

Evaluation Of Efficacy Of A Dentifrice Containing A Combination Of Arginine And Calcium Carbonate In Reducing Dentin Hypersensitivity

Abstract

Objectives : The aim of this study was to evaluate the efficacy of the desensitizing dentifrice "Colgate® Sensitive Pro-relief™" containing arginine and calcium carbonate on reduction of dentinal hypersensitivity instantly after application as a single in-office application as claimed by manufacturing company. The study population consisted of 61 subjects between the ages of 18-70 years and in good general health. They were required to possess a minimum of two hypersensitive teeth with no clinical evidence of mobility, ongoing periodontal disease or dental restorations and cavities. Clinical procedure involved scoring baseline dentin hypersensitivity using tactile exploration, air blast and cold water and then reevaluation of scores after 5 min of paste application. Statistical analysis was performed using paired t-test for comparison of baseline versus final sensitivity scores.

Results and Conclusions : The results were statistically analyzed and it was found that the dentifrice containing Arginine-Calcium carbonate (Colgate® Sensitive Pro-relief™) was effective in reducing Dentin hypersensitivity as all the parameters i.e., tactile exploration, air blast stimulation and cold water test showed a highly statistically significant reduction from baseline scores.

Key Words

Dentin/Dentinal hypersensitivity (DHS), Arginine, Calcium carbonate

Introduction

Dentin/Dentinal hypersensitivity (DHS) may be defined as short, sharp pain arising from exposed dentine typically in response to chemical, thermal or osmotic stimuli that cannot be explained as arising from any other form of dental defect or pathology[1]. The two most common pathways that lead to dentin exposure and dentin hypersensitivity are gingival recession[2] and enamel loss due to abrasion, erosion, attrition and abfraction. A variety of products for home use and professional treatments for dentin hypersensitivity are available e.g., desensitizing toothpastes, mouth rinses with high fluoride content, varnishes and restorative materials etc. Many desensitizing toothpastes contain a potassium salt which is believed to work by penetrating the length of the dentinal tubule and depolarizing the pulpal nerves thus interrupting the neural response to pain stimuli[3],[4],[5],[6],[7]. Various other available dentifrices contain desensitizing agents like calcium carbonate, aluminium, calcium phosphate, silicates, strontium chloride, sodium fluoride and zinc chloride which act either by blocking dentinal tubules by

the abrasion or by formation of smear layer during brushing or act as protein precipitants[8],[9]. Many of these formulations have been shown to provide measurable reductions in dentin hypersensitivity after two to four weeks of twice daily use and generally several weeks or more to demonstrate maximum effectiveness and achieve maximum levels of pain relief [10],[11],[12]. Their effects are sustained for as long as daily use of the desensitizing toothpaste is continued but may rapidly wear off thereafter. Recently a new dentifrice "Colgate® Sensitive Pro-Relief™" containing Arginine and Calcium carbonate claiming instant and long lasting relief from dental hypersensitivity has become available.

The objective of this clinical study conducted in a group of patients with known dentin hypersensitivity, was to determine the efficacy of Colgate® Sensitive Pro-Relief™ and test the claim of manufacturing company in reducing dentin hypersensitivity of this desensitizing paste containing Arginine and Calcium carbonate, instantly after application as a single in-office application on the affected teeth as

¹ D S Kalsi

² Kulmeet Kaur

³ Vikrant Sharma

¹ Professor

² Reader

³ Senior Lecturer, Dept. Of Periodontology
Bjs Dental College, Ludhiana

Address For Correspondence:

Dr. D S Kalsi

Department Of Periodontology

BJS Dental college, Ludhiana

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claimed by the manufacturing company.

Material And Methods

This clinical study was conducted at B.J.S. Dental College, Ludhiana to clinically evaluate the efficacy of a newly available dentifrice "Colgate® Sensitive Pro-Relief™" on dentin hypersensitivity in providing instant relief from dentin hypersensitivity after a single professional application of the product for 5 minutes. The desensitizing paste contains 8% Arginine and Calcium carbonate as active desensitizing agents. Inclusion criteria - Eligible study subjects had to be between the ages of 18-70 years and in good general health. They were required to possess a minimum of two hypersensitive teeth with mild - moderate recession as assessed with a blast of air, stream of cold water at 5-10°C temperature and with exploration with an explorer. None of the teeth under evaluation showed mobility, ongoing periodontal disease, pathological migration or had dental restorations or cavities. Subjects with reported history of allergy to any dentifrice were excluded from the study.

Clinical procedure - 61 subjects who met the selection criteria received a baseline evaluation to assess and grade dentin hypersensitivity by air blast, cold water and tactile exploration tests. A trained

dental professional applied a pea sized amount of dentifrice being evaluated to the sensitive surfaces of the teeth being tested with a cotton pellet after isolation with cotton rolls. Patients were refrained from rinsing for 4 minutes. After the holding time of 4 minutes, patients were asked to rinse thoroughly with tap water and tactile, cold water and air blast hypersensitivity scoring was repeated.

Clinical Scoring Procedures

Verbal rating scale was used for scoring DHS and patients were told to score degree of hypersensitivity on the following scale.

0- No hypersensitivity

1- Mild hypersensitivity

2- Moderate hypersensitivity

3- Severe hypersensitivity

Tactile hypersensitivity was assessed using a sharp explorer. For this the tip of a dental explorer was moved approximately at right angle over the tooth being tested using light force similar to the one used for probing and the patients were then asked to grade the pain of hypersensitivity if any.

For evaluation of air blast hypersensitivity, a blast of air was directed from a standard dental unit air syringe on the tooth being evaluated for 1 sec from a distance of 1 cm after covering adjacent tooth surfaces with operator's fingers.

For assessing cold water sensitivity 5ml cold water at 5-100C was taken in a syringe and slowly flowed in 10 seconds from a distance of 1cm on the tooth being evaluated. The adjacent tooth surfaces were covered by operator's fingers.

Statistical Methods

Data was collected and tabulated and statistical analysis was performed separately for tactile hypersensitivity, air blast hypersensitivity and cold water hypersensitivity scores. Within treatment groups, comparisons of the baseline versus final hypersensitivity scores were analysed using paired t-test.

Results

Sixty one subjects participated in the study. Throughout the study, there were no adverse effects on the oral soft or hard tissues of the oral cavity as observed by the examiner or reported by the subjects when questioned. The mean pre and post tactile, air blast and cold water hypersensitivity scores are shown in **Table 1**.

Table 1 Intragroup comparisons of the mean pre-scores and post-scores of tactile, air blast and cold water tests.

Group	Pre score (Mean± Sd)	Post score (Mean± Sd)	Difference in percentage	P value	Significance
Tactile test	0.75±0.92	0.30±0.50	60.0%	<0.001	HS
Air blast test	1.16±0.79	0.63±0.55	45.6%	<0.001	HS
Cold water test	2.02±0.88	1.10±0.94	45.5%	<0.001	HS

Tactile, air blast and cold water sensitivity scores were recorded before product application and after product application and the comparison was done between the mean pre-operative and post-operative scores.

For tactile hypersensitivity, the mean baseline pre scores were 0.75±0.92 and post-scores were 0.30±0.50. The percentage changes from baseline were 60.0% which is highly significant.

For air blast hypersensitivity, the mean baseline pre-scores were 1.16±0.79 and post-scores were 0.63±0.55. The percentage changes from baseline were 45.6% which is highly significant.

For cold water hypersensitivity, the mean baseline pre scores were 2.02±0.88 and post-scores were 1.10±0.94. The percentage changes from baseline were 45.5% which is highly significant.

Discussion

Dentin/Dentinal hypersensitivity is characterized by short sharp pain arising from exposed dentine typically in response to thermal, evaporative, tactile, osmotic or chemical stimuli which cannot be ascribed to any other form of dental defect or pathology[13],[14],[15]. It is a painful clinical condition that affects 8 to 57% of adult population and is associated with dentin exposure to the oral environment.[16],[17] A recent novel approach for the treatment of DHS is a technology based on Arginine, a natural product, and Calcium carbonate. In 2002, Kleinberg et al. reported the development of this novel desensitizing technology based on the role that saliva plays in naturally reducing dentinal hypersensitivity. Saliva provides calcium and phosphate, which over time occlude and block open dentinal tubules from external stimuli known to cause dentinal hypersensitivity.[18],[19] The technology is proposed to block dentinal hypersensitivity pain by occluding dentinal tubules by using Arginine, which is positively charged at physiologic pH of 6.5-7.5, to bind to the negatively charged dentin surface, which helps attracts a calcium-rich layer from saliva, and infiltrates and blocks dentinal

tubules thereby effectively blocking the flow of dentinal fluid through dentinal tubules which is essential for causing DHS as per the widely accepted hydrodynamic theory by Brannstrom. [20],[21]

The purpose of this study was to evaluate the efficacy of the commercially available desensitizing product based on Pro-Argin™ technology "Colgate® Sensitive Pro-relief™" on dentin hypersensitivity. It is demonstrated in this study that as claimed by the company, the effective use of the test product requires less than 1 minute of application time, is very easy to use, and has the advantage of pre-treating suspected hypersensitive areas.

An adult population with history of dentin hypersensitivity was enrolled for participation in this study and tactile, cold water and air blast scores were recorded as baseline hyper-sensitivity values and then after 5 minutes (1 minute dentifrice application and 4 minutes of dentifrice holding time) dentin hypersensitivity was re-evaluated. Significant reductions in dentin hypersensitivity scores i.e., 60.0% reduction in tactile hypersensitivity, 45.6% reduction in air-blast hypersensitivity and 45.5% reduction in cold water hypersensitivity instantly after product application were observed. These results were comparable to the work conducted by Kleinberg et al[19] who reported statistically significant reductions of 58.8% in air blast stimulated hypersensitivity and 64.6% in tactile hypersensitivity for Arginine dentifrice group following a single post-scaling application of the 8% Arginine-Calcium carbonate desensitizing dentifrice. They subsequently conducted a monadic design study to establish duration of the hypersensitivity relief benefit and reported instant hypersensitivity improvements of 71.7% (air blast) and 84.2% (tactile) that were maintained for 28 days after a single application of the product thus validating its use as home application too. A similar clinical study conducted on 390 patients found professional application of Arginine and Calcium carbonate by dentists and dental hygienists in Hong Kong significantly reduced severity of pain in patients with dentine hypersensitivity.[22]

In clinical trials, this product has been found to provide immediate and lasting relief of dentin hypersensitivity for four

weeks when it is applied in patients immediately after dental scaling, as a final polishing step during a professional cleaning procedure[23]. Another study demonstrated its effectiveness in relieving dentinal hypersensitivity when applied prior to dental prophylaxis, with a significant reduction in dentinal hypersensitivity postprocedurally[24]. A range of state-of-the-art measurement techniques have been used to establish the mechanism of action of this product e.g., confocal laser scanning microscopy (CLSM) studies etc. These have demonstrated its effectiveness in occluding open dentin tubules[23]. In addition, it was determined through hydraulic conductance testing that these deposits significantly reduced the flow of dentinal fluid in the tubules[25].

Conclusions

The results of this clinical study support the conclusions that – single professional application of the dentifrice containing Arginine and Calcium carbonate (Colgate® sensitive pro-relief™) provides a highly significant instant reduction in dentin hypersensitivity as evaluated with tactile test, air blast test and cold water tests.

The results from this study demonstrate that this desensitizing paste can be used as an in-office modality to provide relief from pre-existing or anticipated dentin hypersensitivity when applied in advance of dental procedures, such as scaling and root planning etc. It seems that this product has the potential to be of great assistance to clinicians in dealing with dentin hypersensitivity as an in office dentinal hypersensitivity controlling agent and home use agent, especially when used prior to pre-existing or anticipated post operative dentinal hypersensitivity.

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