ORIGINAL ARTICLE

Year : 2015 | **Volume** : 18 | **Issue** : 5 | **Page** : 389-393

Comparison of efficacy of three different desensitizing agents for in-office relief of dentin hypersensitivity: A 4 weeks clinical study

Amit Jena, Govind Shashirekha
Department of Conservative Dentistry and Endodontics, Institute of Dental Sciences, Siksha 'O' Anusandhan University, Bhubaneswar, Odisha, India

Click **here** for **correspondence address** and email

Date of Submission	03-Apr-2015
Date of Decision	22-Jun-2015
Date of Acceptance	28-Jul-2015
Date of Web Publication	1-Sep-2015

Abstract

Aim: To evaluate the effectiveness of three different pastes containing 5% NovaMin, 8% arginine, and 15% hydroxyapatite nanoparticles (n-HA) respectively in the treatment of dentin hypersensitivity (DH).
Materials and Methods: A 4 weeks study was conducted on 45 adult patients with cervical abrasions leading to hypersensitivity of two or more teeth anterior to molars. Patients were divided into three toothpaste groups. Group I: 5% NovaMin, Group II: 8% arginine, Group III: 15% n-HA. Sensitivity was assessed at baseline, immediately after application and after 1-week and 4 weeks. Tactile stimuli response using a visual analog scale and standard cold air blast using Schiff cold air sensitivity scale were used to compare the efficacies of toothpastes after a single application.
Statistical Analysis: Two-way analysis of variance and *post-hoc* Tukey test were used and $P \leq 0.05$ was considered statistically significant.
Results: Visual analog scale analysis: Group III and Group II showed statistically significant reduction in DH at all-time intervals when compared with Group I. In SCA analysis there is no statistically significant difference between Group II and Group III immediately after application.
Conclusion: Toothpaste containing 15% n-HA was found to be most effective in reduction of DH after a single application up to a period of 4 weeks followed by 8% arginine and 5% NovaMin toothpastes.

Keywords: Dentin hypersensitivity; desensitizing toothpaste; hydroxyapatite nanoparticles; NovaMin; Pro-Arginine

How to cite this article:
Jena A, Shashirekha G. Comparison of efficacy of three different desensitizing agents for in-office relief of dentin hypersensitivity: A 4 weeks clinical study. J Conserv Dent 2015;18:389-93

How to cite this URL:
Jena A, Shashirekha G. Comparison of efficacy of three different desensitizing agents for in-office relief of dentin hypersensitivity: A 4 weeks clinical study. J Conserv Dent [serial online] 2015 [cited 2015 Dec 19];18:389-93. Available from: http://www.jcd.org.in/text.asp?2015/18/5/389/164052

Introduction

Dentin hypersensitivity (DH) is one of the most commonly encountered clinical problem and is characterized by 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 dental defect or disease. [1],[2] Its diagnosis can be challenging and the dental professional must perform differential diagnosis to exclude all other dental defects and diseases that might

give rise to similar presentations [1],[3] such as a split or broken tooth, dental caries, or periodontal disease. Correct diagnosis is important to develop and implement an appropriate treatment plan. [3],[4]

Gingival recession, resulting from abrasion or periodontal disease, is the primary route through which the underlying dentin becomes exposed, and acid erosion is an important factor in opening exposed dentin tubules. [1],[5],[6],[7] Once a patient has DH, any external stimulus, such as physical pressure or air movement, can cause discomfort for the patient.

The discomfort of DH vary from a minor inconvenience to the very disturbing condition that provokes chronic discomfort and emotional distress. [8] As normal hygiene maintenance becomes more difficult, accumulation of dental plaque increases the risk for caries formation, gingival inflammation, and further periodontal problems. [9]

The most widely accepted theory for DH is the hydrodynamic theory proposed by Brännström. [10] A simple clinical method of diagnosing DH includes evaporative or "air blast" method or using an exploratory probe on the exposed dentin, in a mesiodistal direction, examining all the teeth in the area in which the patient complains of pain. [11] The severity or degree of pain can be quantified either according to the categorical scale (i.e., slight, moderate or severe pain) or using a visual analog scale (VAS). Another commonly used method is "Schiff" scale. [12]

Products for the management of DH typically aim to control the hydrodynamic mechanisms of pain. Approaches to control the condition fall into two broad categories: Agents or products that reduce fluid flow within the dentin tubules by occluding the tubules themselves, thereby blocking the stimuli, and those that interrupt the neural response to stimuli.

Despite the large number of published studies, however, there is still no consensus on as to which product constitutes the "gold standard" for DH treatment. [13],[14]

Prevalence and epidemiology

DH has an incidence ranging from 4% to 74%. [15],[16],[17],[18],[19] A slightly higher incidence of DH is reported in females than in males. While DH can affect the patient of any age, most affected patients are in the age group of 20-50 years, with a peak between 30 and 40 years of age. [16] Regarding the type of teeth involved, canines and premolars of both the arches are the most affected teeth. A buccal aspect of the cervical area is the commonly affected site. [20]

The objective of this study was to determine the efficacy of three different desensitizing pastes containing 5% NovaMin, 8% arginine, and a test paste containing 15% hydroxyapatite nanoparticles (n-HA), in reducing DH instantly after single application and at 1- and 4 weeks follow-up.

Materials and Methods

Siksha'O' Anusandhan University Research and Ethical Committee approved the study. An *in-vivo*, double-blind study was done among 45 patients consisting of 17 male and 28 female patients who visited the department at our institute. The randomization process was made using a computer-generated random table. Excel software (Microsoft) was used for randomization. To ensure the examiner remained blind investigators were neither involved in the randomization process nor were they aware of the assigned group in all outcome evaluations.

Inclusion criteria

- Ages of 18-50 (inclusive) and in generally good health with minimum of two hypersensitive teeth which were anterior to the molars and demonstrated cervical abrasion or gingival recession.
- Less than 1 mm loss of dentin in depth which did not require any restorative regimen.
- Subjects were required to be available for the duration of the study, and to sign an informed consent form.

Baseline sensitivity values were recorded before starting the treatment by using the tactile method and air blast stimuli.

Exclusion criteria

- Gross oral pathology, chronic disease, advanced periodontal disease, treatment for periodontal disease (within the last 12 months), or hypersensitive teeth with a mobility >1.
- Subjects with existing medical conditions, pregnant or lactating women, individuals who were participating in any other clinical study or who had participated in a desensitizing dentifrice study or who used a desensitizing dentifrice within the last 3 months, were not allowed to participate in the study.

Tactile sensitivity assessment

Tactile sensitivity was assessed by using a blunt probe used under slight manual pressure in the mesiodistal direction on the hypersensitive areas of the tooth. The degree of hypersensitivity was reported according to VAS. Score were given on a 10 cm sensitivity VAS, which had ratings from 0 to 1 no pain, 2-3 for mild pain, 4-6 for moderate, and 7-10 for severe pain. Subjects with baseline values ≥4 on VAS were accepted into the study. [21]

Air blast sensitivity assessment

Air blast sensitivity was assessed by directing a 1-2 s blast of air perpendicular to exposed dentin (40 psi ± 5 psi) onto the buccal surface of the sensitive tooth, from a distance of one centimeter, using the air component of a dental air/water syringe. Adjacent proximal teeth were shielded from the air blast through the placement of two fingers. A score of 2 or 3 (Schiff Cold Air Sensitivity Scale) [12] were included in the study.

Qualifying subjects were stratified based on baseline tactile and air-blast hypersensitivity scores and randomly assigned within strata to one of the three study treatment groups:

- Group I: Desensitizing paste containing 5% NovaMin (Vantej Toothpaste, Dr. Reddy's Laboratories, Hyderabad, India) (*n* = 40 teeth).
- Group II: Desensitizing paste containing 8% arginine (Colgate Sensitive Pro-Relief ® Desensitizing Paste, Colgate-Palmolive (India) Ltd., Mumbai, India) (*n* = 40 teeth).
- Group III: Test paste containing 15% hydroxyapatite nanoparticles (nanoXIM ® , Fluidinova Technologies, Moreira de Maia, Portugal) (*n* = 42 teeth).

Method of application

A pea sized amount of the assigned toothpaste was applied to the isolated hypersensitive lesions using disposable micro applicators (Neelkanth Healthcare Pvt., Ltd., Jodhpur, India) for 5 s. Rotary cup (Shofu Inc., Kyoto, Japan) was used at moderate to high speed to polish the paste onto the sensitive areas for approximately 60 s.

Postapplication Immediate, after 1-week and after 4 weeks score of tactile and air-blast DH examinations were performed and recorded by the same examiner and following the same methodology employed at the baseline examinations.

Statistical analysis

The statistical software used was SAS 9.2, SPSS 15.0 (SPSS, Chicago, IL, USA) for analysis of data. Word document and Excel sheet (Microsoft Inc. Redmond, WA, USA) were used to generate tables. Analysis of variance and *post-hoc* Tukey test were used to find the significance of the reduction in DH between the three groups at different time intervals of patients. The level of statistical significance was set at 0.05.

Results

All the 45 subjects completed the study, and the total number of teeth was 122. There were no adverse effects on hard and soft tissues. Repeated measures of time were taken as the primary variable.

Statistical analysis showed a reduction of DH in VAS score [Table 1] and SCA score [Table 2] in all groups when baseline values were compared with immediate, 1-week and 4 weeks postoperative scores.

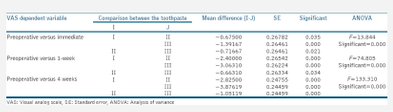

Table 1: Comparison of VAS between the groups

Click here to view

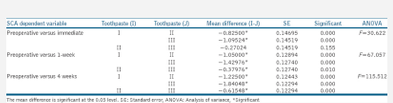

Table 2: Comparison of SCA score between the groups

Click here to view

Visual analog scale score analysis

Group III and Group II showed statistically significant reduction in DH at all-time intervals when compared with Group I. Group III was significantly better than Group II at all-time intervals.

SCA score analysis

Immediately after application SCA scores shows no statistically significant difference between Group II and Group III ($P = 0.155$) when compared to Group I ($P = 0.000$). At 1-week and 4 weeks the difference of means between Groups II and III in not significant as compared to Group I.

The effectiveness of the single application of desensitizing paste over a period of 4 weeks amongst the subjects was graded as Group III > Group II > Group I.

Discussion

The present randomized clinical study investigated the efficacy in reducing DH of a new test toothpaste containing 15% n-HA as the main component. Test toothpaste was prepared using the material which was incorporated into a nonaqueous dentifrice formulation without fluoride and contained 15% by weight of the n-HA. The results showed a

significant reduction of DH for the test toothpaste group for both VAS and SCA scores at immediate, 1- and 4 weeks after single application.

n-HA -containing toothpastes were first introduced and tested in Japan in the 1980s (e.g., Apadent, Apagard, by Sangi Co., Ltd., Tokyo). However, insufficient data is available in the literature regarding the desensitizing efficacy of nano-hydroxyapatite.

Desensitizing pastes have been used widely in the past for treating DH because of their low cost and ease for the use for the home application. The vast majority of desensitizing toothpastes, representing approximately 10% of the global toothpaste market, contain a potassium salt to "numb" the pain of DH. [22] New technologies, such as the Pro-Argin technology, NovaMin bioactive glass, and hydroxyapatite crystals are believed to bind to the exposed dentin surface and within the openings of the dentin tubules to mediate the formation of biological mineral, thereby reducing DH.

As the goal of the study was to determine, which agents would eliminate the participant's acute complaints of DH on a single application, we decided to conduct a short-term (4-week) study. It is important, however, that studies be carried out to determine which agents provide long-term relief from DH.

For pain assessment, we used more than one stimulus as recommended by Holland *et al*. [23] which arose from the fact that different stimuli can elicit different pain sensations. All dental lesions are investigated by using a probe tip as a tactile stimulus, which causes the inward movement of the dentinal fluid owing to the compression of the dentin. Thus, mechanoreceptors causing the painful sensation are activated. [24] Air stimulus decreases the temperature at the dentin surface, causes a rapid outward fluid flow from opened dentin tubules, which stimulates the painful sensation. [25] A standard dental explorer was used as a tactile stimulus and blasts of air from the 3-way syringe at 40 psi (±5 psi) as an evaporative stimulus.

All the toothpastes could penetrate and occlude the exposed dentin tubules which are responsible for dental sensitivity through the irritation of nerves. *In vitro* studies have showed that n-HA toothpaste causes remineralization comparable to or even higher than a fluoride toothpaste and inhibited caries development. [26] Therefore, n-HA containing toothpastes could be an effective alternative to fluoride toothpaste, and might help to promote remineralization.

Other treatments for DH such as laser therapy and iontophoresis are also used. [27],[28] However, these treatments have several disadvantages, including high cost, the complexity of use, and decreasing effectiveness over time.

Conclusion

Under the limitations of the study, 15% n-HA containing toothpaste was found to be most effective followed by 8% arginine and 5% NovaMin group.

n-HA is well-known and commonly used as synthetic bone filler biomaterial but is not yet widespread in dental health care products. The findings of the present study encourage the application of nanotechnology in toothpaste. Its low cost, ease of use, and home application make n-HA dentifrice as an effective desensitizing agent providing quick relief from symptoms of DH even on a single application.

Acknowledgments

We sincerely thank Mr. Paulo Quadros, Head of Product and Business Development, Fluidinova, SA, Portugal for providing us the 15% n-HA paste and Prof. (Dr.) E. Venkata Rao, Department of Community Medicine, IMS and SUM Hospital, Bhubaneswar for helping us with statistical analysis.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Addy M. Dentine hypersensitivity: New perspectives on an old problem. Int Dent J 2002;52:367-75.
2. Canadian Advisory Board on Dentin Hypersensitivity. Consensus-based recommendations for the diagnosis and management of dentin hypersensitivity. J Can Dent Assoc 2003;69:221-6. [PUBMED]
3. Pashley DH, Tay FR, Haywood VB, Collins MC, Drisko CL. Dentin hypersensitivity: Consensus-based recommendations for the diagnosis and management of dentin hypersensitivity. Inside Dent 2008;4:1-35.
4. Ide M. The differential diagnosis of sensitive teeth. Dent Update 1998;25:462-6.
5. Cummins D. Dentin hypersensitivity: From diagnosis to a breakthrough therapy for everyday sensitivity relief. J Clin Dent 2009;20:1-9.
6. Drisko C. Dentine hypersensitivity. Dental hygiene and periodontal considerations. Int Dent J 2002;52:385-93.

7. Drisko C. Oral hygiene and periodontal considerations in preventing and managing dentine hypersensitivity. Int Dent J 2007;57:399-93.

8. Bissada NF. Symptomatology and clinical features of hypersensitive teeth. Arch Oral Biol 1994;39 Suppl:31S-2S.

9. Carranza FA. General principles of periodontal surgery. Clinical periodontology. 10 th ed. St. Louis: Saunders; 2009. p. 87-901.

10. Brännström M. A hydrodynamic mechanism in the transmission of pain production stimuli through dentine. In: Anderson DJ. Sensory Mechanisms in Dentine. Oxford: Pergamon Press; 1963. p. 73-9.

11. Gillam DG, Orchardson R. Advances in the treatment of root dentin sensitivity: Mechanisms and treatment principles. Endod Topics 2006;13:13-33.

12. Schiff T, Dotson M, Cohen S, De Vizio W, McCool J, Volpe A. Efficacy of a dentifrice containing potassium nitrate, soluble pyrophosphate, PVM/MA copolymer, and sodium fluoride on dentinal hypersensitivity: A twelve-week clinical study. J Clin Dent 1994;5:87-92.

13. Prasad KV, Sohoni R, Tikare S, Yalamalli M, Rajesh G, Javali SB. Efficacy of two commercially available dentifrices in reducing dentinal hypersensitivity. Indian J Dent Res 2010;21:224-30.
[PUBMED] Full Text

14. Orchardson R, Gillam DG. Managing dentin hypersensitivity. J Am Dent Assoc 2006;137:990-8.

15. Rees JS, Jin LJ, Lam S, Kudanowska I, Vowles R. The prevalence of dentine hypersensitivity in a hospital clinic population in Hong Kong. J Dent 2003;31:453-61.

16. Flynn J, Galloway R, Orchardson R. The incidence of 'hypersensitive' teeth in the West of Scotland. J Dent 1985;13:230-6.
[PUBMED]

17. Fischer C, Fischer RG, Wennberg A. Prevalence and distribution of cervical dentine hypersensitivity in a population in Rio de Janeiro, Brazil. J Dent 1992;20:272-6.

18. Irwin CR, McCusker P. Prevalence of dentine hypersensitivity in a general dental population. J Ir Dent Assoc 1997;43:7-9.

19. Taani DQ, Awartani F. Prevalence and distribution of dentin hypersensitivity and plaque in a dental hospital population. Quintessence Int 2001;32:372-6.

20. Addy M, Mostafa P, Newcombe RG. Dentine hypersensitivity: The distribution of recession, sensitivity and plaque. J Dent 1987;15:242-8.
[PUBMED]

21. Clark GE, Troullos ES. Designing hypersensitivity clinical studies. Dent Clin North Am 1990;34:531-44.

22. Docimo R, Montesani L, Maturo P, Costacurta M, Bartolino M, DeVizio W, *et al*. Comparing the efficacy in reducing dentin hypersensitivity of a new toothpaste containing 8.0% arginine, calcium carbonate, and 1450 ppm fluoride to a commercial sensitive toothpaste containing 2% potassium ion: An eight-week clinical study in Rome, Italy. J Clin Dent 2009;20:17-22.

23. Holland GR, Narhi MN, Addy M, Gangarosa L, Orchardson R. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. J Clin Periodontol 1997;24:808-13.

24. Pashley DH. Mechanisms of dentin sensitivity. Dent Clin North Am 1990;34:449-73.

25. Krauser JT. Hypersensitive teeth. Part II: Treatment. J Prosthet Dent 1986;56:307-11.
[PUBMED]

26. Najibfard K, Ramalingam K, Chedjieu I, Amaechi BT. Remineralization of early caries by a nano-hydroxyapatite dentifrice. J Clin Dent 2011;22:139-43.

27. Singal P, Gupta R, Pandit N. 2% sodium fluoride-iontophoresis compared to a commercially available desensitizing agent. J Periodontol 2005;76:351-7.

28. Sgolastra F, Petrucci A, Severino M, Gatto R, Monaco A. Lasers for the treatment of dentin hypersensitivity: A meta-analysis. J Dent Res 2013;92:492-9.

Correspondence Address:
Amit Jena
Department of Conservative Dentistry and Endodontics, Institute of Dental Sciences, Siksha 'O' Anusandhan University, K-8, Kalinga Nagar, Bhubaneswar - 751 003, Odisha
India
Login to access the email ID

Source of Support: None, **Conflict of Interest:** None

DOI: 10.4103/0972-0707.164052

Tables

[Table 1], [Table 2]

Online since 10th June, 2008

ISSN: Print -0972-0707, Online - 0974-5203

Editorial and Ethics Policies

BY-NC-SA | Open Access | $ No Fee | RoMEO | Dublin Core Metadata | W3C HTML 4.1 | W3C CSS | ACAP ENABLED | View mobile site

ISSN: Print -0972-0707, Online - 0974-5203