



Original Research Article

Evaluation of efficacy of a herbal dentifrice on dentinal hypersensitivity: A clinical study

Jasjit Kaur^{1,*}, Rahul Paul², Vikram Blaggana², Preeti Upadhyay², Geetika Arora²

¹Purexa Global Pvt Ltd, East of Kailash, New Delhi, India

²Inderprastha Dental College & Hospital, Ghaziabad, Uttar Pradesh, India



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ABSTRACT

Background: Dentinal hypersensitivity is a one of the leading dental problems and herbal based formulations have been in use recently for the same.

Objective: This study was conducted for the evaluation of the safety and efficacy of a novel herbal toothpaste in reduction of dentinal hypersensitivity in vivo.

Materials and Methods: A total of 12 subjects were randomly taken into consideration as a single group. Brushing instructions were given for 7 days use of toothpaste to all subjects. Sensitivity scores for tactile, air stimulus and cold water were recorded at baseline, 3rd and 7th day for the study subjects.

Results: There was a significant reduction seen in the clinical parameters evaluated in all subjects at the end of the period of use of the toothpaste compared to baseline.

Conclusion: The novel herbal dentifrice can be recommended for treatment of dentinal hypersensitivity.

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1. Introduction

Dentinal hypersensitivity (DH) is a characteristic pain arising from the exposure of dentine, typically in response to various stimuli such as thermal, evaporative, tactile, osmotic or chemical, which cannot be attributed to any other form of dental defect or pathology. It is a common problem which affects 8% to 57% of the adult dentate population and peaks during the third and fourth decades of life.¹⁻³ Any tooth and tooth surface can be affected but dentine hypersensitivity is seen to have a predilection for the buccal cervical regions of canines and premolars.⁴

Various theories have been postulated to decipher the underlying mechanism of hypersensitivity such as odontoblastic transduction theory, neural theory, gate control theory, modulation theory, and hydrodynamic theory.^{5,6} The hydrodynamic theory was given by Gysi in 1900 and was later scientifically explained by Brännström and Aström in 1966, is the most accepted theory. It is based

on the concept that fluid within the dentinal tubule can flow inward or outward, depending on pressure differences in the surrounding tissue. This fluid flow within the tubules serves as a medium to excite the intradental nerves, which is perceived as pain by the patient.^{3,5-7}

According to Bissada and Narhi et al., when constantly present over a long time, hypersensitivity can provoke chronic discomfort and emotional distress in patients. In addition, it can make dental plaque control difficult.⁸ According to hydrodynamic theory by Braennstroem and Astroem, enamel or cementum loss in the cervical areas and the consequent opening of dentinal tubules to the oral environment, under certain stimuli, allows the movement of dentinal fluid inside the tubules, thereby indirectly stimulating the extremities of the pulp nerves, causing pain.³

It was also found that the open dentinal tubules serve as pathways for the diffusive transport of bacterial elements from the oral cavity to the pulp, which may lead to a localized inflammatory pulpal response. Microscopic examination reveals that patent dentinal tubules are more

* Corresponding author.

E-mail address: dr.jasjit10@gmail.com (J. Kaur).

numerous and wider in hypersensitive dentine as compared to non-sensitive dentine.^{9–13}

The etiology of dentinal hypersensitivity is multifactorial and results from dentine exposure and the opening of dentinal tubules. It can manifest when dentine is exposed by enamel loss by abrasion, erosion or corrosion, or due to loss of cementum by brushing or periodontal treatment, or more commonly, by the association of two or more of these factors. Agents for topical relief of dentine hypersensitivity act by either blocking the exposed dentine tubules or having a direct desensitizing effect on the pulpal nerve fibres.^{14,15}

Treatments can be self-administered by the patient at home or applied by a dental professional in the dental office. Various strategies have been used in the treatment of hypersensitivity which include lasers, iontophoresis, dentine sealers and soft tissue grafting. Toothpastes are the most widely used agents for delivering over-the-counter desensitizing agents.^{16–19}

Several herbal agents have gained popularity to provide relief from hypersensitivity. Of these, spinach and rhubarb stalks have been found to be effective as topical desensitizing agents. In vitro studies have shown that phyto complexes derived from rhubarb stalks (*Rhubarb raphanicum*) and spinach leaves (*Spinacia oleracia*) have been used in different formulations, can be effective for topical treatment of dentinal hypersensitivity. These phyto complexes reduced dentinal permeability by mechanism of occlusion of dentinal tubules through the formation of calcium oxalate crystals.^{20,21}

Recently there has been a growing interest in natural products, and herbal based toothpastes have been found as effective as the conventionally formulated dentifrices in plaque control as well as for gingivitis.

2. Materials and Methods

This was a single-centre, single blinded pilot study comprising 12 patients. The study duration was 7 days, in which the sensitivity scores were taken at baseline, 3rd day and 7th day. The study protocol was initially submitted to the Ethical Committee of the Indraprastha Dental College, Ghaziabad India. Once the ethical approval was granted, subjects were selected from the outpatient section of the Department of Periodontics, the Indraprastha Dental College with a chief complaint of dentinal hypersensitivity after a written informed consent was taken from them.

2.1. Inclusion criteria

1. Patients in good health in age range 18 - 50 yrs.
2. Dentinal hypersensitivity caused due to gingival recession or cervical erosion.
3. Subject should have at least 20 natural permanent teeth and at least 2 teeth with a Verbal rating score VRS score of ≥ 2 for inclusion in the study.

4. Defects < 1 mm loss of dentin depth which did not require restorative treatment.
5. Patients required to be available during the study duration and to sign an informed consent form.

2.2. Exclusion criteria

1. Teeth which have caries, defective restorations, chipped teeth or those with deep periodontal pockets (depth > 4 mm).
2. Periodontal surgery within the duration of last 6 months.
3. Subjects who have orthodontic appliances or bridge work introrally that would interfere with evaluation.
4. Presence of occlusal overload or occlusal adjustment recently made in the tooth which is to be evaluated.
5. Subjects who had undertaken treatment with any product that could influence the dentinal hypersensitivity of the patient in the 30 days prior to baseline to be excluded.
6. If subjects are found to be allergic to any of the ingredients used in study or exhibited any gross oral pathology, eating disorders, chronic disease, pregnancy & lactation, acute myocardial infarction within the past 6 months, use of pacemaker, uncontrolled metabolic disease, major psychiatric disorder, heavy smoking / alcohol abuse, any systemic disease or any disease requiring repeated or regular analgesia / anti-inflammatory drugs or antihistamines.

2.3. Clinical parameters for evaluation

1. Tactile stimulus
2. Air Blast Test
3. Cold Water Test

As per the scores of the above stimuli tests, the patient's response will be recorded on the following Verbal Rating Scale (VRS):

1. No discomfort
2. Mild discomfort
3. 2 Moderate discomfort
4. Severe pain only during application of stimuli
5. Severe pain persisting after removal of stimuli.

The sensitivity/pain response was assessed using the numerical (range 0–10) Visual Analogue Scale (VAS), with 0 indicating 'no pain' and 10 indicating 'intolerably severe pain'. Pre-treatment sensitivity (baseline) was evaluated by one researcher (WLOR), with the following test stimuli:

2.3.1. Tactile test (mechanical method)

A sharp dental explorer (17/23) was passed lightly across the affected tooth area, perpendicular to the long axis of the tooth. The test was done three times before the score was recorded.

2.3.2. Air blast test

An air blast from a dental syringe at 60-pound/inches square pressure was directed on the tooth surface for 3 seconds from a distance of approximately 5 mm.

2.4. Cold water test

A pre-cooled 1 cc disposable syringe will be filled with freshly melted ice-cold water. After isolating the specific tooth, 0.2 ml of the water will be slowly expelled from the syringe onto the tooth surface. A minimum 5 min gap will be given between the applications of different stimuli.

2.5. Statistical methods

Analysis was performed using SPSS software Version 21.0. (Non parametric) Chi square test was done to derive the clinical study parameters analysis.

3. Results

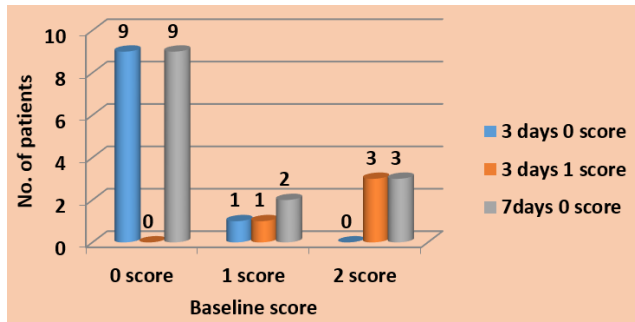


Fig. 1: Effectiveness of RAPID anti hypersensitive herbal toothpaste among test groups

3.1. Tactile stimulus

When tactile stimulus was used to evaluate the effectiveness of the herbal toothpaste in the management of dentinal hypersensitivity, it was found that statistically there was a highly significant decrease in scores after 3 days and continued till to 7 days.

3.2. Cold water stimulus

Cold water test used to evaluate the effectiveness of herbal toothpaste in dentinal hypersensitivity management. After its use for 7 days it was found that statistically there were highly significant reductions in scores of all subjects by the end of 7th day.

4. Air blast test

Air blast test used to evaluate the effectiveness of the herbal toothpaste in dentinal hypersensitivity management.

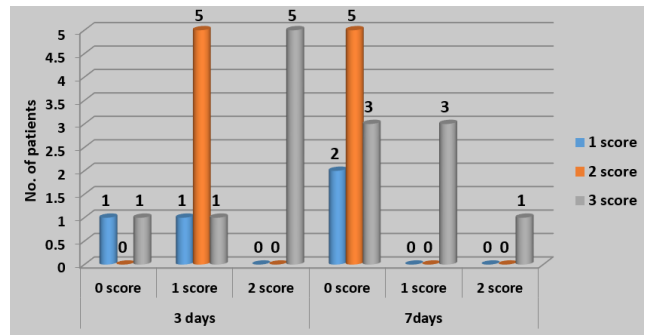


Fig. 2:

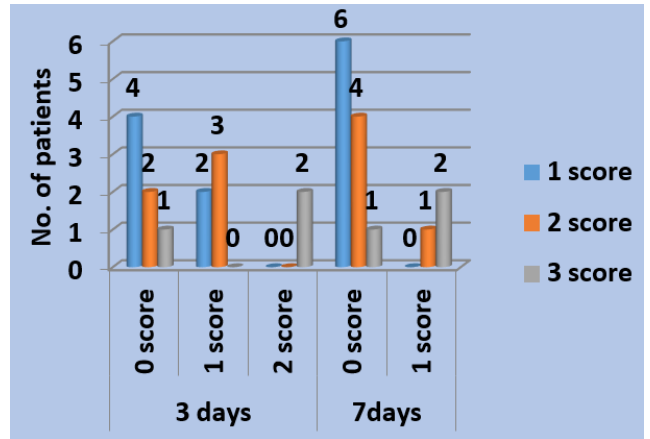


Fig. 3:

As compared to baseline there was a reduction of about 79% i subjects at the end of 7th day.

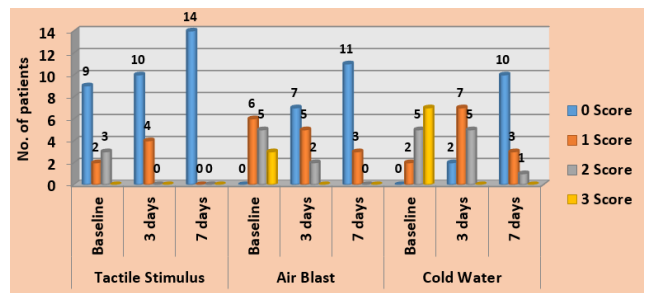


Fig. 4: Axis- time interval; Y- axis- no of patients

5. Discussion

Dentin hypersensitivity is one of the leading dental problems in the dentate population. It is seen that the incidence is more in the middle aged group and most commonly affects cervical area of buccal surfaces of the lower anteriors and premolars.³⁻⁶

The current study was conducted to evaluate the clinical efficacy of herbal dentifrice in the management of dentinal

Table 1: Effectiveness of rapid anti hypersensitive herbal toothpaste among test groups

Score	3 Days				7 Days			
Tactile Stimulus								
Baseline	0	1	2	3	0	1	2	3
0	9 (64.3%)	0 (0%)	-	-	9 (64.3%)	-	-	-
1	1 (7.1%)	1 (7.1%)	-	-	2 (14.3%)	-	-	-
2	0 (0%)	3 (21.4%)	-	-	3 (21.4%)	-	-	-
3	-	-	-	-	-	-	-	-
p-value	0.003*							
Cold Water								
Baseline	0	1	2	3	0	1	2	3
0	-	-	-	-	-	-	-	-
1	1 (7.1%)	1 (7.1%)	0 (0%)	-	2 (14.3%)	0 (0%)	0 (0%)	-
2	0 (0%)	5 (35.7%)	0 (0%)	-	5 (35.7%)	0 (0%)	0 (0%)	-
3	1 (7.1%)	1 (7.1%)	5 (35.7%)	-	3 (21.4%)	3 (21.4%)	1 (7.1%)	-
p-value	0.019*				0.005*			
Air Blast								
Baseline	0	1	2	3	0	1	2	3
1	4 (28.6%)	2 (14.3%)	0 (0%)	-	6 (42.9%)	0 (0%)	-	-
2	2 (14.3%)	3 (21.4%)	0 (0%)	-	4 (28.6%)	1 (7.1%)	-	-
3	1 (7.1%)	0 (0%)	1 (7.1%)	2 (14.3%)	1 (7.1%)	2 (14.3%)	-	-
p-value	0.043*				0.051			

*($p \leq 0.05$ – Significant, CI = 95 %)

Table 2: Percentage reduction change

Variable	3 days	7 days
Tactile Stimulus	71.4%	100%
Cold Water	14.3%	71.4%
Air Blast	50%	78.6%

hypersensitivity. The results demonstrated a reduction in the symptoms of dentinal hypersensitivity for the test product from baseline to 3 days and 7 days weeks for all the three clinical parameters of dentinal hypersensitivity.

The test product comprised of the following constituents:

Spinach, licorice, arnica, rhubarb root as active agents for desensitizing action.

The functional and anatomical occlusion of tubules reduces the flow of dentinal fluid. Any substance that leads to a decrease in dentinal conductance (i.e. dentinal permeability) by reducing the diameter or closing the tubules and diminishing their number thereby reduces dentinal hypersensitivity and pain.^{7–9} Several in vivo as well as in vitro studies have shown that pastes or aqueous solutions based on potassium oxalate occlude dentinal tubules by the formation of calcium oxalate crystals on the dentine surface and inside dentinal tubules which are acid resistant.^{22–25} In the present study, the SEM results depict that treatment with oxalate-containing phyto complexes induces microcrystal deposition on dentinal surface and inside dentinal tubules. These treatments reduce the tubular diameters by forming crystals or crystal like structures,

as confirmed by permeability evaluations. All tested phyto complex-based treatments contained oxalate salts.^{26–29}

Palakya (spinach) contains natural oxalate compounds, which help in formation of phyto complexes on the teeth. This leads to occlusion of dentinal tubules and blockage of the transmission of pain from the surface to the tooth's nerves. These oxalate compounds produce protective films and thus help to prevent tooth destruction (Sauro et al., 2006). Lavanga (Clove) contains eugenol, has an obtundent effect which numbs nerves and controls pain. The essential oil of clove also is known for its antibacterial action against species involved in dental caries such as *Streptococcus mutans* (Gupta et al., 2011).^{24–27}

Spinach leaves contain both soluble and insoluble oxalate compounds; the soluble oxalate content comprises approximately 80% of the total oxalates (970 mg/ 100 g of spinach leaves). In rhubarb stalks, both soluble and insoluble form of oxalates are present. The soluble oxalate content in rhubarb stalks comprises approximately 30% of the total oxalates (805 mg/ 100 g of rhubarb stalks). The soluble oxalate content in mint comprises approximately 10% of the total oxalates (170 mg/100 g of mint leaves).^{28,29}

The current in-vitro study of natural product extracts that induced a series of structural and physiological changes in dentine may be correlated in vivo with the relief of pain and dentinal hypersensitivity. It is well known that oxalates are able to create crystals, most likely calcium crystals, when applied to dentinal tissue. They produce a layer of crystals that reduces dentinal permeability.

6. Conclusion

In conclusion, these results depict that the phytocomplexes extracted from rhubarb and spinach, have a role in the topical treatment of dentinal hypersensitivity. The decrease in dentinal permeability, combined with increased resistance to acid attack and the formation of microcrystals produced by phytocomplexes from rhubarb and spinach, indicates that they may be useful products for dentinal hypersensitivity therapy.

7. Source of Funding

Purexa Global Pvt Ltd.

8. Conflict of Interest

None.

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Author biography

Jasjit Kaur Manager- Clinical Research and Product Development

Rahul Paul Professor and HOD

Vikram Baggana Professor and HOD

Preeti Upadhyay Professor

Geetika Arora Associate Professor

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