Original Article

Awareness of Ozone Therapy on Periodontal Health among the Saudi Dental Population

Rayyan A Kayal[1*], Thunayan AlOdhaib[2], Fatimah AlKhater[3], Adlaa AlHarbi[4], Turki AlBalawi[5], Abdulrahman Banjar[3], Abdulellah Gharmullah AlAmodi[6], Khames T AlZahran[7]

[1]Department of Periodontology, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia. [2]Department of Periodontology, General Dentist, Qassim University, Qassim, Saudi Arabia. [3]Department of Periodontology, General Dentist, Imam Abdulrahman bin Faisal University, Dammam, Saudia Arabia. [4]Department of Periodontology, General dentist, Vision colleges, Jeddah, Saudi Arabia. [5]Dental intern, King Abdulaziz University, Jeddah, Saudi Arabia. [6]Department of Periodontology, General Dentist, King Khalid University, Abha, Saudi Arabia. [7]Department of Endodontics, Saudi Board of Endodontic SR, King Faisal Specialist Hospital & Research Center, Riyadh, Saudi Arabia.

Abstract

A naturally occurring gas made of three oxygen atoms is called ozone. It has strong antibacterial properties and a massive oxidizing effect on oral infections**.** This study aimed to assess the knowledge and awareness level of the usage of Ozone therapy on periodontal health among dental interns, General dental practitioners, and specialist in KSA. A cross-sectional survey was conducted in Saudi Arabia. The study was among dental interns, General dental practitioners, and professionals, during the period from January -December 2022. An online questionnaire was done to test the knowledge and attitude of dental interns and undergraduate students about the use of ozone therapy on periodontal health used in data collection. All data were collected and analyzed by SPSS software, and the results of the participant answers were represented as pie charts and graphs. The study included 413 participants, 58.1% of them were females and 41.9% were males. 82.9% aged between 24- 33 years old. 51.6% of participants heard of ozone therapy. 82.3% were interested to read about the usage of ozone therapy in dentistry. 45.5% of participants believe in the efficiency of ozone therapy. 36.3% of participants had good knowledge, 38.7% had moderate knowledge and 24.9% had poor knowledge. In conclusion, Saudi dentists had moderate to poor knowledge of periodontal ozone therapy. Knowledge score was significantly associated with age but not with gender or clinical experience.

Keywords: Ozone, Periodontal, Knowledge, Dental, KSA.

Introduction

A naturally occurring gas made of three oxygen atoms is called ozone. It has strong antibacterial properties and a massive oxidizing effect on the oral infection [1]. Ozone can be used in dentistry in three different ways: as a gas, a solution in water, or oil [2]. There is growing evidence that ozone therapy can be used as a helpful therapeutic agent in both the medical and dental areas. In Germany in the 1950s, Ozone therapy was first used as a current development application for the treatment of wounds and other infections [3]. Because of its many known beneficial effects, the use of ozone in medicine and dentistry has expanded significantly in recent years. Numerous studies have demonstrated that ozonized oils and water have broad-spectrum antibacterial activity against bacteria, viruses, fungi, and protozoa [4]. According to the findings from a recent systematic review and meta-analysis, adjunct use of ozone irrigation is found to perform better in terms of enhancing clinical parameters [5]. The ability of this therapy to balance biological oxidative stress is a fundamental attribute of its efficacy. Because it interacts with organic fluids to produce reactive oxygen molecules that affect cellular metabolism, ozone is advantageous for tissue regeneration [6]. A literature review on the keywords 'ozone' and 'dentistry' were used to search the PUBMED database for articles in English from 1950 to 2016, as well as Polish language articles published in 2004-2010 using the terms 'ozone therapy' and 'dentistry'. The result is Out of 274 articles, 152 were checked. After analyzing the abstracts, 73 papers were selected, including 4 general-term works, and only 17 related to periodontics [7]. As there is no research related to our topic, it would be interesting to investigate new data and design an article about the awareness of using ozone therapy in periodontics among dental students and interns in KSA.

Address for correspondence: Rayyan A Kayal, Department of Periodontology, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia.
rkayal@kau.edu.sa

How to cite this article: Kayal RA, AlOdhaib T, AlKhater F, AlHarbi A, AlBalawi T, Banjar A, et al. Awareness of Ozone Therapy on Periodontal Health among the Saudi Dental Population. Arch Pharm Pract. 2022;13(S1):82-7.

Materials and Methods

Objective

Our study aimed to assess the knowledge and awareness level of Ozone therapy on periodontal health among dental interns' General dental practitioners and professionals in KSA.

Study Design

A cross-sectional study was conducted among dental interns and General dental practitioners and professionals in Saudi Arabia during January-December 2022.

Study Setting: Participants, Recruitment, and Sampling Procedure

The population of this study was made up of dental interns, General dental practitioners, and specialists throughout Saudi Arabia.

Inclusion and Exclusion Criteria

All dental interns, General dental practitioners, and specialists in KSA are included in this study. All dental students are excluded from the study.

Sample Size

The sample size was determined by using the Qualtrics calculator with a 5% margin of error and a confidence level of 95%; for this study, at least 384 participants were required.

The Sample size was estimated using the formula:

$$n = P(1-P) * Z\alpha^2 / d^2 \text{ with a confidence level of 95\%} \quad (1)$$

n: Calculated sample size
Z: The z-value for the selected level of confidence (1- a) = 1.96.
P: An estimated prevalence of knowledge
Q: (1 – 0.50) = 50%, i.e., 0.50
D: The maximum acceptable error = 0.05.
So, the calculated minimum sample size was:

$$n = (1.96)^2 \text{ X } 0.50 \text{ X } 0.50 / (0.05)^2 = 384 \quad (2)$$

Method for Data Collection and Instrument (Data Collection Technique and Tools)

A total of 413 participants was evaluated using a questionnaire comprising 14 questions in an online portal google form including; demographic details, awareness, and knowledge about the usage of Ozone therapy in periodontal health. The participant was requested to complete the online questionnaire which should take approximately 5 minutes to complete. The Online questionnaire consists of two sections, the first section consists of demographic data which includes participant profile, age, gender, nationality, and the second section tests the knowledge and attitude of dental interns and General dentist including specialists and postgraduate students about the use of ozone therapy on periodontal health. The final awareness categories were as follows: 1-10 points were categorized as a low level of knowledge, from 11-16 points was a moderate level of knowledge, from 17-20 is a high level of knowledge, and from 21-24 points was a very high level of knowledge. Finally, All the data collected was entered, tabulated, and analyzed by "Microsoft Office Excel" software" program (2016). The questionnaires were weighted to check the accuracy of the data that was entered by the data clearing and exploration method in the database.

Pilot Test

The questionnaire was distributed to above 15 individuals and asked to fill it. This was done to measure the understanding of the questionnaire and the feasibility of the study. The final data of the study doesn't include the pilot data of the study.

Analyzes and Entry Method

All data were collected and analyzed by SPSS software, and the results of the participant answers were represented as pie charts and graphs. A descriptive statistical analysis was carried out, a chi-square test was used, and a p-value was also calculated. The scoring system has been used to assess the knowledge and attitude of the students as follows: There are 12 questions that have a score, each of the 12 questions was have 2 points for the right answer, 1 point for the neutral answer, and 0 points for the wrong answer.

Results and Discussion

The study included 413 participants, 58.1% of them were females and 41.9% were males. 82.9% were aged between 24- 33 years old and 11.4% were aged between 34- 43 years old. 90.8% of the participants were Saudi. 47.9% were GPs, 35.6% were interns and 15.7% were residents or specialists. 72.9% graduated from governmental dental school while the remaining graduated from private dental colleges **(Table 1)**.

Table 1. Sociodemographic characteristics of participants (n=413)

Parameter		No.	%
Age	24 - 33	342	82.8
	34 - 43	47	11.4
	44 - 53	24	5.8
Gender	Male	173	41.9
	Female	240	58.1
Nationality	Saudi	375	90.8
	Non-Saudi	38	9.2
Experience level	Intern	147	35.6
	General Practitioner	198	47.9
	Resident or Specialist	65	15.7
	6th year	3	.7
Graduated dental school	Governmental college	301	72.9
	Private dental college	112	27.1
Place of work	Governmental practice	250	60.5
	Private practice	129	31.2
	Other	34	8.2

As illustrated in **Table 2**, 51.6% of participants heard of ozone therapy. 82.3% were interested to read about the usage of ozone therapy in dentistry. 42.9% reported that they have little information about ozone therapy. 60% reported that the

sole chemical property of the ozone layer can be attributed to the oxidative effect. Only 44.1% were aware of the use of ozone therapy in dentistry. 45.5% of participants believe in the efficiency of ozone therapy.

Table 2. Knowledge of participants of ozone therapy (n=413)

Parameter		No.	%
Heard of Ozone therapy	Yes	213	51.6
	No	200	48.4
Interested to read about the usage of ozone therapy in dentistry	Yes	340	82.3
	No	73	17.7
Knowledge about Ozone therapy	A few information	177	42.9
	Very well	27	6.5
	No information	209	50.6
The sole chemical property of the ozone layer can be attributed to	Oxidative	248	60.0
	Non-oxidative	95	23.0
	Reductive	70	16.9
Ozone is a molecule with a ..... configuration:	Di-oxygen	87	21.1
	Tetra-oxygen	93	22.5
	Tri-oxygen	233	56.4
Aware of the use of ozone therapy in dentistry	Yes	182	44.1
	No	231	55.9
Ozone therapy was helpful to treat periodontal disease	Agree	167	40.4
	Disagree	17	4.1
	Maybe	7	1.7
	Neutral	214	51.8
	No	1	.2
	Yes	7	1.7
Form of ozone used in treating periodontal conditions	Both ozonated oil and water	189	45.8
	Neither ozonated oil nor ozonated water	67	16.2
	Ozonated oil	3	.7
	Ozonated water	6	1.5
	Ozonated water without ozonated oil	148	35.8
Ozone has analgesics or anti-inflammatory action	Agree	149	36.1
	Disagree	44	10.7
	Neutral	205	49.6
	Not aware	11	2.7
Ozone therapy leads to faster wound healing:	Yes	4	1.0
	Agree	185	44.8
	Disagree	21	5.1
	Neutral	192	46.5
	Not aware	9	2.2
Ozone therapy is used in all cases without any contraindications:	Yes	6	1.5
	Agree	64	15.5
	Disagree	145	35.1
	Neutral	189	45.8
	No	4	1.0
	Not sure	8	1.9
Ozone therapy should be incorporated more into dentistry	Yes	3	.7
	Agree	169	40.9
	Disagree	28	6.8
	Neutral	211	51.1
	Strongly Agree	4	1.0
	Strongly disagree	1	.2
Agree with the idea of saving teeth and dental tissue by using Ozone therapy	Agree	183	44.3
	Disagree	26	6.3
	Neutral	204	49.4
Source of information about ozone therapy	Conferences	65	15.7
	Continues education	128	31.0
	Dental school	90	21.8
	Journal	3	.7
	Journals	117	28.3
	Others	5	1.2
	Through friend	5	1.2

Believe in the efficiency of ozone therapy	Yes	188	45.5
	No	46	11.1
	Not sure	179	43.3

Figure 1, illustrates the knowledge scores of participants regarding ozone therapy. 36.3% of participants had good knowledge, 38.7% had moderate knowledge and 24.9% had poor knowledge.

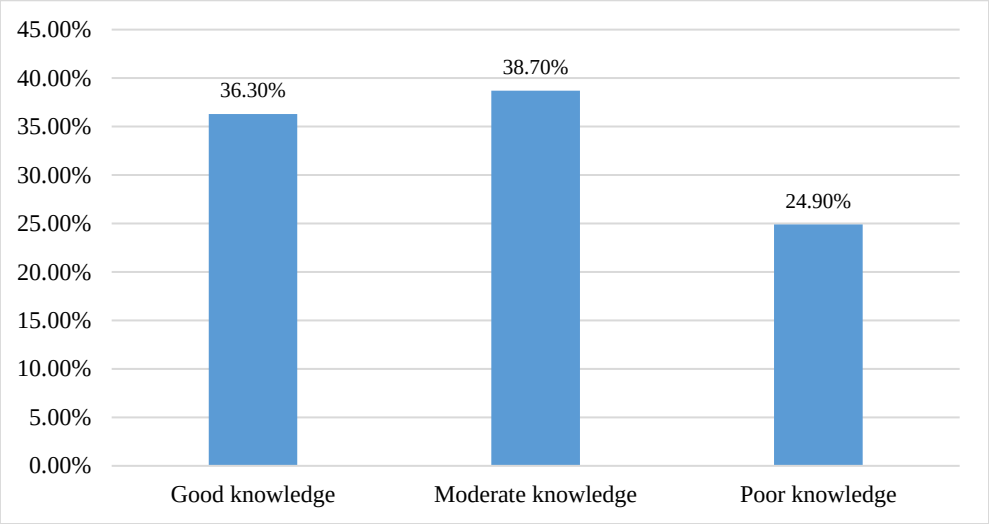

Figure 1. Knowledge scores of participants about Ozone therapy on periodontal health (n=413)

Table 3 shows that knowledge score was significantly associated with age but not with gender or experience.

Table 3. Association between knowledge scores with sociodemographic characters of participants (n=413)

		Knowledge score			Total (N=413)	P value
		Good	Moderate	Poor		
Age	24 - 33	121 80.7%	129 80.6%	92 89.3%	342 82.8%	0.017
	34 - 43	16 10.7%	26 16.3%	5 4.9%	47 11.4%	
	44 - 53	13 8.7%	5 3.1%	6 5.8%	24 5.8%	
Gender	Male	66 44.0%	62 38.8%	45 43.7%	173 41.9%	0.589
	Female	84 56.0%	98 61.3%	58 56.3%	240 58.1%	
Experience level	Intern	60 40.0%	55 34.4%	32 31.1%	147 35.6%	0.472
	General Practitioner	64 42.7%	78 48.8%	56 54.4%	198 47.9%	
	Resident or Specialist	26 17.3%	25 15.6%	14 13.6%	65 15.7%	
	6th year	0 0.0%	2 1.3%	1 1.0%	3 0.7%	
Nationality	Saudi	134 89.3%	143 89.4%	98 95.1%	375 90.8%	0.212
	0n-Saudi	16 10.7%	17 10.6%	5 4.9%	38 9.2%	
Graduated dental school:	Governmental dental college	109 72.7%	118 73.8%	74 71.8%	301 72.9%	0.941
	Private dental college	41 27.3%	42 26.3%	29 28.2%	112 27.1%	
Place of work:	Governmental practice	88	95	67	250	0.798

	58.7%	59.4%	65.0%	60.5%
Private practice	48	51	30	129
	32.0%	31.9%	29.1%	31.2%
Other	14	14	6	34
	9.3%	8.8%	5.8%	8.2%

Ozone is being used in nearly all dental applications and is becoming more and more common in daily dental practices. The use of ozone in dentistry is a very good alternative and/or supplementary disinfectant to traditional antiseptics due to its undeniable disinfection capacity over other antiseptics. The intra-oral use of ozone gas was not advised due to safety concerns. Only ozonated oils and dissolved ozone in water were widely utilized in dentistry and still are today. With the creation of a dental handpiece with a suction component that is activated by a foot pedal, ozone gas can now be utilized safely in circumstances where dispersion is a significant concern, such as tooth hard tissues. The main use of ozone in dentistry is relays on its antimicrobial properties. It is proven to be effective against both Gram-positive and Gram-negative bacteria, viruses, and fungi [8]. Ozone also has actions that include antibacterial, immune system regulating, metabolic rate improvement, and biosynthesis enhancement. Cellular and humoral immunity are impacted by ozone. The body's ability to transport oxygen, make adenosine triphosphate (ATP) and produce enzymes like glutathione peroxidase, catalase, and superoxide dismutase are all positively impacted by it. Ozone gas, ozonated water, ozonized olive oil, or ozonized sunflower oil can all be used to create ozone for dental purposes. The use of ozone in periodontology (gingivitis, periodontitis, periimplantitis, surgical injuries, prophylaxis) [9].

According to our study results, 36.3% of participants had good knowledge, 38.7% had moderate knowledge and 24.9% had poor knowledge. 51.6% of participants heard of ozone therapy. 82.3% were interested to read about the usage of ozone therapy in dentistry. A previous study was conducted by interns in Saudi Arabia and reported that the majority of survey respondents were aware that ozone therapy is used in dentistry. The bactericidal properties of ozonated Nanobubble water are acknowledged by 68% of respondents. 73% of respondents agree that gaseous ozone's microbicidal effects are superior to those of aqueous ozone. Within the confines of the study, dental students exhibited a modest level of awareness. In the future, ozone therapy could be used in dental offices [10]. Another study was conducted on a Kentucky-dentists were surveyed regarding their familiarity with ozone therapy. According to the findings, there is more general knowledge about ozone therapy than the researchers had anticipated. The use of ozone therapy in dental practice was unknown to more than half of the participants. The date a dentist graduated from dental school or whether or not the practitioner went on to specialize in a particular area do not appear to be associated to their knowledge of ozone therapy. Similar to the researcher's premise, more dentists in each group of graduates were unaware of ozone therapy than those who were [11]. Despite there being multiple recent studies about the use of ozone therapy in periodontics but most of them focus on the effect of ozone on specific clinical procedures rather than considering the knowledge and attitude of dental practitioners toward that.

Knowledge scores were not associated with years of experience in our study sample. This was in the line with a previous study that reported the groups of more recent graduates have not acquired greater understanding about Ozone Therapy in dentistry. It's not entirely obvious why some groups knew more about ozone therapy than others. This might be because dentists who have been out of school for a while have had more opportunities to take continuing education courses on topics like ozone therapy. Because ozone therapy might not be covered in dental school's curriculum, more recent graduates may be less familiar with it. Additionally, it's probable that after the more recent graduates open their dental practices, they will be less interested in subjects like ozone therapy and more interested in continuing education programs that will help them grow their practices. Ozone Therapy may not be widely known in the dentistry community because it has not yet received FDA approval, and additional research will likely be required before it is viewed as a therapeutic option by the majority of dentists.

Conclusion

In conclusion, Saudi dentists had moderate to poor knowledge of periodontal ozone therapy. Knowledge score was significantly associated with age but not with gender or clinical experience. Even though more clinical research is needed to standardize ozone therapy's indications and treatment methods, there are still so many different approaches that are either very promising or well-established that it is hoped that ozone therapy will eventually become a common practice in dentistry for disinfecting surgical sites.

ACKNOWLEDGMENTS: Special thanks to the Faculty of Dentistry at King Abdulaziz University and the Deanship of Scientific Research (DSR) for supporting this project. The research proposal was approved by the Regional Research and Ethics committee of King Abdulaziz University.
CONFLICT OF INTEREST: None
FINANCIAL SUPPORT: None
ETHICS STATEMENT: Ethical approval was obtained from the research ethics committee of King Abdulaziz University (application number: 103-10-22). Informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

References

1. Gandhi KK, Cappetta EG, Pavaskar R. Effectiveness of the adjunctive use of ozone and chlorhexidine in patients with chronic periodontitis. BDJ Open. 2019;5(1):17.
2. Ramirez-Peña AM, Sánchez-Pérez A, Campos-Aranda M, Hidalgo-Tallón FJ. Ozone in Patients with Periodontitis: A Clinical and Microbiological Study. J Clin Med. 2022;11(10):2946.
3. Shekhar A, Srivastava S, Kumar Bhati L, Chaturvedi A, Singh S, Agarwal B, et al. An evaluation of the effect of ozone therapy on tissues surrounding dental implants. Int Immunopharmacol. 2021;96:107588. doi:10.1016/j.intimp.2021.107588
4. Butera A, Gallo S, Pascadopoli M, Luraghi G, Scribante A. Ozonized water administration in peri-implant mucositis sites: A randomized clinical trial. Appl Sci. 2021;11(17):7812.
5. Ranjith A, Niranjana JM, Baiju KV. Adjunctive benefit of ozonized water irrigation with mechanical debridement in the management of Stage III periodontitis: A randomized controlled clinical and biochemical study. Int J Dent Hyg. 2022;20(2):364-70.
6. Meneses-Santos D, Lauand GA, Macedo SB, de Souza Castro Filice L, Silva CJ, Rocha FS. Ozone used as a supportive therapy for gingival tissue repair after facial trauma: Report of two cases. Rev Port Estomatol Med Dent e Cir Maxilofac. 2021;62(2):121-6.
7. Łazarz-Półkoszek MJ, Loster JE, Wiśniewska G. Application of ozone to various fields of dentistry–review of literature. Prosthodontics. 2020;70(1):90-106.
8. Greene AK, Few BK, Serafini JC. A comparison of ozonation and chlorination for the disinfection of stainless steel surfaces. J Dairy Sci. 1993;76(11):3617-20.
9. Gupta G, Mansi B. Ozone therapy in periodontics. J Med Life. 2012;5(1):59.
10. Ganesh SB. Knowledge and awareness of the use of ozone therapy in dentistry. Int J Psychosoc Rehabil. 2021;232.
11. Hannah E. Get in the Zone: A survey of Dental Professionals' Knowledge of Ozone Therapy. 2016.