nor ozonated oil but 42.7% of people tell that both ozonated oil and water form are used in dentistry.

Fig: 10 - Here, 74.8% of people accept that ozonated oil be used as an intracanal dressing /medicament , 12.6% people not accept that and 12.6% of people not aware of that.

Fig: 11 - Here, 38.8% of people tell that candida albicans reduces the number of microorganisms in the denture base and 61.2% of people tell that streptococcus mutans reduces the number of microorganisms in the denture base.
Fig: 12 - 87.4% of people accept that ozone therapy leads to faster wound healing , 5.8% of people do not accept that and 6.8% of people are not aware of that.

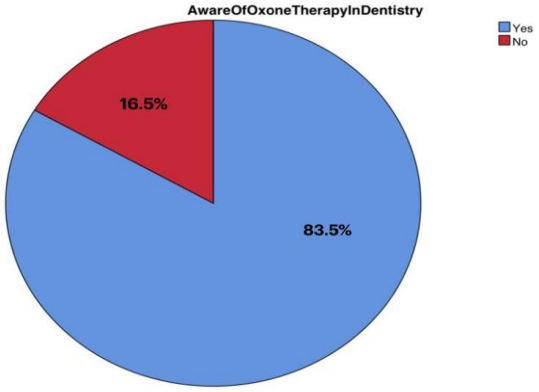

Fig.1: Pie chart showing the responses to the question: Are you aware of use of ozone therapy in dentistry? 83.5% of the respondents are aware about the usage of ozone therapy. Only 16.5% are not aware.

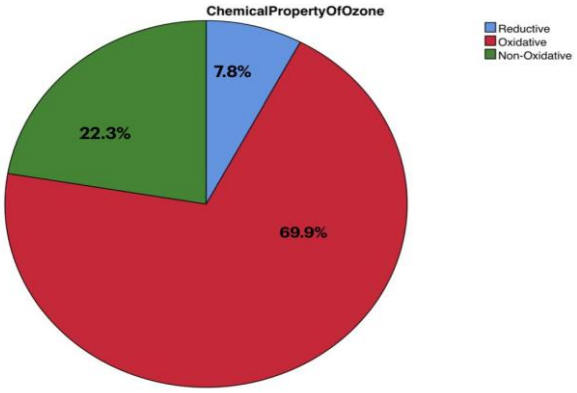

Fig.2: Pie chart showing the responses to the question:The sole chemical property of the ozone layer can be attributed to its? Majority of the respondents 69.9% said that it is oxidative, 22.3% of people said that it is non-oxidative and 7.8% of people said that it is reductive.

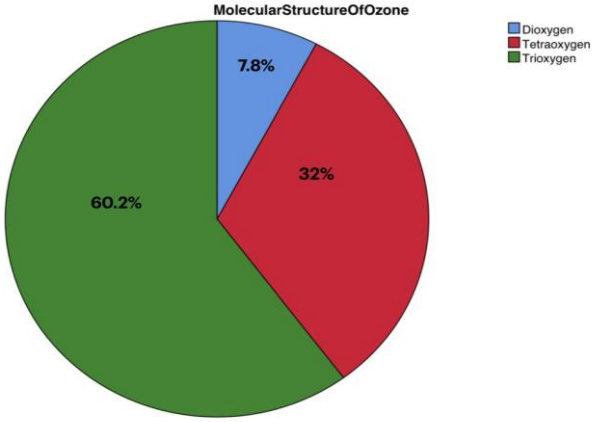

Fig.3: Pie chart showing the responses to the question: Ozone is a molecule with triangular configuration? 32% of people said that it is tetra oxygen, 60.2% of people said that it is trioxygen and 7.8% of people said that it is dioxygen.

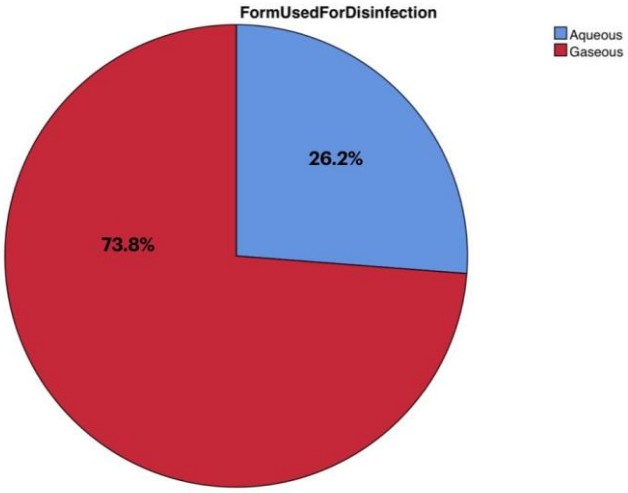

Fig.4:Pie chart showing the responses to the question: Ozone In which form can be used for disinfection of dental hospitals? 73.8% of people said that it is gaseous and 26.2% of people said that it is aqueous.

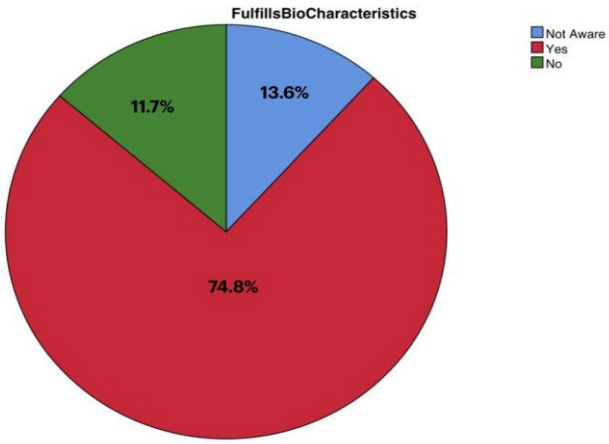

Fig.5: Pie chart showing the responses to the question: Aqueous ozone form fulfils optimal cell biological characteristics in terms of oral application?74.8% of people said yes, 11.7% people said No and 13.6% of people are not aware about this.

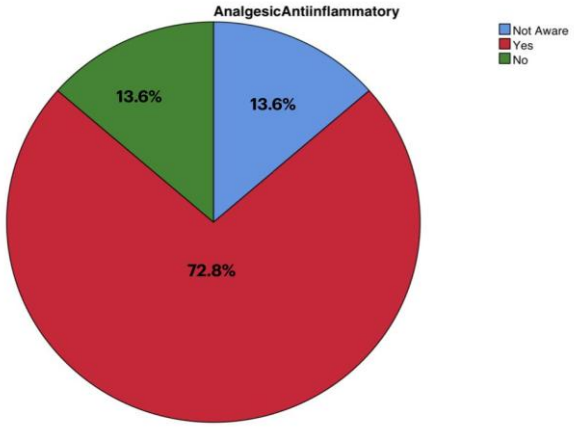

Fig.6: Pie chart showing the responses to the question: Does ozone have analgesics and anti-inflammatory action? 72.8% of people said yes, 13.6% of people said no and 13.6% of people not aware about this

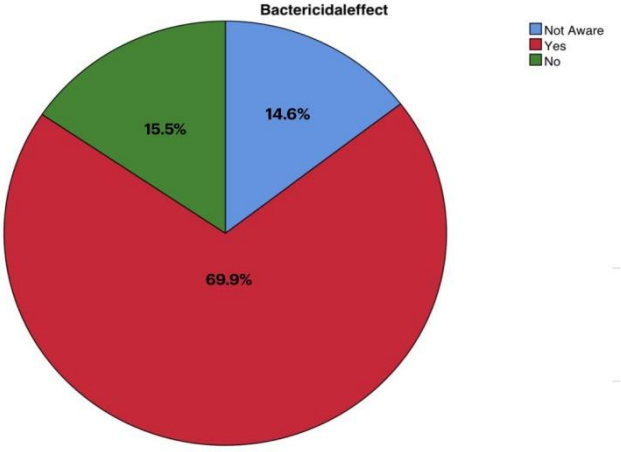

Fig.7: Pie chart showing the responses to the question: Does ozonated nanobubbles water have bactericidal effects? 69.9% of people said yes, 15.5% of people said no and 14.6% of people are not aware about this.

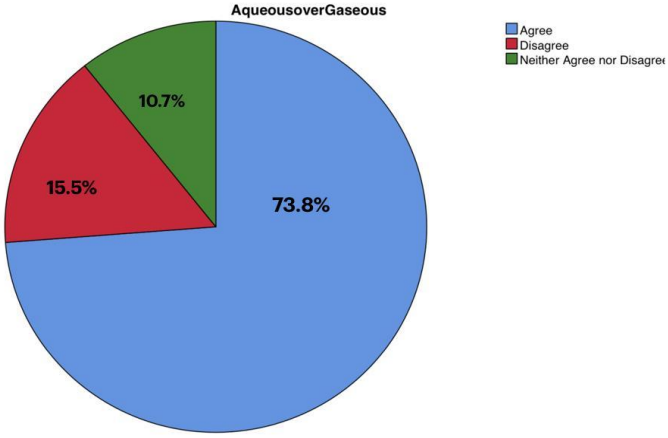

Fig.8: Pie chart showing responses to the question: Gaseous ozone has more effective microbicidal properties? 73.8% of people are agree, 15.5% of people are disagree and 10.7% of people are neither agree/ disagree

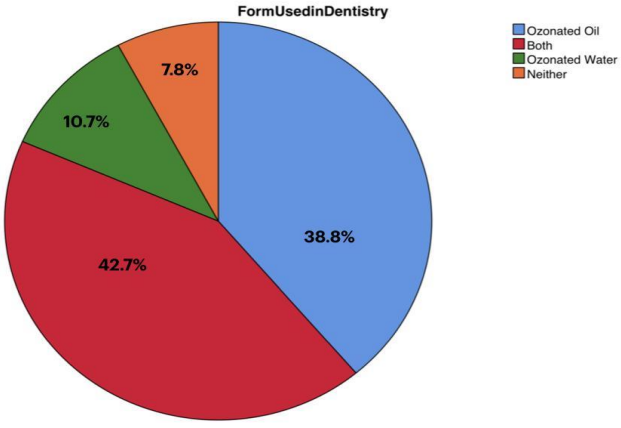

Fig.9: Pie Chart showing the responses to the question:Which form of ozone is used in dentistry? 38.8% of people said that it is ozonated oil, 42.7% of people said that it is both ozonated oil and water, 10.7% of people said that it is ozonated water and 7.8% of people said that it is neither ozonated oil nor ozonated water.

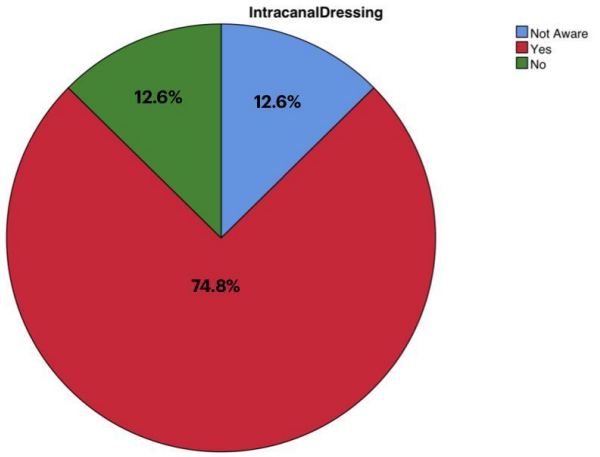

Fig.10: Pie chart showing the responses to the question: Can ozonated oil be used as an intracanal dressing /medicaments? 74.8% of people said yes, 12.6% of people said no and 12.6% of people are not aware about this.

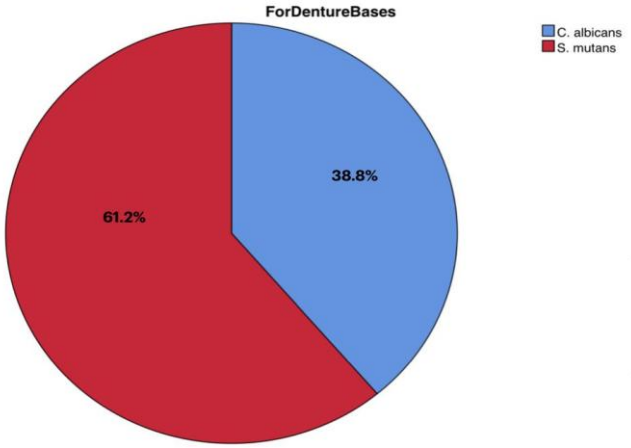

Fig.11: Pie chart showing the responses to the question: Can ozonated water reduce the number of ( ) on the denture base?38.8% of people said that it is candida albicans and 61.2% of people said that it is streptococcus mutans.

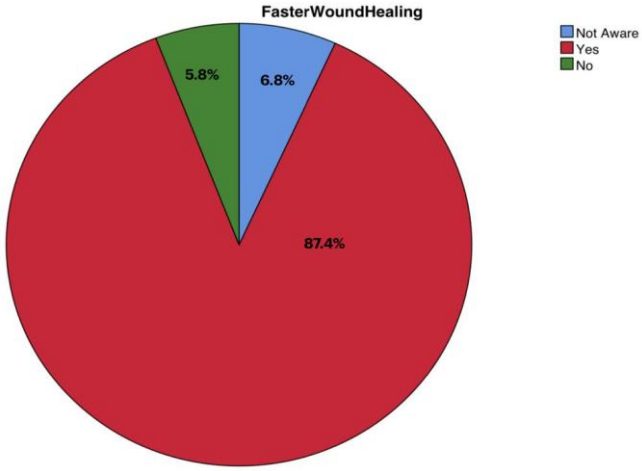

Fig.12: Pie chart showing the responses to the question: Ozone therapy leads to faster wound healing?87.4% of people said yes, 5.8% of people said no and 6.8% of people are not aware about this.

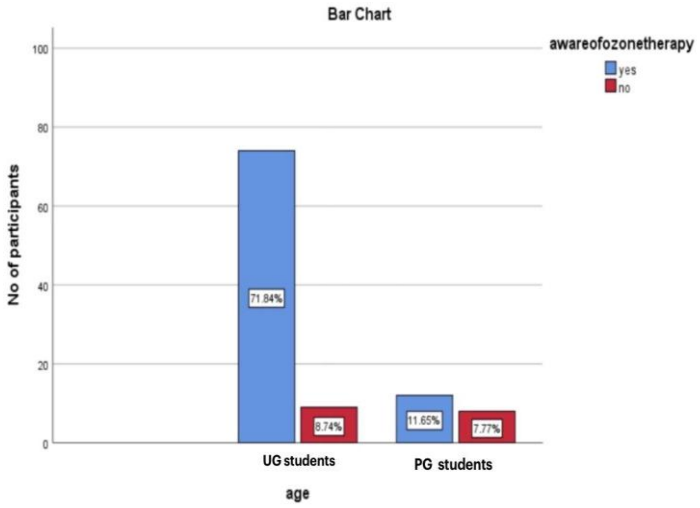

Fig.13: Bar chart shows the association between the age and awareness of the use of ozone therapy. X axis represents the age and Y axis represents the number of participants for awareness of ozone therapy. 71.84% of UG students and 11.65% of PG students are reported yes(Blue) and 8.74% of UG students and 7.77% of PG students are reported no(Red). Chi square test was used to find the association between the variables and was found to be statistically significant. Pearson chi square test value is 222.594, P value is 0.000.

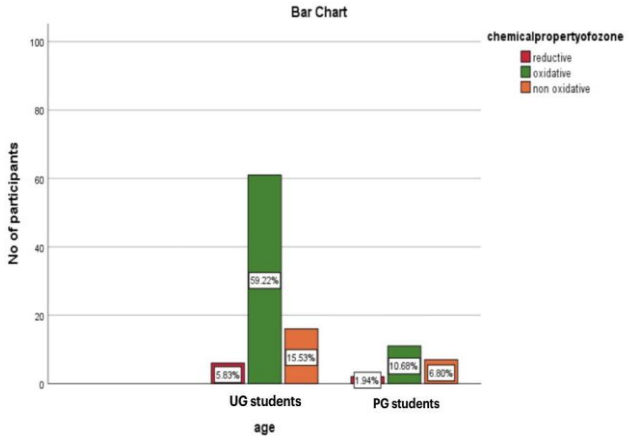

Fig.14: Bar chart shows the association between age and chemical property of ozone therapy. X axis represents the age and Y axis represents the number of participants for chemical property of ozone therapy. 5.83% of UG students and 1.94% of PG students reported reductive(Red). 59.22% of UG students and 10.68% of PG students reported oxidative(Green). 15.53% of UG students and 6.80% of PG students reported non oxidative(Orange). Chi square test was used to find the association between the variables and was found to be statistically significant. Pearson chi square test value is 208.385, P value is 0.000.

(Fig 1) In present study, about 83.5% of people are aware about the use of ozone therapy in dentistry. (Fig:2) about 69.9% of people said that the sole chemical property of the ozone layer is Oxidative. Ozone was first identified as a clear chemical species by schonbein in 1839, but it's formula is based on three oxygen atoms(Dewar, 1948). Ozone is present as the main photochemical components of polluted air and leads to dose dependent oxidative stress because of its ability to produce free radicals deriving from the lipoperoxidation of cell membrane, cell apoptosis and enzyme inactivation (Cross *et al.*, 1992). (Fig:3) about 32% of people said that triangular configuration of ozone is tetra oxygen, 60.2% of people said that it is trioxygen and 7.8% of people said that it is dioxygen. It is a triatomic molecule that consists of three oxygen atoms.Its molecule

weight is 47, 98 G /mole and thermodynamically highly unstable compound that turns on system conditions like temperature and pressure , decomposing to pure oxygen with short life(Burns and Thorburn Burns, 1997). (Fig: 4) about 73.8% of people accept that gaseous form can be used for disinfection of dental hospitals .(Fig:5) about 74.8% of people accept that aqueous ozone form fulfils optimal cell biological charecteristics in terms of oral application. In a study of cytotoxic effective of gaseous ozone and aqueous ozone on human oral epithelial cell and the gingival fibroblasts cell was compared with chlorhexidine digluconate 0.2%, sodium hypochlorite 5.25%, 2.25%. Aqueous ozone allowed the highest level of biocompatibility of the tested antiseptics(Huth *et al.*, 2006)(Noor, S Syed Shihaab and Pradeep, 2016). (Fig:6) about 72.8% of people said that Ozone has analgesics and antiinflammatory action .It effectively decreases the inflammation with effects, at least in part mediated through reduction of proinflammatory cytokines and activation of IL-10 antiinflammatory cytokines(Hammer *et al.*, 2020)(Teja, Ramesh and Priya, 2018). (Fig:7) about 69.9% of people said that ozone nanobubbles water has a bactericidal effect. Some investigators reported a reduced number of bacteria in vivo treatment using ozonated water(Müller, Guggenheim and Schmidlin, 2007). (Fig:8) About 73.8% of people said that ozone has a microbicidal effect. Ozone causes inactivation of bacteria, fungi, yeast and protozoa(Broadwater, Hoehn and King, 1973). (Fig:9) about 38.8% of people said that ozonated oil form is used in dentistry.The effect of ozonated oil and chlorhexidine gel has been evaluated and compared on plaque induced gingivitis to improve the oral health through gingival massage based on the clinical parameters including plaque and gingival score(Captain, 2018). (Fig: 10) about 74.8% of people accept that ozonated oil be used as an intracanal dressing /medicament (Fig: 11) about 38.8% of people said that candida albicans reduces the number of microorganisms in the denture base and 61.2% of people said that streptococcus mutans reduces the number of microorganisms in the denture base.Application of ozone has been advocated in dentistry to sterilisation of cavities, root canal and periodontal pockets (Estrela *et al.*, 2007).. Ozone was effective in eliminating streptococcus mutans. A study assessed the effectiveness of ozonated water in the removal of c.albicans, E.faecalis, and endotoxin from the root canal(Annigeri, Madalli and Shettar, 2010).(Fig: 12)about 87.4% of people said that ozone therapy leads to faster wound healing. Evidence supports ozone as an advanced clinical therapeutic agent for the treatment of chronic wounds, including ulcer, with significant improvement in healing outcome (Viebahn, 1994).Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

CONCLUSION

Ozone can be utilized in almost all aspects of dentistry. It is normally utilized as an irrigating agent in endodontics, periodontal surgery etc. It must be understandable if we want to use ozone. we must protect from its poisonous effects by using an exact ozone generator, by collecting an accurate gas volume with a defined ozone concentration. Within the limitations of study, a moderate level of awareness was present among dental students.In future usage of ozone therapy can be incorporated in dental practices.

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