ejpmr, 2021,8(4), 451-457

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

COMPARATIVE EVALUATION OF TWO COMMERCIALLY AVAILABLE DENTIFRICES CONTAINING PROPOLIS AND POTASSIUM NITRATE ON DENTINAL TUBULE OCCLUSION -AN IN VITRO SEM ANALYSIS

Dr. Aneri A. Gosalia*[1], Dr. Shah Mona U.[2], Dr. Doshi Yogesh S.[3], Dr. Cauvery N. K.[4], Dr. Vidhi Kevadia[5] and Dr. Talat Mohammadi[6]

[1](BDS) Post Graduate Student, Department of Periodontics, Pandit Deendayal Upadhyay Dental College, Solapur, India.
[2](MDS) Head of the Department, Department of Periodontics, Pandit Deendayal Upadhyay Dental College, Solapur, India.
[3](MDS) Professor, Department of Periodontics, Pandit Deendayal Upadhyay Dental College, Solapur, India.
[4,5](MDS) Reader, Department of Periodontics, Pandit Deendayal Upadhyay Dental College, Solapur, India.
[6](MDS) Senior Lecturer, Department of Periodontics, Pandit Deendayal Upadhyay Dental College, Solapur, India.

***Corresponding Author: Dr. Aneri A. Gosalia**

(BDS) Post Graduate Student, Department of Periodontics, Pandit Deendayal Upadhyay Dental College, Solapur, India.

Article Received on 25/01/2021 **Article Revised on 14/02/2021** **Article Accepted on 06/03/2021**

ABSTRACT

Background: Dentine hypersensitivity is generally explained as an exaggerated response to non-noxious sensory stimuli. It is known that the number of occluding open tubules is inversely proportional to the intensity of hypersensitivity recorded. Several compounds have been proposed for the management of dentin hypersensitivity. In the recent past the use of natural products as an alternative to conventional ones has been encouraged. Propolis commonly also known as bee glue, is a resinous substance obtained from beehives. It is known to have antioxidant, antimicrobial, anti-tumor and anti-inflammatory activity. **Aims and Objectives:** To evaluate and compare, in vitro the dentinal tubule occluding effect of two commercially available dentifrices containing Propolis and Potassium Nitrate using scanning electron microscope. **Methodology:** 30 caries free surgically extracted maxillary and mandibular single rooted teeth were selected for the study. Normal saline at room temperature was used to store the teeth. Gross debris was removed and teeth were sectioned using a diamond disc to obtain the specimens. Specimens were divided into three groups; control, Propolis and potassium nitrate groups, consisting of 10 specimens each. The specimens were etched with 37% phosphoric acid for 2 minutes and rinsed with distilled water. Dentifrices were applied for 7 consecutive days for 2 minutes each. Tubule occlusion was assessed by Scanning Electron Microscope. **Results:** Adequate tubule occlusion was seen in both the groups as compared to the control group; whilst potassium nitrate group being more effective over Propolis group. **Conclusion:** Results conclude that both the dentifrices show positive desensitizing effect.

KEYWORDS: Hypersensitivity, Potassium Nitrate, Propolis, Desensitizing Dentifrices.

INTRODUCTION

Dentinal hypersensitivity, or cervical dentinal sensitivity, is a significant clinical problem. It is defined as pain arising from exposed dentine typically in response to thermal, chemical, tactile or osmotic stimuli.[1]

It is characterized by short term pain, intense and subtle, caused by thermal stimulus (such as that associated with water ingestion and hot or cold food) or by chemical (pH alteration) or mechanical (excessive pressure during tooth brushing and/or inappropriate brush use) actions in dentin areas exposed to the intraoral environment.[2,3] Dentin may become exposed via several means, namely; enamel loss through abrasion, abfraction, or erosion or it can result from root surface exposure caused by gingival recession, periodontal treatment, or the combination of both factors[4,5,6,7] or in some individuals the cementum and enamel which normally cover the dentine do not meet and result in dentine exposure as a result of a developmental anomaly. In general, it appears that dentinal hypersensitivity is rarely a result of just one of the above factors, but rather a combination of more than one factor.

Regardless of the etiology of dentine exposure, one feature appears to be in common and that is open dentinal tubules which provide a direct link between the external environment and the internal pulp of the tooth. If the tubules are not exposed it seems unlikely that hypersensitivity will be found. In areas of sensitive

dentine, the apertures of the dentine tubules are patent and this results in more stimuli having closer contact with the dental pulp.[1] It is one of the most common, painful and least successfully treated chronic problems of the teeth. This condition generally involves the facial surfaces of teeth near the cervical border, and is very common in canine, premolars, and molars. Although sensitivity effects all ages, previous reports show that there is a strong correlation between age and dentinal hypersensitivity. Studies have shown that dentinal hypersensitivity was frequently observed between the age group of 20 and 40 years with women showing more prevalence.[8]

Several theories have been proposed which explain the phenomenon of dentinal hypersensitivity, namely; transducer theory, modulation theory, gate control theory and the hydrodynamic theory. The hydrodynamic theory proposed by Brannstrom[9] in the 1960s is the most often accepted as an explanation for painful dentin transmission. According to this theory, when a stimulus is applied to the dentin, a flow movement occurs in the tubules. The dentin flow movement toward the pulp—or flow in the opposite direction—causes a mechanical deformation of the nerve fibers that are inside the tubule or of the dentin/pulp interface, which is transmitted as a painful sensation.

The difficulty found in treating DH is expressed by the enormous number of techniques and therapeutic alternatives to relieve it. Several materials and methods, such as varnishes, liner, restorative materials, dental adhesives[10], dentifrices and mouthwashes are used to reduce dental sensitivity.[11] These desensitizing agents are applied either by the dentist (in office treatment) or used by the patient as home application. Home applications are mainly in the form of dentifrices and also as mouthwashes. The effects of home‑applied agents are manifested after a period of time and would require a considerable degree of patient compliance. In office treatment, modalities provide instantaneous relief to the patient, but the effects are often temporary. Thus, none of the treatment modalities has been able to provide a permanent relief from dentin hypersensitivity.[12]

The desensitizing agents can be divided into groups based on their occlusive or neural action.[13] The occlusive agents can work by different mechanisms, as the precipitation of proteins that are present in the fluid inside the tubule, precipitation of amorphous particles over the dentin and/or inside the tubule, or through mechanical action promoted by the formation of a superficial pellicle penetrating (or not penetrating) into the dentin tubules.[14] The neural blocking method consists of the direct diffusion of potassium ions through the dental structure, raising its concentration in the pulp tissue and blocking the anoxic action (nerve impulse conduction) by the altering of its action potential.[15,16] Independent of the mechanism of action, the objective of hypersensitivity treatment is the immediate interruption of the pain.[17,18]

Scanning electron microscopy (SEM) has shown that tubules in clinically characterized ‘sensitive’ exfoliated teeth are eight times more numerous, two times wider in diameter and more penetrable, whereas tubules in ‘non-sensitive’ teeth are fewer, smaller and usually blocked.[19] This suggests that agents which have the ability to occlude patent dentinal tubules and/or are adhesive to dentine surfaces and hence achieve surface coverage and seal most tubules, would be ideal to relieve DH.[20] However, none of the treatment regimens have been completely efficient in treating DH. Therefore, the continued development of new desensitizing agents is required.[21] The search for a natural desensitizing agent with long lasting effects has led to the observation that propolis had promising effects on dentin hypersensitivity. Propolis is a naturally-occurring bee product. It is widely used in homeopathic and herbal practices as an antiseptic, anti-inflammatory, antimycotic, and a bacteriostatic agent.[22] It was found that application of propolis for 1 and 2 minutes caused blockage of dentinal tubules. Propolis caused a stable coating on the dentine surface and water irrigation did not have effect on the coating of the agent. According to these authors, it may be presumed that tubule occlusion produced by the propolis may last to permit natural physiological reaction to occlude the tubules and maintain desensitization.[23]

Hence, the present study aimed to evaluate and compare, in vitro the dentinal tubule occluding effect of two commercially available dentifrices containing Propolis and Potassium Nitrate using scanning electron microscope.

MATERIALS AND METHOD

Thirty human single rooted teeth which were extracted for orthodontic purposes and having a hopeless prognosis from periodontal point of view were used in the study. Teeth with no cervical caries, restorations, erosions or fractures were selected for the study. They were stored in normal saline at room temperature. An ultrasonic scaler was used to remove all the plaque, debris and calculus from the tooth surface.

The anatomical crown was decoronated from the root portion below cementoenamel junction. These decoronated root specimens were sliced longitudinally using a diamond disc to obtain dentin discs.

The specimens were treated by using 37% phosphoric acid for 2 minutes followed by washing with distilled water and air drying. By doing so, the surface debris was removed without altering the surface topography.

The specimens were divided into 3 groups having 10 specimens each.
Group 1 - Control

Group 2 - Sensodent KF toothpaste
Group 3- Propolis toothpaste

A pea sized amount of toothpaste was taken and brushed on to the root specimens for 2 minutes each for 7 consecutive days. Specimens were stored in normal saline, washed with distilled water and were allowed to air dry for 2 minutes on filter paper. At the end of 7 days, teeth were mounted on a SEM machine, followed by vaccumization. The surfaces of the specimen were visualized under Scanning Electron Microscope of magnification of 1000X and 2000X, and photographs of representative areas were captured. (SEM specifications ICON Analytical Equipment Pvt. Ltd. Specimens scanned at 20.00 kV under 65 Pa pressure and photographed at 1000X and 2000X).

RESULTS

Treated dentin surfaces were free from smear layer and smear plugs and the dentinal tubules were completely open.

Scanning Electron Microscopic observation of selected desensitizing agents showed occlusion of dentinal tubules. Brushing dentin with toothpaste created irregular crystal deposits on its occluding surface. A new smear layer was formed by brushing process, leaving open dentinal tubules occluded by many small deposits.

Sensodent KF showed near about complete occlusion of dentinal tubules; whereas propolis also showed occlusion of dentinal tubules till a certain extent.

Fig I: Single root extracted teeth used in the study.

Fig II: Slices of teeth used for SEM.

Fig III: Different dentifrices used in the study.

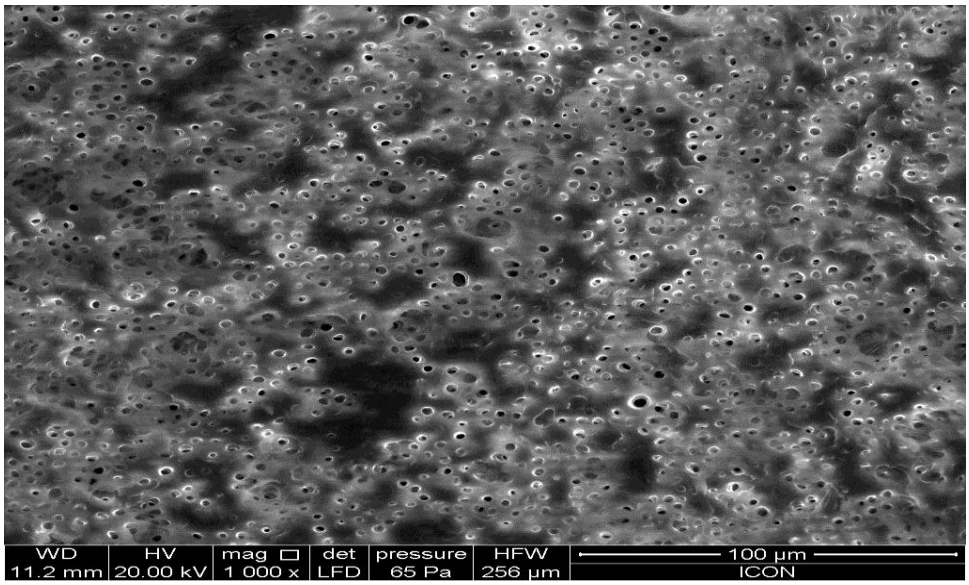

Fig IV: Open dentinal tubules after treatment with 37% phosphoric acid for 2 minutes.

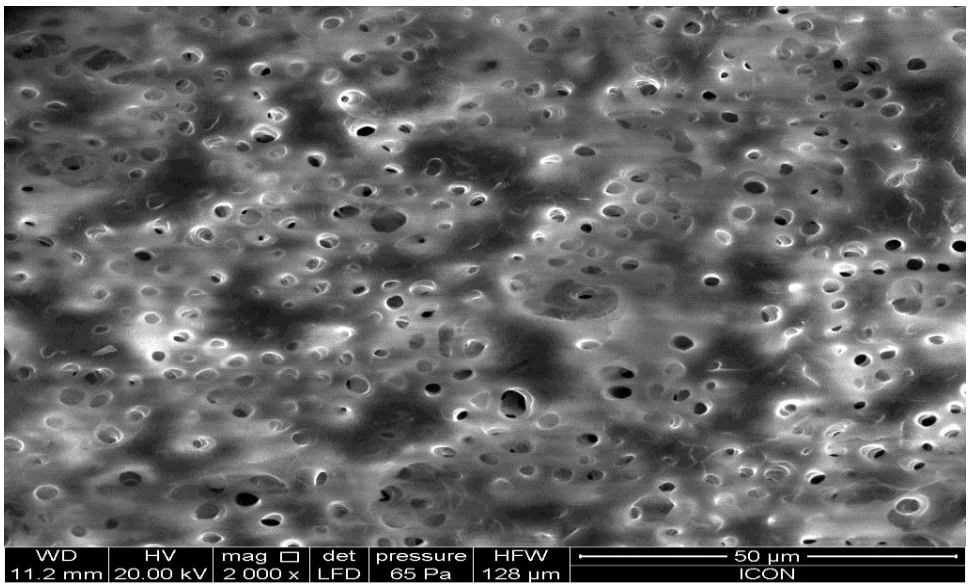

Fig V: Open dentinal tubules after treatment with 37% phosphoric acid for 2 minutes.

(Higher Magnification)

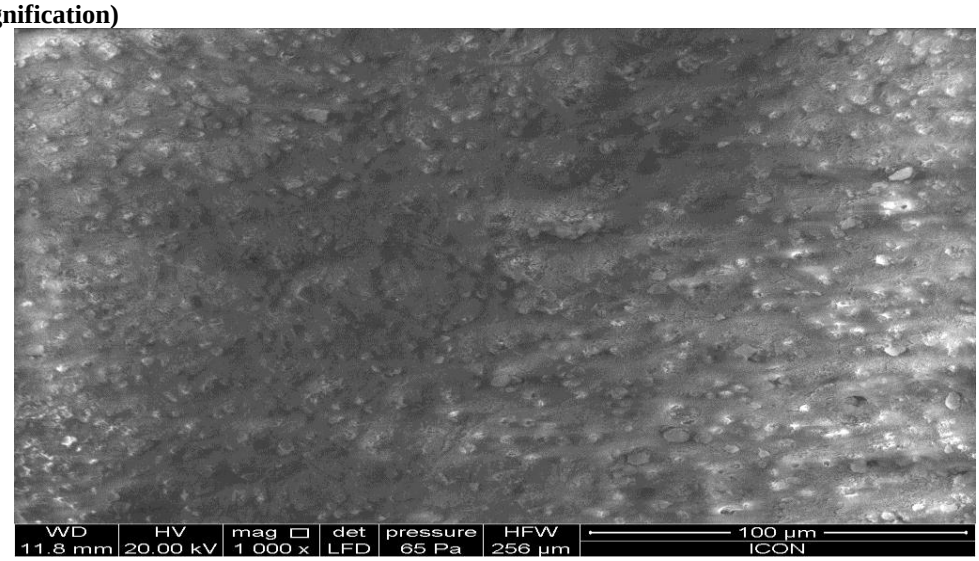

Fig VI: SEM image after application of Propolis toothpaste.

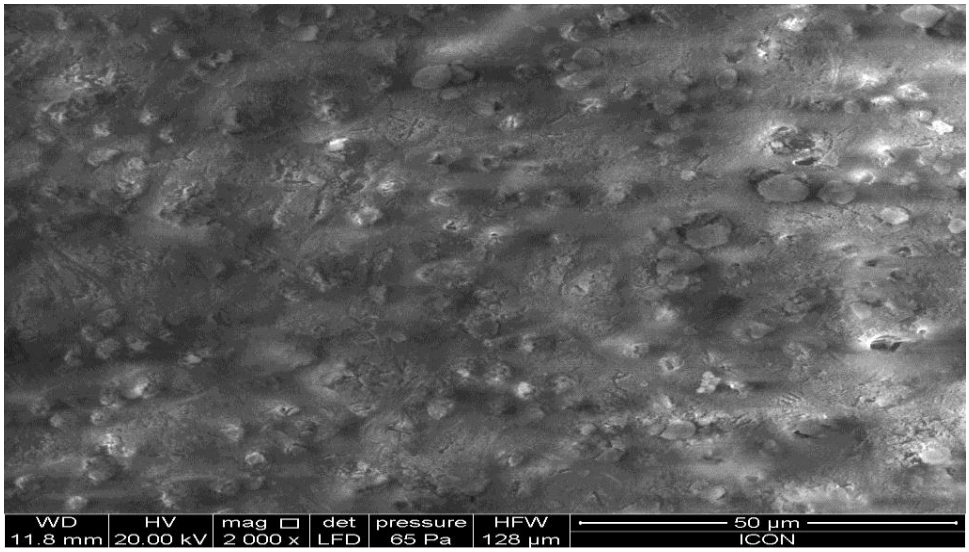

Fig VII: SEM image after application of Propolis toothpaste at higher magnification.

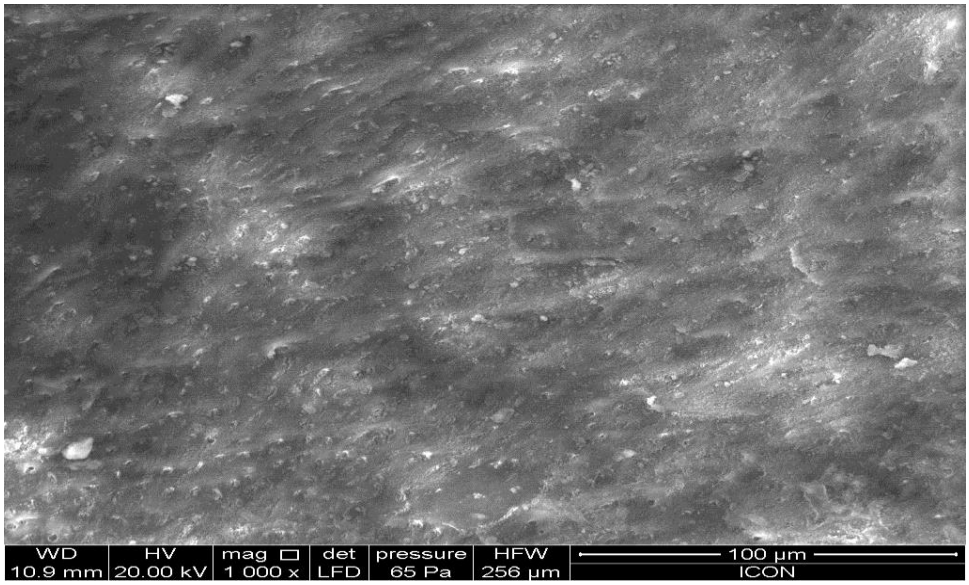

Fig VIII: SEM image after application of Sensodent KF toothpaste.

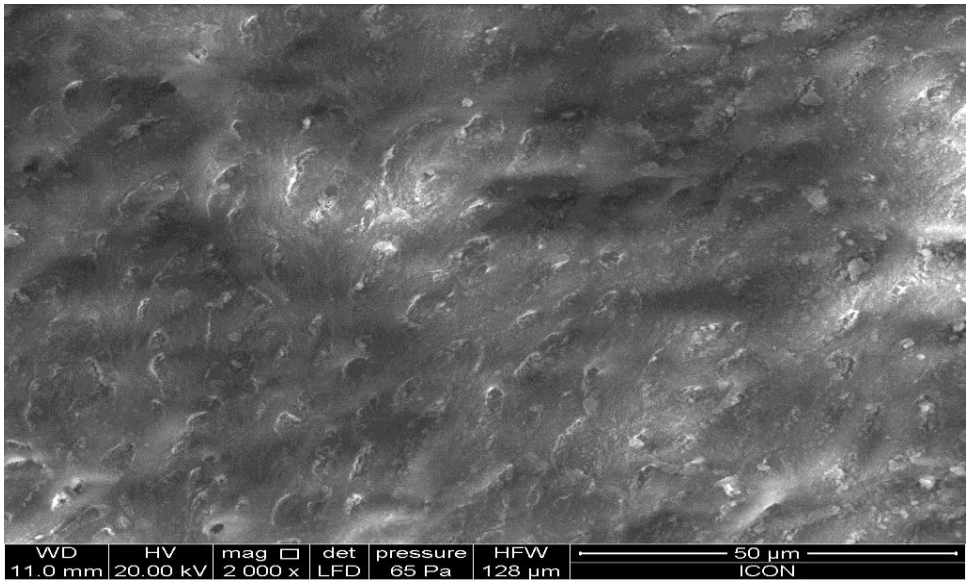

Fig IX: SEM image after application of Sensodent KF toothpaste at higher magnification.

DISCUSSION

Two primary mechanisms suggested in the treatment of dentin hypersensitivity include occlusion of dentinal tubules and blockage of nerve conduction. However, occlusion of dentinal tubules is one of the most commonly used treatment approaches in the treatment of dentinal hypersensitivity. Thus, any agent that leads to a decrease in the dentinal fluid conductance by occluding the tubules can be effective in reducing the clinical symptoms of hypersensitivity.

This study evaluated in vitro, the occlusion of dentinal tubules by two commercially available desensitizing agents having potassium nitrate, sodium monofluorophosphate and propolis as their active ingredient.

Sensodent KF toothpaste consists of potassium nitrate along with sodium monofluorophosphate. Potassium ions released from toothpaste diffuses along dentinal tubules to inactivate intradental nerves and act by blocking synapses between nerve cells, thereby reducing nerve excitation and the associated pain.[15,16] It has been demonstrated in certain in-vitro studies carried out using scanning electron microscope that sodium monofluorophosphate narrows down or occludes the dentinal tubules.[24] It is possible that sodium monofluorophosphate is hydrolyzed in the presence of hydroxyapatite with subsequent incorporation of fluoride ions in the lattice of the apatite crystals.[25]

MC Marcucci 1995 conducted a research on the properties of propolis for oral applications and noted that it has an anti-inflammatory action and stimulates reparative dentin formation, which could be able to reduce the dentin permeability.[26] Mahmoud *et al* 1999, in a pioneer study, conducted to evaluate the effect of propolis on dentinal hypersensitivity; concluded that propolis had a positive effect in the control of dentinal hypersensitivity.

Pura *et al* 2012[23] conducted an in vitro in a dentin disc model under SEM and confirmed that propolis occluded substantial no of tubules and there was a uniform stable coverage across dentin disc surface. These findings were supported by another in vitro study carried out by Almas *et al* 2001.

Several comparative studies have stated the superiority of propolis over other desensitizing agents. Madhavan *et al*[27] in a 90-day comparative clinical trial stated that propolis was most efficient in treating dentinal hypersensitivity when compared to CPP-ACP F i.e., Casein phosphopeptide amorphous calcium phosphate and Sodium fluoride. Yet another clinical trial conducted by Pura *et al*[12] confirmed that propolis was more effective than 5% potassium nitrate in relieving dentinal hypersensitivity.

As this study considers only in-vitro effects of these dentifrices, it is important to investigate the individual patient variables like diet, salivary pH to the patency of dentinal tubules. Further clinical trials should be conducted to evaluate the desensitizing effect of these dentifrices in patients.

CONCLUSION

The SEM study demonstrated that these desensitizing agents decrease dentin hypersensitivity by occluding dentinal tubules. However, clinical trials are needed to evaluate the efficacy of propolis as a desensitizing agent in preventing dentin hypersensitivity in humans.

REFERENCES

1. Bartold PM. Dentinal hypersensitivity: A review. Aust Dent J., 2006; 51(3): 212–8.
2. Rehabilitation O, Dentistry R, Materials D,

Dentistry R. Clinical evaluation of low-level laser therapy and fluoride varnish for treating cervical dentinal hypersensitivity, 2003.
3. He S, Wang Y, Li X, Hu D. O ral Rehabilitation Effectiveness of laser therapy and topical desensitising agents in treating dentine hypersensitivity : a systematic review, 2011; (15): 348–58.
4. Bissada NF. SYMPTOMATOLOGY AND CLINICAL FEATURES HYPERSENSITIVE TEETH, 1994; 39.
5. Short-term Clinical Evaluation of Four Desensitizing Agents, 9(1): 1–10.
6. Pereira JC, Christina A, Figueiredo B. Effect of Commercially Available and Experimental Potassium Oxalate-Based Dentin Desensitizing Agents in Dentin Permeability : Influence of Time and Filtration System, 2006; 17: 300–5.
7. Board CA. Consensus-Based Recommendations for the Diagnosis and Management, 2003; 69(4): 221–6.
8. Dentinal Hypersensitivity, 6(2): 1–10.
9. Brannstrom M. The Hydrodynamic Theory of Dentinal Pain : Sensation in Preparations, Caries, and the Dentinal Crack Syndrome, 1986; 12(10): 453–7.
10. Kazemi RB. Permeability changes of dentine treated with titanium tetrafluoride, 1999; 27: 531–8.
11. Gillam DG, Orchardson R. Advances in the treatment of root dentine sensitivity : mechanisms and treatment principles, 2006; 13–33.
12. Purra A, Mushtaq M, Acharya S, Saraswati V. A comparative evaluation of propolis and 5.0% potassium nitrate as a dentine desensitizer: A clinical study. J Indian Soc Periodontol, 2014; 18(4): 466–71.
13. NICOLA X. WEST. Dentine hypersensitivity : preventive and therapeutic approaches to treatment. Periodontol, 2000. 2008; 48(13): 31–41.
14. Pashley DH. Dentin Permeability, Dentin Sensitivity, and Treatment Through Tubule Occlusion, 1986; 12(10): 465–74.
15. Peacock JM, Orchardson R. Effects of Potassium Ions on Action Potential Conduction in A- and C-Fibers of Rat Spinal Nerves, 2015; 74(2): 634–41.
16. Markowitz K, Bilotto G. CAT WITH POTASSIUM AND DIVALENT CATIONS, 1991; 36(I).
17. Al-sabbagh M, Brown A, Thomas M V. I n - Office Treatment of Dentinal Hyper s ensitivity, 2009; 53: 47–60.
18. P-y L, Y-w C, C-y C, K-l C, C-p L, Lin P, et al. In-office treatment for dentin hypersensitivity : a systematic review and network, 2013; (1963): 53–64.
19. E. G. Absi, M. Addy D adam. Dentin hypersensitivity: A study of the patency of dentinal tubules in sensitive and non sensitive cervical dentin. J Clin Periodontol, 1987; 14(3): 280–4.
20. Parolia A, Mala K, Mohan M. Management of dentinal hypersensitivity : a review, 2011; (March 2013).
21. Rösing CK, Fiorini, Tiago Liberman DN, Cavagni J. Dentine hypersensitivity: analysis of self-care products. Braz Oral Res., 2009; 23(5): 56–63.
22. Arjun Torwane N, Hongal S, Goel P, Chandrashekhar BR, Jain M, Saxena E, et al. Effect of two desensitizing agents in reducing dentin hypersensitivity: An in-vivo comparative clinical trial. J Clin Diagnostic Res., 2013; 7(9): 2042–6.
23. Aamir Rashid Purra MM. Scanning electron microscopic evaluation of the desensitizing effect of propolis in the dentine disc model : An in-vitro study. Int J Dent Clin., 2012; 4(3): 6–9.
24. Jain DN, S.2 DDY, U. DSM, K. DCN, Kevadia5 DV, Mohammadi6 DT. COMPARATIVE EVALUATION OF COMMERCIALLY AVAILABLE DESENSITIZING DENTIFRICES ON DENTINAL TUBULE OCCLUSION: AN IN-VITRO SCANNING ELECTRON MICROSCOPIC STUDY. Eur J Pharm Med Res., 2019; 6(8): 449–57.
25. Addy M, Dowell P. Dentine hypersensitivity - A review: Clinical and in vitro evaluation of treatment agents. J Clin Periodontol, 1983; 10(4): 351–63.
26. Marcucci MC. Propolis : chemical composition, biological properties and therapeutic activity. Apidilogie, 1995; 26(5): 83–99.
27. Madhavan S, Nayak M, Shenoy A, Shetty R, Prasad K. Dentinal hypersensitivity: A comparative clinical evaluation of CPP-ACP F, sodium fluoride, propolis, and placebo. J Conserv Dent., 2012; 15(4): 315–8.