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Dr. Shantipriya Reddy
Prof and Head,
Department of Periodontics,
Dr Syamala Reddy Dental College,
Hospital and research Centre,
Bengaluru-560037, Karnataka, India.

Dr. Prasad M G S
Reader,
Department of Periodontics,
Dr Syamala Reddy Dental College,
Hospital and research Centre,
Bengaluru-560037, Karnataka, India.

Sanchita Prasad
Sr Lecturer,
Department of Periodontics,
Dr Syamala Reddy Dental College,
Hospital and research Centre,
Bengaluru-560037, Karnataka, India.

Dr. Nirjhar Bhowmik
Sr Lecturer,
Department of Periodontics,
Dr Syamala Reddy Dental College,
Hospital and research Centre,
Bengaluru-560037, Karnataka, India.

Dr. Ashwini N
Post Graduate Student,
Department of Periodontics,
Dr Syamala Reddy Dental College,
Hospital and research Centre,
Bengaluru-560037, Karnataka, India.

Dr. Sravya L
Sr Lecturer,
Department of Periodontics,
Dr Syamala Reddy Dental College,
Hospital and research Centre,
Bengaluru-560037, Karnataka, India.

Dr. Savita Singh
Post graduate Student,
Department of Periodontics,
Dr Syamala Reddy Dental College,
Hospital and research Centre,
Bengaluru-560037, Karnataka, India.

Correspondence
Dr. Ashwini N
Post Graduate Student,
Department of Periodontics,
Dr Syamala Reddy Dental College, Hospital and research Centre, Bengaluru-560037, Karnataka, India Centre,
Bengaluru-560037, Karnataka, India.

The effect of pro-argin technology vs nano technology using commercially available dentifrice: A comparative study

Shantipriya Reddy, Prasad M G S, Sanchita Prasad, Nirjhar Bhowmik, Ashwini N, Sravya L, Savita Singh

Abstract
AIM: The aim of this clinical study was to clinically evaluate the effect of two commercially available dentifrice formulation.
Materials And Method: 30 patients having at least 2 sensitive teeth with a VRS (Verbal Rating Scale) of >5 after air blast stimulation, qualified to participate in the study. Group 1 (colagte pro-Argin toothpaste) and Group 2(Aclaim), each containing 15 participants, were subjected to cold water and air blast stimulation for an assessment of DH at baseline and after 3 days usingVRS scores.
Statistical Analysis used: independent t-test and paired t test.
Results: Air blast test within the groups showed a statistical significance ($p<0.001$). Statistically no significant difference was found between both group 1 (Pro Argin) and group 2 (Aclaim) and with both the tests.
Conclusion: both the dentifrices Pro-Argin™ and Aclaim™ were found to provide rapid relief in patients reporting with Dentinal Hypersensitivity.

Keywords: Dentinal hypersensitivity, Colgate Pro-Argin™, Aclaim™

1. Introduction
Dentin hypersensitivity (DH) is one of the most common painful conditions reported causing discomfort and qualifies as one the conditions which has been least successfully resolved[1] DH defined as brief, sharp pain elicited when dentin is exposed to thermal, tactile, osmotic, chemical or evaporative stimuli (Canadian Advisory board on dentin hypersensitivity 2003)[2]. There have been several factors responsible for causing DH, like attrition, abrasion or erosion and also exposure of dentin due to gingival recession [3].
Various clinical surveys have shown the prevalence of DH ranging from 2.8% to 74%. DH mostly affects the individuals in their 4th and 5th decade of life [4].
Several theories have been proposed to explain the mechanism of pain stimulation. The most commonly accepted mechanism, being the hydrodynamic theory, which is based on Hagen-Poiseuille equation. The theory states that the fluid movements within dentinal tubules are believed to activate the sensory nerves of the pulp, leading to pain which is typically a short burst for a short span of time and has been claimed to be due to stimulation of A-β and A-δ nerve fibres [5].
Various therapeutic approaches have been formulated for the treatment of DH which include agents like strontium salts, potassium nitrate, arginine/calcium, carbonate nanocrystals of hydroxyapatite [6] are of interest as they have been formulated for rapid or instant relief of pain due to DH. Other emerging methods in the management of dentinal hypersensitivity includes use of lasers and iontophoresis. While laser works on the principle of protein coagulation in the exposed dentinal tubules iontophoresis is based on the principle that similar electromagnetic charges repel each other when sodium fluoride dissolves in solution, the fluoride molecule forms an anion with an extra electron-thus becoming negatively charged. In iontophoresis, it is believed that fluoride ion is electrically driven deeper into the dentinal tubules [7].
Assessment of pain relief after using these therapeutic approach is very important to know their efficacy.

There are several methods used to assess the pain stimulation, like the airblast method, cold fluids, tactile method, temperature controlled probes [8]. In this study Verbal rating scale was considered to evaluate the response to sensitivity [9].
In the present study, two commercially available dentifrice formulations, Pro-Argin technology and nano hydroxyapatite have been used to assess the clinical outcome in reduction of DH after 3 day treatment as the formulation are based on rapid/instant relief. The aim of this clinical study is to clinically evaluate the effect of two commercially available dentifrice formulation.

2. Materials and Methods

2.1 Study design

The study was performed in the Department of periodontics and Implantology, Dr Syamala Reddy Dental College and Hospital, Bengaluru from June 2014 to October 2014. A total of 30 subjects with DH were recruited for the study, who gave consent to participate in the study.

Inclusion Criteria

- Subjects aged between 18-65 years
- Atleast two sensitive teeth (buccal/facial) aspect with recession abrasion, erosion) with a score of >3 on verbal rating scale, ranging from 0-3= no pain/mild pain, 4-6= moderate pain, and 7- 10= severe pain.

Exclusion criteria

- Subjects with a history of allergy to any of the drugs or chemicals used in the study.
- Any removable appliance (RPD or orthodontic retainer).
- Ongoing orthodontic treatment with fixed appliances.
- Presence of any large or defective restorations, cracked enamel or caries on the hypersensitive tooth.
- Pregnancy and lactating mothers.
- Dental pathology causing pain similar to dentin hypersensitivity.
- Patients with any systemic problem or mental or physical disability.

3. Methodology

30 eligible individuals were randomized to receive commercially available desensitizing dentifrice, Colgate pro relief (group 1) and Aclaim (group 2). The randomisation was done by a flip of a coin. The distribution of the samples was done by the second examiner. All participants were evaluated at baseline and after 3 days using the verbal rating scale. The teeth subjected to the test were isolated using gauze, two measures of sensitivity were used:

Air blast and cold water stimulation.

Air blast stimulation: A 3 seconds air blast from an air syringe held perpendicular and 3 mm away from the exposed dentin at a pressure of 45- 60 psi.

Cold water test: 1 ml of freshly melted ice cold water was delivered drop wise on to the buccal/facial cervical region using a syringe.

The time interval between measures on a given tooth was 5 min. Tooth sensitivity was recorded by the verbal rating scale ranging from 0 to 10.
Both the groups were instructed to brush twice daily with soft bristled tooth brush and the given dentifrice using *Modified stillmans method as explained by the second examiner. The choice of the following brushing method was made on its well established efficiency to clean the sulcular areas which is a potential niche for plaque accumulation. Dental plaque is itself considered as one of the possible cause of DH; additionally modified Stillmans technique is shown to increase the GCF flow thus providing a flushing action [10].

4. Results and Discussion

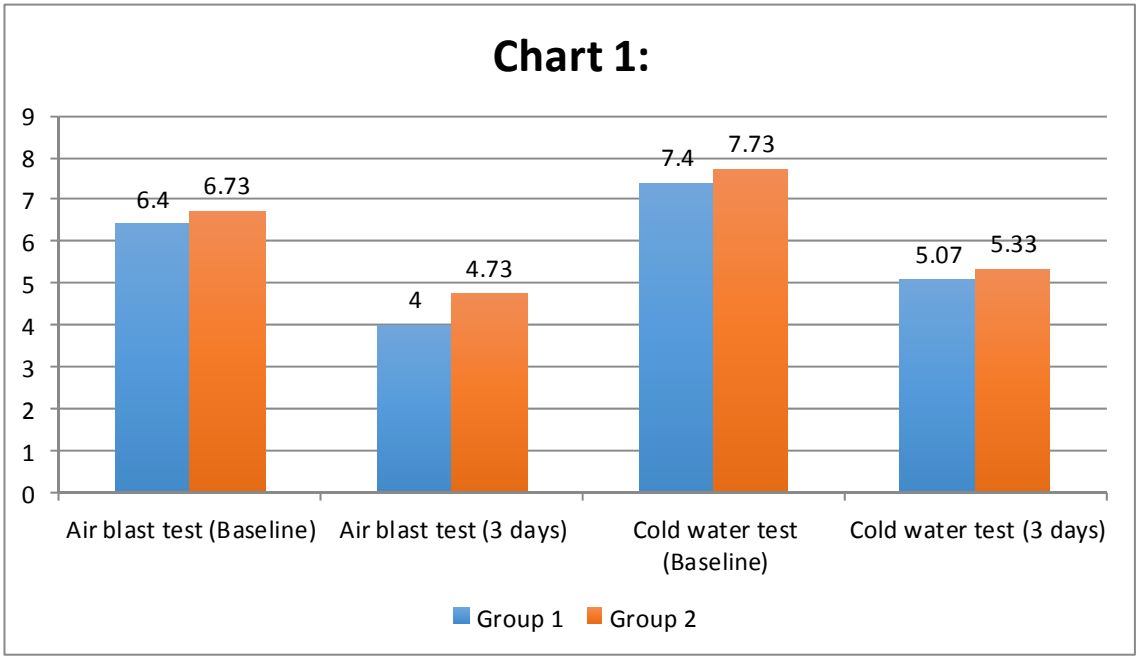
The VRS (verbal rating scale) obtained in both the groups at baseline and after 3 days were subjected to statistical analysis. All the statistical analysis were done using SPSS version 14. A p value of <0.05 was considered statistically significant. Intergroup comparisons were done using independent sample t test and intragroup comparisons were done using paired t Table 2 and graph 2 demonstrates intragroup comparisons of results between baseline and 3 days.
Airblast test showed a mean baseline score of 6.4 and 6.73 in group 1 and group 2 respectively and scores after 3 days showed a mean score of 4.00 and 4.73 respectively demonstrating a statistically significant difference ($p < 0.001$).
Similarly, when cold water test were compared, a mean baseline score of 7.40and 7.73 was obtained in group 1 and group 2 respectively and the mean scores after 3 days showed 5.07 and 5.33 in group 1 and group 2 respectively demonstrating a statistically significant difference($p<0.001$) in reduction of DH scores.

Table 1 and graph 1 shows scores of airblast test and cold water test in group 1 and group 2.
Airblast test for DH did not show any statistical difference between group 1 and group 2 at baseline but after 3 days a statistically significant difference was obtained ($p<0.01$) between the groups. When the mean difference in airblast test scores between baseline and 3 days were compared, they were found to be 2.40 in group 1 and 2.00 in group 2 indicating that group 1 showed better results in terms of reduction of DH after 3 days.
Cold water test scores for DH at baseline and at 3 days revealed no statistically significant difference between the groups. The mean difference DH scores between baseline and 3 days was found to be 2.33 and 2.4 for group 1 and group 2 respectively indicating group 2 showing better reduction of DH scores after 3 days as compared to group 1.
However, statistically no significant difference was found between both group 1 (Pro Argin) and group 2 (Aclaim) and with both the tests.

Table 1: Inter-group

		Group				p-value
		1		2		
		Mean	SD	Mean	SD	
Air blast test	Baseline	6.40	.83	6.73	.70	0.245; NS
	3 days	4.00	.65	4.73	.80	0.01; Sig
Cold water test	Baseline	7.40	.74	7.73	1.03	0.318; NS
	3 days	5.07	.70	5.33	1.35	0.502; NS
Difference	Air	2.40	.91	2.00	1.07	0.279; NS
	Cold	2.33	.90	2.40	1.30	0.871; NS

Independent sample t test



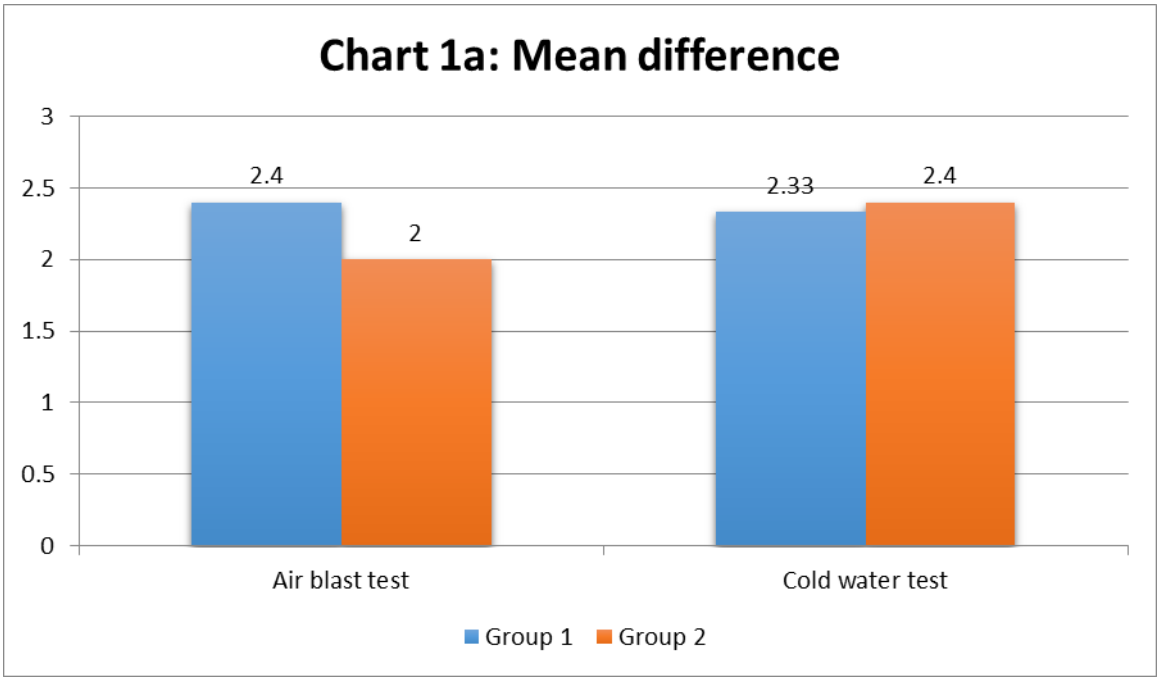
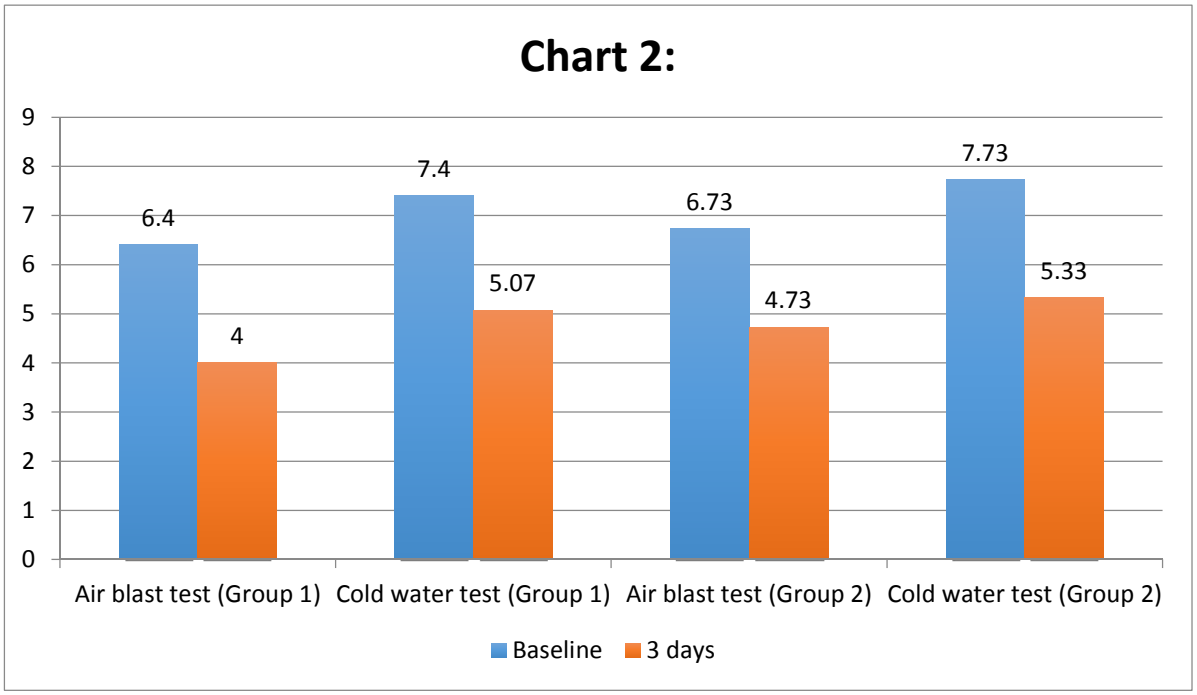


Table 2: Intra-group

Group		Baseline		3 days		p-value
		Mean	SD	Mean	SD	
1	Air	6.40	.83	4.00	.65	<0.001; Sig
	Cold	7.40	.74	5.07	.70	<0.001; Sig
2	Air	6.73	.70	4.73	.80	<0.001; Sig
	Cold	7.73	1.03	5.33	1.35	<0.001; Sig



5. Discussion

Dentin hypersensitivity, is one of the most common unresolved dental problems that we encounter in clinical practice. The reason for this could be the lack of knowledge regarding etiology, nature of the lesion and the pulpal status that makes the condition difficult to manage. Thus the condition appears to be affecting about 8 - 57% of population [10].

Most commonly accepted theory that explains the mechanism of DH is the Brannstrom theory [6] but there exists no commonly accepted approach for the treatment of DH. Two basic approaches have been advocated for treatment of DH, one that penetrates into the dentinal tubules, depolarises the nerve synapse and prevents the conduction of pain impulses and the second that occludes the dentinal tubules [8].

Though these approaches have been effective in reducing the DH, the relief obtained is highly variable. Thus, efforts to improve the clinical outcome by the introduction of various compositions of desensitizing agents are being tried and marketed.

Newer formulations available commercially for rapid/ instant relief of pain was of interest to us in order to evaluate their efficacy in pain reduction [11].

Therefore the present study aimed at comparing the efficacy and viability of 2 commercially available desensitising dentifrices containing Arginine technology (Pro-Argin) and nanotechnology (nano hydroxyapatite.

All the subjects who participated in the study showed a response to the use of dentifrices with an exception of 1 patient in group 1 (Pro-argin) and 2 patients in group 2(Aclaim) who showed no change in VRS scores even after 3 days of using the dentifrice. The percentage reduction in mean airblast test scores was found to be better in **Pro-argin group™** (38%) while with cold water test **Aclaim™** was found to be better in reducing DH with a percentage reduction of 30%. However certain other studies have shown a greater percentage reduction in means scores of DH with air blast method around 59%- 74 % [6].

Both **Pro- Argin™** and nano hydroxyapatite dentifrice (**Aclaim™)** were found to be effective in reducing DH scores after 3 days, but there was no statistically significant difference between the two.

Several studies [12, 13, 14, 15 16] done have also yielded similar results, however, our study aimed at evaluating the efficacy after 3 days alone. But certain other studies [6, 8, 14] not only evaluated the DH scores after 3 days but also continued the study upto 4-8 weeks. These studies with longer duration of follow up reported much better treatment outcome as compared to studies which evaluated at 3 days [13, 15]. The reason for us to limit the study to 3 days was purely to evaluate the effectiveness of newer dentifrices which have been formulated to provide rapid relief.

Even though the follow up period was a s short as 3 days, both dentifrices were effective in reducing the DH scores of both tests (air blast test and Cold water test) used though the results should be interpreted with caution owing to small sample size and different pain threshold levels of the patient. Also the use of VAS [9] (visual analogue scale) or Schiff sensitivity scale [6] instead of VRS (verbal rating scale) which are said to be more reliable could have influenced the results.

6. Conclusion

Within the limitation of the present short duration trial on effectiveness of two commercially available dentifrices to treat Dentinal Hypersensitivity following conclusions could be drawn that both the experimental dentifrices **Pro-argin™** and **Aclaim™** were found to provide rapid relief in patients. However, further long term clinical trails with larger sample size need to be carried out to demonstrate a significant effect in reducing dentinal hypersensitivity.

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