Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 384-391 | ISSN:2251-6727

Effectiveness of Ozonated Oil and Pro-Argin Formulation Toothpaste Alone and Their Combination in Treatment of Dentin Hypersensitivity: A Randomised Controlled Clinical Split Mouth Study.

Dr. Pradnya Nagmode[1], Dr. Gayatri Gundap[2], Dr. Sathish Abraham[3], Dr. Nitin Lokahande[4], Dr. Taniya Israni[5]

[1]Professor and PG guide,SMBT Dental College & Hospital, Sangamner

[2]PG Student, SMBT Dental College & Hospital, Sangamner

[3]HOD & PG Guide, SMBT Dental College & Hospital, Sangamner

[4]Reader & PG Guide, SMBT Dental College & Hospital, Sangamner

[5]PG Student, SMBT Dental College & Hospital, Sangamner

(Received: 11 June 2024 Revised: 16 July 2024 Accepted: 10 August 2024)

KEYWORDS

Dentrifice, Hypersensitivity, stimulation

ABSTRACT:

Introduction: Dentin hypersensitivity is a prevalent dental condition with a prognosis that is predictable but no permanent treatment. There are several alternatives for treating Dentin Hypersensitivity, but it hasn't yet been proven that any of them is better than the rest on their own.

Aim: To evaluate and compare the effectiveness of Pro-Argin formulated dentifrice and Ozonated oil in the treatment of Dentin Hypersensitivity when used alone and in combination, using placebo as a control.

Methodology: This was a randomized split-mouth clinical trial. Sixty patients aged 20–60 years suffering from dentin hypersensitivity to air-blast, cold, and tactile stimulation corresponding to 4 cm and above on the Visual Analog Scale (VAS) in four quadrants with at least two hypersensitive teeth per quadrant were selected. Hypersensitive teeth were allotted to Group 1 – Pro-Argin formulation toothpaste application alone, Group 2 – Ozonated oil application alone, Group 3 – Pro-Argin toothpaste application, followed by Ozonated oil, Group 4 – placebo toothpaste application. VAS score was recorded at baseline, immediate and after 4 weeks.

Results: A statistically significant reduction in dentin hypersensitivity was observed in all the four groups, from the baseline and 4 weeks application ($P < 0.05$). Group 1 and Group 3 demonstrated a significantly higher reduction in dentin hypersensitivity for all the stimuli as opposed to Group 2 at all follow-up intervals

Conclusion: The study concluded that the combined application of Pro-argin toothpaste and Ozonated oil may provide appreciable clinical therapeutic benefit leading to effective management of dentinal hypersensitivity.

INTRODUCTION

In the field of dentistry most commonly encountered problem is Dentinal hypersensitivity. The diagnosis is frequently difficult, thus it is important to rule out other illnesses that are presenting similar symptoms. (1) Dentin hypersensitivity is characterized by transient, sharp pain arising from exposed tooth dentin in response to external stimuli, typically thermal, evaporative, tactile, electrical, osmotic, or chemical, that cannot be attributed to any other dental disease. (2)

DH is a persistent problem that is more of a symptom complex than a disease, and if it is not treated clinically, it can negatively affect a patient's quality of life. Patients in the age range of 20 to 50 are most frequently affected, with a peak between 30 and 40 years of age. The teeth that are most frequently afflicted are canines and

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 384-391 | ISSN:2251-6727

premolars. The most frequently affected area is the buccal aspect of the cervical region. [3]

The aetiology of Dentin hypersensitivity can be caused by a variety of conditions, including periodontal disease, chemical erosion, and traumatic oral hygiene. Tactile, thermal, or osmotic stimuli that cause gingival recession, enamel loss, or root surface denudation as a result expose the dentinal tubules, leading in acute pain and discomfort. Various theories have been proposed to explain the actual mechanism. Among these, the hydrodynamic theory has ever been widely accepted. [4]

The simplest clinical approach for evaluating dentinal hypersensitivity is using an exploratory probe on the exposed dentinal surface in the mesiodistal direction for all the teeth in the painful area or using the evaporative or air blast method. [1] The degree of pain can be quantified either according to categorical scale (i.e., slight, moderate, or severe pain) or using the Visual Analog Scale (VAS). [3]

There are two methods for controlling Dentin Hypersensitivity that can be used to manage the hydrodynamic mechanism of pain. Agents that obstruct dentine tubules to restrict fluid flow, inhibiting the stimuli, as well as those that prevent the neurological response to the stimuli. [3]

Although there are many different treatment methods for dentinal hypersensitivity, desensitizing dentifrices are the most popular and well acceptable. The majority of desensitizing toothpastes contain potassium salt which is believed to work by penetrating the length of the dentin tubule and depolarizing the nerve, interrupting the neural response to pain stimuli. [5]

A novel Dentin hypersensitivity treatment technology (Pro-Argin), consisting of 8% arginine, an aminoacid found in saliva, in combination with calcium carbonate, is now available as a desensitizing paste for in-office application. This desensitizing technology mimics saliva's natural process of plugging and sealing open dentinal tubules. [7] Ozone application is an alternative for the treatment of dentin hypersensitivity. [8] Over the past 100 years, medical grade ozone has been used therapeutically. Its distinctive features include immunostimulatory, analgesic, detoxifying, antimicrobial, biosynthetic, and bioenergetic effects for several applications in dentistry. Ozone therapy, uses oxygen/ozone administered via gas or dissolved in water or oil base to obtain a therapeutic benefit, and has been considered as a versatile, bio-oxidative therapy found to be an effective treatment modality for Dentin Hypersensitivity. Being non -invasive, it also enhances patient compliance. [9]

MATERIALS AND METHODOLOGY

In this split-mouth, randomized control trial, sixty systemically healthy controls aged 20–60 years visiting the outpatient department of Conservative dentistry and Endodontics and fulfilling the inclusion criteria were selected for the study.

Inclusion criteria:

1. The presence of a minimum of two teeth, hypersensitive to tactile, cold, or air stimulation corresponding to 4 cm and above on the Visual Analog Scale (VAS) in four quadrants
2. Hypersensitivity located at facial aspects of the incisors, canines and premolars.
3. Willingness to provide written informed consent for being included in the study.

Exclusion criteria:

1. Medical and pharmacotherapeutic histories that may compromise the protocol including the chronic use of anti-inflammatory, analgesic and psychedelic drugs.
2. Benign or malignant pathological oral lesions.
3. Caries in the selected or adjacent teeth.
4. Teeth with non-carious lesions with pulpal involvement.
5. Congenital enamel or dentin defects.
6. Crazed or hypoplastic teeth.
7. Pregnancy or breast feeding.
8. The teeth having carious lesions, extensive restorations, endodontic treatment on the selected teeth, teeth diagnosed to have cracked tooth syndrome, vertical fracture, and pulpitis were also excluded from the study

The institution's ethics committee and review board authorised the study, and was carried out in conformity with the 2013 revision of the Helsinki Declaration.[13]

METHOD OF MEASUREMENTS –

For diagnostic record photographs at various treatment steps, Intra-oral periapical X-rays and detailed medical and dental history were taken. Suitability of the patient

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 384-391 | ISSN:2251-6727

for the trial was assessed based on inclusion and exclusion criteria. Parameters were assessed at baseline, immediately after treatment and 4 weeks after application. Clinical parameters used was VAS (Visual Analogue Scale). Lottery method using chits was used for the allotment Group I, Group II, Group III and Group IV to the four quadrants.

METHODS FOR DETECTING DENTINAL HYPERSENSITIVITY –

a) **Air-blast method**: Air blast from the 3-way syringe for 1 sec at a distance of 1cm and at right angle to the site of the assigned teeth, while adjacent teeth were isolated with clinician fingers to prevent false positive results. The distance would be approximated by a periodontal probe (UNC-15, Hu-Friedy, Chicago, IL, USA).

b) **Tactile stimulus**: Tactile stimulus is done by using curved explorer #23 and passed across the facial area of the tooth, perpendicular to its long axis, at an approximated constant force under slight manual pressure in the mesio-distal direction on the cervical area of the tooth. The test was repeated three times before the final score was recorded.

During dentin stimulation, the operator's fingertips or cotton rollers were placed over the adjacent teeth. While other operators carried out the prescribed treatments, a single operator assessed each tooth for hypersensitivity.

After recording thorough case history and written informed consent from the patients enrolled in the study considering inclusion and exclusion criteria, each patient had undergone thorough full mouth scaling and root planing with the help of ultrasonic scalar (EMS). Following which the sites were randomly allotted to as Group I (Pro-Argin formulated dentifrice), Group II (Ozonated oil), Group III (Pro-Argin formulated dentifrice along with Ozonated oil), and Group IV (Placebo).

GROUP I (PRO-ARGIN FORMULATED DENTIFRICE)

- The sites were dried with an air blast and carefully isolated using cotton rolls. - The paste was applied using rotating rubber cup (2000 revolutions/minute) for 1 minute. (Figure 1)

GROUP II (OZONATED OIL)

- The treatment was done under relative isolation and drying the sites with air blast.
- Using a disposable applicator tip Ozonated oil was applied for 20s. (Figure 2)

GROUP III (PRO-ARGIN FORMULATED DENTIFRICE ALONG WITH OZONATED OIL)

- The sites to be treated were isolated using cotton rolls, cleaned and dried using air blast.
- The paste was applied using rotating rubber cup in the similar manner as done in Group I, followed by application of Ozonated oil according to the same protocols followed in Group II. (Figure 3)

GROUP IV (PLACEBO PASTE- COLGATE TOOTHPASTE)

- Under proper isolation with cotton rolls, placebo paste was applied using rotating rubber cup.
- After 1 minute the surfaces were slightly washed with water.

Recordings were assessed at baseline, immediately after treatment, and 4 weeks after application by one examiner throughout the trial. The effectiveness of above therapies were assessed by scoring patients response to tactile stimulation, air blast stimulation, following the predefined criteria. (Figure 4)

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 384-391 | ISSN:2251-6727

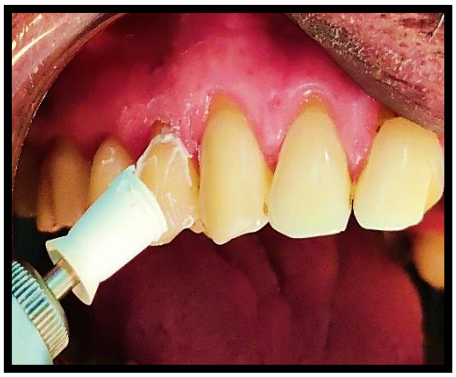

Figure 1

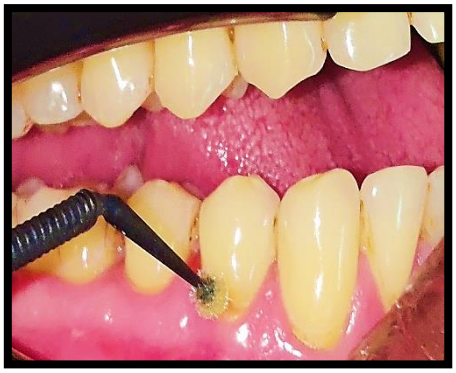

Figure 2

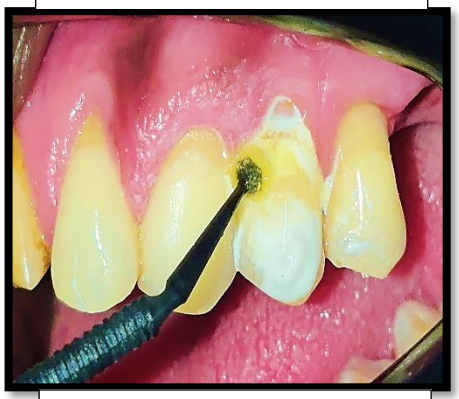

Figure 3

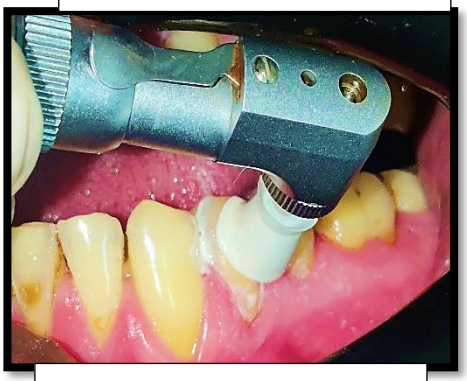

Figure 4

STATISTICAL ANALYSIS

Data entry was done in Microsoft Office Excel 2010 and analyses of results was done using Statistical product and service solution (SPSS) version 22 software. Descriptive statistics such as mean and standard deviation was calculated for quantitative variables. The p value was fixed at 0.05. Data normality was checked using Shapiro Wilk test. One way Anova F test was used for overall comparison between four study groups in relation to vas pain score and Tukeys post hoc test for pairwise comparison between groups

RESULTS

The scores of subjects responses varied among treatment groups at baseline, immediately and after treatment at 4 weeks. There was a significant difference in tactile sensitivity and air blast sensitivity scores of all groups from baseline, immediately after treatment and at 4 weeks. [Table 1]

Overall comparison of tactile sensitivity and air blast/evaporative sensitivity scores of individual group showed significant difference in the score values from baseline, immediately after treatment and after 4 weeks. Group 4 showed no significant difference in score values from baseline, immediate after treatment and at 4 weeks. [Table 2]

The intergroup comparison of Tactile sensitivity and Air blast sensitivity scores of all groups from baseline, immediately after treatment and at 4 weeks revealed that Group 1 and Group 3 showed greater change in score values compared to group 2 and group 4. Group 2 showed significant difference in score values than group 4

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 384-391 | ISSN:2251-6727

VAS score	Baseline Mean (SD)	Immediate Mean (SD)	4 weeks Mean (SD)
Group 1 (Paste)	**6.51 (0.22)**	**4.34 (0.29)**	**1.47 (0.23)**
Group 2 (Oil)	**6.51 (0.30)**	**4.67 (0.31)**	**2.43 (0.37)**
Group 3 (Combination)	**6.18 (0.21)**	**4.08 (0.28)**	**1.29 (0.25)**
Group 4 (Placebo)	**6.82 (0.35)**	**5.9 (0.36)**	**5.0 (0.62)**
One way Anova F test	**F = 17.012**	**F = 130.741**	**F= 359.75**
P value, Significance	**p < 0.001****	**p < 0.001****	**p < 0.001****

Table 1: Comparison of visual analog scale (VAS) scores at baseline, immediate , post treatment at 4 weeks.

VAS score	Change from Baseline to Immediate Mean (SD)	Change from Baseline to 4 weeks Mean (SD)
Group 1 (Paste)	**2.17 (0.41)**	**5.03 (0.28)**
Group 2 (Oil)	**1.83 (0.43)**	**4.07 (0.53)**
Group 3 (Combination)	**2.09 (0.3)**	**4.89 (0.31)**
Group 4 (Placebo)	**0.91 (0.53)**	**1.81 (0.61)**
One way Anova F test	**F = 36.124**	**F = 210.723**
P value, Significance	**p < 0.001****	**p < 0.001****

p>0.05 – no significant difference (NS) ***p<0.05 -significant** ****p<0.001 – highly significant**

Table 2: Overall Comparison of visual analog scale (VAS) scores at baseline, immediate , post treatment at 4 weeks using One way Anova F test respectively

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 384-391 | ISSN:2251-6727

Group	Comparison Group	Change from Baseline to Immediate Mean (SD)	Change from Baseline to 4 weeks Mean (SD)
Group 1 (Paste) vs	Group 2 (Oil)	p =0.065	P< 0.001**
	Group 3 (Combination)	P =0.944	P =0.762
	Group 4 (Placebo)	P< 0.001**	P< 0.001**
Group 2 (Oil) vs	Group 3 (Combination)	p =0.211	P< 0.001**
	Group 4 (Placebo)	P< 0.001**	P< 0.001**
Group 3 (Combination) vs	Group 4 (Placebo)	P< 0.001**	P< 0.001**

p>0.05 – no significant difference (NS) *p<0.05 -significant **p<0.001 – highly significant

Table 3: Pairwise comparison of visual analog scale (VAS) scores at baseline, immediate, post treatment at 4 weeks using Tukey's post hoc test respectively

DISCUSSION

Different stimuli, including as chemical, mechanical, or thermal stimuli delivered to exposed dentin under oral conditions, might result in pain perception. [10] Dentin is a fluid-filled, porous, mineralized tissue with tubules that aid in penetrability. Attrition, erosion, abfraction, and gingival recession are noncarious cervical lesions that contribute to the loss of enamel and cementum, exposing dentinal tubules to the oral environment and resulting in hypersensitivity. [1] Every time certain stimuli are applied to a patient's teeth, they become chronically sensitive. Others complain of unexpected, intermittent discomfort that might be hard to nail down. A painful reaction can be brought on by one or more stimuli, including those that are tactile, osmotic (sweet), thermal (especially cold), or evaporative (air movement). [7]

The increased knowledge of oral health has greatly helped in the detection of oral illnesses. [1] In the general population, the prevalence of dentin hypersensitivity ranges from 3% to 57%. In the present research, a split-mouth study design was employed to make it easier to compare the three treatment options under uniformed and comparable circumstances. [11]

For many years, it has been exceedingly difficult to treat painful dental issues like dental hypersensitivity, and this has been a major challenge up to this point. [1] Several randomised controlled clinical trials have examined the in-office application of arginine-calcium carbonate. A single application of this paste during dental cleaning and scaling operations brought immediate relief that lasted for at least 28 days in individuals with hypersensitive teeth, according to prior clinical trials employing arginine calcium carbonate paste. The in-office application of arginine-calcium carbonate paste produced a substantial reduction in sensitivity compared to that of the placebo control, continuing throughout the full follow-up period in a 4-week, randomised, double-blind, split mouth design clinical study. [12]

In the present study, there was a significantly higher reduction in dentin hypersensitivity in Group 1 and Group 3 for all the stimuli when compared to Group 4 at all follow-up intervals. It has been shown that ozone can enlarge and open the dentinal tubules, as well as start the elimination of this smear layer. This study also revealed that group 2, treated with ozonated oil alone showed a significantly greater reduction of dentin hypersensitivity at all intervals. The dentinal tubules opened by ozone are completely and effectively blocked by calcium and fluoride ions when a remineralizing agent is applied, preventing fluid exchange across these tubules. [9]

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 384-391 | ISSN:2251-6727

The majority of medications used in the treatment of Dentin Hypersensitivity obstruct these open dentinal tubules. The positively charged arginine and naturally occurring calcium carbonate in saliva are thought to work together and bind to the negatively charged dentin surface when a desensitising paste containing arginine is applied to exposed dentin. This is thought to deposit a plug within the dentinal tubules and form a protective layer on the dentin surface. This plug penetrates the tubule at a depth of 2 μm and is made up of arginine, calcium carbonate, phosphate, and salivary glycoproteins. [9]

In this study, both Groups 1 and 3 treated with arginine containing desensitizing agent showed greater percentage of reduction in sensitivity scores from baseline, immediate after treatment and at 4 weeks .The lower percentage of change in scores in group 2 and group 4 compared to group 1 and group 3 suggested greater effectiveness of arginine containing desensitizing agent.

This is in line with a number of clinical research that demonstrated the immediate positive benefits of toothpastes containing arginine and calcium carbonate, which continued up to 8 weeks after therapy; in other cases, these effects extended up to 24 weeks.

The therapeutic drugs utilised in this study are agents that may be purchased and used in the oral cavity, although their uses may be restricted because of their side effects. Ozone is not a chemical that is easily accessible or stable, and at a concentration of 0.0007% per application, it may be harmful. [9]

Future studies are necessary to clinically validate the likely superior and long-lasting effect of this synergistic combination in the treatment of Dentin Hypersensitivity, even though this study is the first of its kind to evaluate the effects of adjunctive use of a desensitising paste containing arginine with ozonated oil on dentin hypersensitivity management.

CONCLUSION

The ozonated oil may have a synergistic impact, causing dentinal tubules to open up, allowing the desensitising agent to penetrate more thoroughly. With these observations, it may be reasonable to hypothesize that the adjunctive application of ozonated oil with a Pro-argin containing desensitizing toothpaste may provide appreciable clinical therapeutic benefit leading to effective management of dentinal hypersensitivity.

The application of Pro-argin formulation desensitizing agent caused more impact on reduction of dentin hypersensitivity than to application of Ozonated oil or toothpaste alone.

REFERENCES

1. Bansal D, Mahajan M. Comparative evaluation of the effectiveness of the two herbal desensitizing toothpastes in the relief of dentinal hypersensitivity. Journal of the International Clinical Dental Research Organization. 2021 Jan 1;13(1):42.
2. Amaechi BT, Lemke KC, Saha S, Luong MN, Gelfond J. Clinical efficacy of nanohydroxyapatitecontaining toothpaste at relieving dentin hypersensitivity: An 8 weeks randomized control trial. BDJ open. 2021 Jun 25;7(1):1-8.
3. Kar PP, Shaikh ZA, Hiremath AM, Vikneshan M. Comparison of the effectiveness of three different desensitizing toothpastes in reducing dentin hypersensitivity: A 4-week clinical study. Journal of Conservative Dentistry: JCD. 2019 Mar;22(2):181.
4. Neeta Mishra, Sudhashu Agarwal, Pradyama Mishra, Komal S. Sharma, Chetan Sharma. A comparative evaluation of diode laser, stannous fluoride gel and potassium nitrate gel in the treatment of dentinal hypersensitivity- A clinical study. 2017 Dec:3(4): 118-122.
5. Khadka J, Lamichhane P, Nepal M, Kunwar D, Lamba S, Gautam N. Comparison of the Effectiveness of Three Different Desensitizing Toothpastes in Reducing Dentin Hypersensitivity. Journal of KIST Medical College. 2022 Aug 8;4(8):50-8.
6. Schiff T, Delgado EV, Zhang YP, Cummins DI, DeVizio W, Mateo LR. Clinical evaluation of the efficacy of an in-office desensitizing paste containing 8% arginine and calcium carbonate in providing instant and lasting relief of dentin hypersensitivity. American Journal of Dentistry.
7. 2009 Mar 1;22(Spec No. A):8A-15A.

8. Panagakos F, Schiff T, Guignon A. Dentin hypersensitivity: effective treatment with an inoffice desensitizing paste containing 8% arginine and calcium carbonate. American journal of dentistry. 2009 Mar;22:3A-7A.
9. Souza AW, Silveira GA, Oliveira HD, Glória JC, Gonçalves PF, Flecha OD, Douglas-de-Oliveira DW. Dentin hypersensitivity treatment with ozonated oil: a randomized controlled tripleblind clinical trial. Research, Society and Development. 2021 Dec 22;10(17):e147101724234-
10. Veena HR, Mathew CA, Daniel RA, Shubha P, Sreeparvathy R, Pradhan N. An in vitro analysis of the effect of adjunctive use of ozonated oil with a desensitizing agent on dentinal tubule occlusion. Journal of Oral Biology and Craniofacial Research. 2020 Oct 1;10(4):727-32.
11. Torres CR, Silva TM, Fonseca BM, Sales AL, Holleben P, Di Nicolo R, Borges AB. The effect of three desensitizing agents on dentin hypersensitivity: A randomized, split-mouth clinical trial. Operative dentistry. 2014 Sep 1;39(5):E186-94.
12. Jain A, Rao J, Pal N, Singh A. Effectiveness of fluoride varnish, diode laser, and their combination in treatment of dentin hypersensitivity: A randomized split-mouth clinical trial. Journal of Indian Society of Periodontology. 2020 Jul;24(4):369.
13. Bal MV, Keskiner I, Sezer U, Açıkel C, Saygun I. Comparison of low level laser and arginine-calcium carbonate alone or combination in the treatment of dentin hypersensitivity: a randomized split-mouth clinical study. Photomedicine and laser surgery. 2015 Apr 1;33(4):200-5.
14. General Assembly of the World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. The Journal of the American College of Dentists. 2014;81(3):14-8.