A comparative evaluation of propolis and light-cured ormocer-based desensitizer in reducing dentin hypersensitivity

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Abstract:
Objectives: The purpose of the study was to evaluate and compare the clinical efficacy and the durability of propolis and Light-cured ormocer-based desensitizer (Admira Protect, Voco: Cuxhaven Germany) in the treatment of dentin hypersensitivity (DH). Materials and Methods: The study was conducted over a period of 2 months on 13 patients with 72 hypersensitive teeth, randomly allocated into three treatment groups: Group A: Treated with Propolis, Group B: Admira protect (Voco: Cuxhaven Germany), and Group C: Sterile water (Placebo control). Baseline sensitivity was recorded by the operator using tactile and evaporative stimuli. Visual analog scale (VAS) was used to record the degree of sensitivity perceived by the patients. All the groups received applications of allotted materials on day 1, 7, 14, and 21. After each application VAS scoring was recorded. On day 30 and 60, only pain evaluation was done to determine the durability of each test materials. Statistical Analysis: One-way ANOVA, repeated measure ANOVA and post hoc test was done for multiple comparison. Results: All the groups showed significant results in reducing DH. Among Groups A and B, Group B showed immediate postoperative result at the end of the 1st week. Conclusion: Both the test materials were effective in reducing DH but Admira protect was found to be more efficient in reducing pain with longer duration of action (CTRI regd no: CTRI/2017/12/010755).

Key words:
Admira protect, dentin hypersensitivity, placebo, propolis, tactile and evaporative stimuli, visual analog scale

INTRODUCTION

Holland et al. defined dentin hypersensitivity (DH) as “short, sharp pain arising from exposed dentin in response to stimuli typically thermal, evaporative, tactile, osmotic, or chemical and which cannot be ascribed to any other form of dental defect or pathology.”[6] Improper tooth brushing and periodontal disease that leads to gingival recession can cause dentin exposure. Adding to it, population spending more efforts on oral hygiene practices and a healthy erosive diet are more linked to wearing of tooth that leads to DH.[2,3]

Branstorm’s hydrodynamic theory explains that the fluid flow in dentin tubules indirectly stimulates the pulp nerve endings causing painful sensation.[4,5] Therefore, it can be regarded that any material that blocks this fluid movement can decrease DH. DH can be managed with toothpastes and mouthwashes that are applied at home, although it requires a considerable amount of patient compliance. However, instantaneous pain relief can be given by in-office treatments using desensitizing agents. Nevertheless, these agents have failed to provide lasting relief from pain, therefore, a quest for newer agents are needed.[2,6]

Attributing to the medicinal potentials of natural products and diverse biological activities, propolis was selected for the treatment of DH. The way mother nature has contributed with her products in the field of medicine and health has been overwhelming. Propolis being one such product occurring from bees has antiseptic, antioxidant, anti-inflammatory, and antimicrobial properties. It constitutes resin, essential oils, and wax along with amino acids, antimicrobial agents and bioflavonoid. Propolis, besides its wide application in medical filed, has also shown a positive effect in occluding dentinal tubules.[9-11]
Therefore, a comparison was made between its efficacy and another synthetic recently developed desensitizing agent, which happens to be light-cured organically modified ceramic (ormocer)-based desensitizer (VOCO Admira Protect, Cuxhaven, Germany). According to the manufacturer’s statement, it is biocompatible with special filler technology and fluoride release. It consists of monomers, organic acids, and ormcners. Ormncer comprises inorganic-organic copolymers and inorganic silanated filler particles that bond to dentin.\[13\] Very few \textit{in vitro} and \textit{in vivo} studies have evaluated its efficiency and showed a promising result in reducing DH with a long-lasting effect.\[15\-16\]

Hence, the aim of the present study was the in-office evaluation and comparison of the clinical durability and efficacy of the above two mentioned desensitizers in reducing DH.

**MATERIALS AND METHODS**

This study was designed \textit{in vivo}, randomized controlled clinical trial that included 13 patients with 72 hypersensitive teeth. An approval was taken from the Institutional Ethical Committee and a written consent was obtained from all the participants before the examination. Patients qualified for the study who were willing to participate for 2 months were selected from the outpatients presenting to the outpatient department of the institution. Systemically healthy male and female controls, the age group of 20–40 years was included in the study. Cervical lesions such as erosion, abrasion, or gingival recession <4 mm, and teeth with loss of dentin <2 mm depth according to tooth wear index were accounted eligible for the study.\[17\] Participants with notable evidence of pulpitis, carious lesions, defective restorations, active periodontal disease, active cervical caries, or deep abrasions involving pulp were excluded. Furthermore, any history of drug addiction, allergy/idosyncratic reactions, use of analgesic and/or anti-inflammatory drugs, pregnant, and lactating women were not included in the study.

Demographic details, medical, and dental histories were obtained together of each selected patients. Using tactile and evaporative stimuli, participants with DH were assessed. Tactile stimulation included placement of a periodontal probe perpendicularly to the tooth surface and passing by with gentle pressure and gradually increasing until the participant responded. A dental unit triple syringe was used to evaluate evaporative stimuli to blow out air for about second, which was kept perpendicular and 2 mm away from tooth surface while covering the adjacent teeth with fingers or cotton rolls. The determination of pain evaluation was carried over by visual analog scale (VAS) which was given to the participants to mark the degree of pain they tended to experience, in which 0 indicated no pain and 10 denoted maximum pain. Soon after baseline screening, all the participants underwent thorough oral prophylaxis and were assigned for DH treatment after 7 days.

In total, 72 teeth were randomly allocated with the help of computer program into three groups:

1. Group A: Propolis (commercially available) as test group \((n = 24)\)
2. Group B: Light-cured ormcner-based desensitizer (VOCO, Admira Protect) as test group \((n = 24)\)
3. Group C: Sterile water as placebo group \((n = 24)\).

The sequence that includes the number of patients and their treatment code was placed in opaque sealed envelopes. The double-blinding technique was followed where neither the patients nor the scorer was aware about the material used to avoid bias. The desensitizing agent was applied by a separate operator.

1. Prior starting the procedure on day 1, VAS was recorded and the teeth to be treated were isolated using cotton rolls
2. Polishing and drying with cotton pellets were done on all the surfaces of the tooth
3. Application of Admira Protect was done as per manufacturer’s instructions
4. Topical application of propolis on hypersensitive areas using micro brush was done and was left to dry for about 60s and was left undisturbed for 5 min. The same procedure was carried out for the second time after complete drying
5. Any left-over/residual material on the gingival surface was carefully removed making sure that none of the products touched the other zones of the oral mucosa
6. VAS scoring was recorded instantly after the treatment
7. For the desensitizing agent to get adequate time to act without being washed away, patients were instructed to avoid rinsing, eating, or drinking for 30 min after the treatment. In addition, patients were instructed to not use any other professionally or self-applied desensitizing agent during investigation
8. The application of placebo (sterile water) was done in the same manner.

Patients were recalled on 7, 4, and 21st day for the application of the same agents. Tactile and evaporative stimuli were applied at each visit after the application to evaluate the pain and patients were given the VAS scale to mark the degree of pain they experienced.

On the 30 and 60th day, participants were recalled. VAS scoring was recorded on these days without application of products to determine the durability of the two products.

**Statistical analysis**

Descriptive statistics enabled the calculations of mean and the standard deviations of all groups at each period. ANOVA analysis in a way was done to find out the difference between and at different time intervals. \textit{Post hoc} test was used for multiple comparisons between the groups and pairwise test was done to compare the reduction in severity during successive days as compared to baseline in each group. To determine the efficacy of each group at each time interval when compared with the baseline value, repeated measure ANOVA was used. All the statistical analysis was executed using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY: IBM Corp., USA). The level of statistical significance was set at \( P < 0.05 \).

**RESULTS**

The flow chart of the experimental design is presented in Figure 1.

The distribution of participants in different groups is shown in Table 1. Group A had 5 participants with 4 teeth that were...
treated with propolis. While Group B had 4 participants with 24 sensitive teeth were treated with Admira Protect. These test groups were compared with Group C with 4 participants and 24 teeth, treated with sterile water as placebo.

Table 2 shows the descriptive analysis and one-way ANOVA of mean and standard deviation of VAS score between different groups from baseline to day 60. There was mean reduction in severity of DH observed in all the groups at different time intervals. Group A, at baseline, the mean value showed 8.6 ± 0.55 which after 4th application reduced to 2.6 ± 0.89 on day 21. The difference in the reduction of severity was statistically significant (P < 0.001). In Group B, at baseline, the mean VAS score recorded 8.5 ± 0.58, which after 2nd application reduced to 2.8 ± 1.70. The difference in reduction of severity was statistically significant (P < 0.001). Group C, the placebo group, the reduction of the severity is comparatively less as compared to the other two test groups. Although all the groups showed statistically significant reduction, immediate reduction of pain was noted in Group B as compared to Group A. On day 30 and day 60, all the three groups, showed further reduction and the scores became stable.

Table 3 shows multiple comparison of mean VAS score between different groups at different time intervals. Immediate reduction in pain was observed in Group B when compared with Group C on day 7 (P = 0.01) whereas Group A showed a reduction on day 21 when compared with Group C (P = 0.001). Groups A versus B had given significant result on day 14 (P = 0.02 and < 0.05).

Table 4 shows pairwise comparison of mean VAS score of each day with baseline value. Group A: The significant reduction in sensitivity observed on day 21 as compared to baseline. Group B: There was a significant reduction in sensitivity noted on day 14 as compared to the baseline value. Group C: though mean P value was statistically significant, the difference in reduction of the severity of teeth was not statistically significant as compared to Groups A and B.

Figure 2 shows the graphical representation of mean reduction of VAS score of each group for each period which showed that Group B has given better result in reducing sensitivity as compared to propolis and placebo group.
Table 2: Comparison of mean visual analog scale score between different groups at different time intervals

| Group       | Baseline | Day 1  | Day 7  | Day 14 | Day 21 | Day 30 | Day 60 | Statistical inference (F, df, P) |
|-------------|----------|--------|--------|--------|--------|--------|--------|---------------------------------|
| Group A     | 8.6±0.55 | 5.8±0.84 | 4.6±1.00 | 4.0±1.00 | 2.6±0.89 | 1.6±0.55 | 1.6±0.55 | 162.829, 6, <0.001 |
| Group B     | 8.5±0.58 | 5.3±1.26 | 2.8±1.70 | 1.5±1.73 | 0.3±0.50 | 0.3±0.50 | 0.3±0.50 | 93.561, 6, <0.001 |
| Group C     | 8.3±0.96 | 6.8±1.26 | 6.3±1.70 | 5.8±1.26 | 5.3±0.96 | 4.5±1.29 | 4.5±1.29 | 30.559, 6, <0.001 |
| Total       | 8.5±0.66 | 5.9±1.19 | 4.5±1.90 | 3.8±2.12 | 2.7±2.18 | 2.1±1.94 | 2.1±1.94 |                                      |
| Statistical inference | 0.284, 2, | 1.879, 2, | 6.559, 2, | 10.298, 2, | 37.365, 2, | 27.319, 2, | 27.319, 2, |                                      |

1ANOVA applied; 2Repeated measures ANOVA applied; 3P<0.05 is statistically significant; A – Propolis; B – Admira Protect; C – Sterile water; ANOVA – Analysis of variance; SD – Standard deviation; F – Ratio of variance; df – Degree of freedom; P – Level of significance

Table 3: Multiple comparison of mean visual analogue scale score between different groups at different time intervals

| Multiple pair wise comparisons | Baseline | Day 1  | Day 7  | Day 14 | Day 21 | Day 30 | Day 60 | P |
|-------------------------------|----------|--------|--------|--------|--------|--------|--------|---|
| A versus B                   | 0.84     | 0.48   | 0.07   | 0.02*  | 0.002* | 0.04*  | 0.04*  |   |
| A versus C                   | 0.48     | 0.23   | 0.10   | 0.08   | 0.001* | 0.000* | 0.000* |   |
| B versus C                   | 0.63     | 0.09   | 0.01*  | 0.001* | 0.000* | 0.000* | 0.000* |   |

*P<0.05 is statistically significant; A – Propolis; B – Admira Protect; C – Sterile water; P – Level of significance

**DISCUSSION**

The occlusion of dentinal tubules is the major concern in the treatment of DH. Different mechanisms have been proposed for occluding the dentinal tubules which can be done by the precipitation of proteins present in dentinal tubular fluid, precipitation of amorphous particles over exposed dentin surfaces and/or inside tubules, or by the formation of a superficial pellicle which may penetrate the dentin tubules and the neural blocking method.

Natural agents like propolis, which is a bee product has been used since the ancient times in medical field to treat diseases and inflammatory conditions. It is considered that bioflavonoid present in propolis, plays an important role in reducing hypersensitivity. On the other hand, SEM studies have found that chemical agents such as light cure activated ormocer-based desensitizing agent (Admira protect) are effective enough to seal the dentinal tubules. The conventional light cure is used in polymerization of the resin thus reducing the fluid flow. In the review of literature, no study has been done to compare propolis and Admira protect in the treatment of DH. Hence, in this study, we evaluated clinical efficacy of propolis (Group A, test) and Admira (Group B, test), and a comparison was made with sterile water (Group C, placebo).

The two most common stimuli used in clinical studies are thermal and tactile stimuli. In the present study, we tested with the help of tactile stimuli and air blast from a three in one air/water syringe, which was according to the study done by Sowinski et al. The potency of the desensitizing agents was evaluated with VAS.

The test material in Group A was propolis. This agent showed the statistically remarkable reduction in mean VAS scoring on day 2 (2.6 ± 0.89) when compared to the baseline (8.6 ± 0.55). There was a further reduction in score that became stable on day 30–day 60, thus showed its satisfactory long-term effect. The result is in accordance with the pioneer study conducted by Mahmoud et al. The author stated that 70% of the participants had severe hypersensitivity at the baseline. At the first recall, it was reduced to 50% and on second recall 30% of participants were satisfied and had no pain. In Another vitro SEM study, propolis was found to be effective in occluding dentinal tubules within 60–120 s of its first application. The mechanism of action of propolis in reducing sensitivity could be due to high content of bioflavonoids. Mahmoud et al. stated that flavonoids present in propolis may suppress the information of free radicals by binding heavy metals in ions, known to catalyze many processes leading to the appearance of full radicals. These bioflavonoids may interact with the dentin to form crystals within dentinal tubules, thus reducing the fluid flow. This theory was stated by Sabir et al. in his study and used propolis as a direct pulp capping agent. He noted partial dentin bridge formation beneath the pulp capping agent at 4th week.

The application of Admira protect showed a significant result on day 7 (2.8 ± 1.70) as compared to baseline (8.5 ± 0.58). On day 30 and 60, it was further reduced to 0.3 ± 0.50 and showed a longer duration of action. In an in vitro study, Admira Protect is considered a best durable agent when compared to other products. This may be because, polymerization leads to precipitation of plasma proteins from dentinal tubules, thus reducing permeability and fluid flow. Our result goes in accordance with the in vitro studies done by Torres et al. and Ravishankar et al. They used Admira protect along with...
CONCLUSION

Within the limitations of the study, it can be concluded that: Both the desensitizing agents significantly reduced DH despite their different chemical compositions. Propolis showed its action in relieving sensitivity after 4th application whereas Admira protect is significantly more effective in reducing sensitivity immediately after 2nd application and gradually increased by the end of 2 months showing its better duration of action.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Holland GR, Narhi MN, Addy M, Gangerosa L, Orchardson R. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. J Clin Periodontol 1997;24:808-13.
2. West NX, Sanz M, Lussi A, Bartlett D, Bouchard P, Bourgeois D. Prevalence of dentine hypersensitivity and study of associated factors: A European population-based cross-sectional study. J Dent 2013;41:841-51.
3. Flynn J, Galloway R, Orchardson R. The incidence of ‘hypersensitive’ teeth in the West of Scotland. J Dent 1985;13:230-6.
4. Nanci A. Ten Cate’s Oral Histology: Development, Structure, and Function. 9th ed. Elsevier; 2018:434-36.
5. Pashley DH. Mechanisms of dentin sensitivity. Dent Clin North Am 1990;34:449-73.
6. Lier BB, Rosing CK, Aass AM, Gjermo P. Treatment of dentin hypersensitivity by Nd:YAG laser. J Clin Periodontol 2002;29:501-6.
7. Khalid A, Afaf D, Ameira M. Propolis as a natural remedy: An update. Saudi Dent J 2001;13:1.
8. Mahmoud AS, Almas K, Dahlan AA. The effect of propolis on dentinal hypersensitivity and level of satisfaction among patients from a university hospital Riyadh, Saudi Arabia. Indian J Dent Res 1999;10:130-7.
9. Almas K, Mahmoud AS, Dahlan AA. A comparative study of propolis and saline application on human dentin. A SEM study. Indian J Dent Res 2001;12:21-7.
10. Mahmoud A, Almas K, Dahlan AA. The effect of propolis on female subjects with dentinal hypersensitivity. J Dent Res 1999;79:406.
11. Sabir A, Tabbu CR, Agustioso P, Soroseno W. Histological analysis of rat dental pulp tissue capped with propolis. J Oral Sci 2005;47:135-8.
12. Malkoç MA, Sevimay M. Evaluation of mineral content of dentin treated with desensitizing agents and neodymium yttrium-aluminum-garnet (Nd:YAG) laser. Lasers Med Sci 2012;27:743-8.
13. Dundar A, Yavuz T, Orucoglu H, Daneshmehr L, Yalcin M, Sengun A. Evaluation of the permeability of five desensitizing agents using computerized fluid filtration. Niger J Clin Pract 2005;8:445-9.
14. Pathan AB, Bolla N, Kavuri SR, Sunil CR, Damaraju B, Pattan SK. Ability of three desensitizing agents in dentinal tubule obliteration and durability: An in vitro study. J Conserv Dent 2016;19:31-6.

15. Ravishankar P, Viswanath V, Archana D, Keerthi V, Dhanapal S, Lavanya Priya KP. The effect of three desensitizing agents on dentin hypersensitivity: A randomized, split-mouth clinical trial. Indian J Dent Res 2018;29:51-5.

16. Torres CR, Silva TM, Fonseca BM, Sales AL, Holleben P, Di Nicolo R, et al. The effect of three desensitizing agents on dentin hypersensitivity: A randomized, split-mouth clinical trial. Oper Dent 2014;39:E186-94.

17. Peter S. Tooth wear index. Essentials of Preventive and Community Dentistry. 3rd ed. Arya (Medi) Publishing House, New Delhi: Arya Publications; 2006, ISBN-81-86809-40-6. p. 202-3.

18. Ladalardo TC, Pinheiro A, Campos RA, Brugnera Júnior A, Zanin F, Albernaz PL, et al. Laser therapy in the treatment of dentine hypersensitivity. Braz Dent J 2004;15:144-50.

19. Addy M, Dowell P. Dentine hypersensitivity – A review. Clinical and in vitro evaluation of treatment agents. J Clin Periodontol 1983;10:351-63.

20. Pashley DH. Dentin permeability, dentin sensitivity, and treatment through tubule occlusion. J Endod 1986;12:465-74.

21. Peacock JM, Orchardson R. Effects of potassium ions on action potential conduction in A- and C-fibers of rat spinal nerves. J Dent Res 1995;74:634-41.

22. Ide M, Wilson RF, Ashley FP. The reproducibility of methods of assessment for cervical dentine hypersensitivity. J Clin Periodontol 2001;28:16-22.

23. Sowinski J, Ayad F, Petrone M, Devizio W, Volpe A, Ellwood R, et al. Comparative investigations of the desensitizing efficacy of a new dentifrice. J Clin Periodontol 2001;28:1032-6.

24. Pearce NX, Addy M, Newcombe RG. Dentine hypersensitivity: A clinical trial to compare 2 strontium densensitizing toothpastes with a conventional fluoride toothpaste. J Periodontol 1994;65:113-9.

25. Yates RJ, Newcombe RG, Addy M. Dentine hypersensitivity: A randomised, double-blind placebo-controlled study of the efficacy of a fluoride-sensitive teeth mouthrinse. J Clin Periodontol 2004;31:885-9.

26. Price DD, Finniss DG, Benedetti F. A comprehensive review of the placebo effect: Recent advances and current thought. Annu Rev Psychol 2008;59:565-90.

27. Wager TD, Atlas LY, Leotti LA, Rilling JK. Predicting individual differences in placebo analgesia: Contributions of brain activity during anticipation and pain experience. J Neurosci 2011;31:439-52.

28. Nolan TA, Price DD, Caudle RM, Murphy NP, Neubert JK. Placebo-induced analgesia in an operant pain model in rats. Pain 2012;153:2009-16.