

# Pro-Argin: A Breakthrough Technology for Dentin Hypersensitivity Treatment

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## Abstract

Pro-Argin technology is a novel treatment for dentin hypersensitivity, a common clinical condition difficult to treat as the treatment outcome is not consistently successful. Although some of the traditional methods have been clinically evaluated and found to be effective, we need to continue looking for more effective, faster acting and longer lasting treatment. This technology is based on the interaction between arginine and calcium carbonate which infiltrate and block the dentinal tubules and prevent dentinal fluid flow, thus reducing dentin hypersensitivity. The successful treatment of dentin hypersensitivity requires application of Pro-Argin paste along with modification of salivary factors.

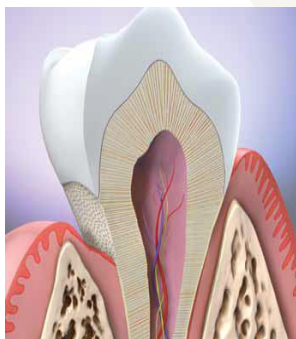
**Keywords:** Dentin Hypersensitivity, Tubule Occlusion, Pro-Argin Technology, Arginine, Calcium Carbonate, Colgate Pro-Relief.

## Introduction:

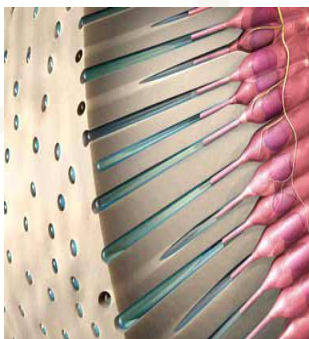
Dentin hypersensitivity is a pain arising from exposed dentin, typically in response to clinical, thermal, tactile, evaporative or osmotic stimuli that cannot be explained as arising from any other form of dental pathology.

Most authorities agree that Brannstrom's "Hydrodynamic Theory" of nerve stimulation due to movement of dentinal fluid, best explains dentin hypersensitivity. The relationship between dentin hypersensitivity and the patency of dentin tubules in vivo has been established and occlusion of the tubules

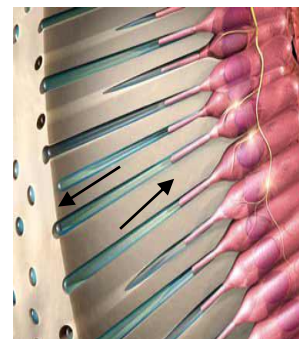
seems to decrease that sensitivity. Clinicians have used many materials and techniques to treat dentin hypersensitivity, including specific dentifrices, dentin adhesives, antibacterial agents, aldehydes, resin suspensions, fluoride rinses, fluoride varnishes, calcium phosphate, potassium nitrate, oxalates, and strontium agents among others. More recently, dentin desensitizing solutions also have been used under amalgam restorations and crowns to prevent postoperative sensitivity. Also used are Nd:YAG laser, bioactive glass, Casein phosphopeptide and Portland cement.<sup>1</sup>



Gingival Recession



Open Tubules

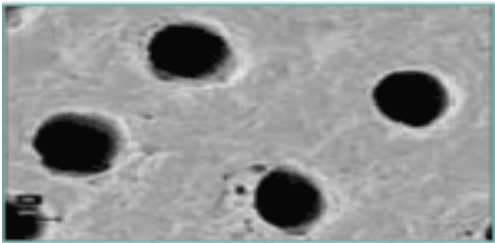


Fluid Movement

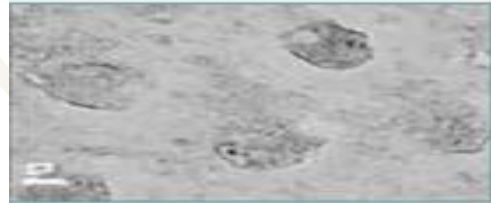
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## Pro-Argin™ Technology

In 2002, Kleinberg et al, at the State University of New York – Stony Brook, reported the development of a new anti-sensitivity technology based on their understanding of the role that saliva plays in naturally reducing dentin hypersensitivity over time. The essential components of this new technology are Arginine, an amino acid positively charged at physiologic pH(6.5-7.5), Bicarbonate, a pH buffer, and insoluble Calcium carbonate, a source of calcium.<sup>2</sup> The arginine present in the products are obtained from vegetable sources.<sup>3</sup>



SEM photograph of untreated dentin surface with exposed tubule



SEM photograph of dentin surface showing occlusion of dentin tubules after application of desensitizing paste with Pro-Argin™ Technology<sup>4</sup>

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## Mechanism of action

In healthy patients, saliva is naturally very effective in reducing dentin hypersensitivity by supplying and carrying calcium and phosphate ions into open dentin tubules to gradually occlude them and form a surface protective layer consisting of precipitate of salivary glycoproteins with calcium phosphate.

A recent review of biological approaches to dentin hypersensitivity therapy proposed that the ideal treatment should mimic natural desensitizing processes leading to spontaneous occlusion of open dentin tubules. The Pro-Argin technology mimics saliva's natural process of plugging and sealing open dentin tubules.

When the desensitizing paste is applied to exposed dentin, Arginine (positively charged) and calcium carbonate, found in saliva naturally, work together to accelerate the natural mechanisms of occlusion by binding to the negatively charged dentine surface to

An in-office product based on this technology (ProCludea) was marketed in the United States for the management of tooth sensitivity during professional prophylaxis.

The technology has also been incorporated into toothpaste (DenCludea) for use at home following prophylaxis. In 2009, Colgate-Palmolive re-launched ProClude as Colgate Sensitive Pro-Relief in-office desensitizing paste.<sup>3</sup> Other products based on Pro-Argin technology include a Mouthwash (alcohol free, containing 0.8% arginine), Enamel Protection paste, Whitening toothpaste and a Multiprotection toothpaste.

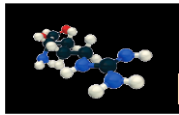
deposit a dentin-like mineral, as a plug within the dentin tubules and a protective layer on the dentin surface. This consists of arginine, calcium carbonate and phosphate and salivary glycoproteins.<sup>4</sup> Freeze fracture images have shown that this plug reaches a depth of 2  $\mu\text{m}$  into the tubule.<sup>2</sup> It is resistant to normal pulpal pressures and to challenge by acids in oral cavity. It is also effective in reducing dentin fluid flow thereby relieving hypersensitivity.

Chemical mapping of the occluded surfaces using energy dispersive x-ray (EDX) has shown that the material on the dentin surface and within the dentin tubules contains high levels of calcium carbonate and phosphate. Confocal Laser Scanning Microscopy (CLSM) and High resolution scanning electron microscopy (SEM) images studies have demonstrated that the arginine-calcium carbonate desensitizing paste is highly effective in occluding open dentin tubules and is resistant to acid challenge.<sup>2</sup> CLSM has also confirmed that the toothpaste and the

desensitizing prophylaxis paste have the same mechanism of action.

Atomic force microscopy (AFM) revealed that images of untreated specimens showed the helical fine structure of both inter-tubular dentin and tubules that

were completely open while images of specimens treated with the desensitizing paste displayed absence of the helical structure on the dentin surface, as a consequence of surface coating, and the tubules were sealed.<sup>2</sup>



Arginine, calcium carbonate



Sealed surface



Plug within the tubules

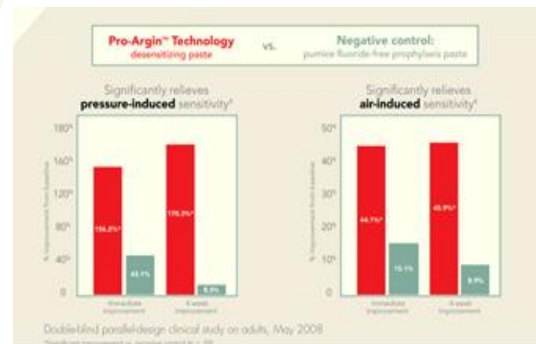
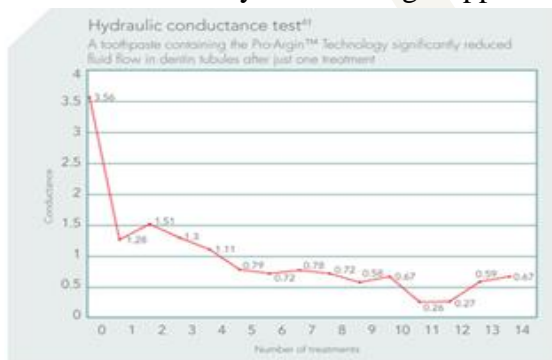
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**Literature Review:**

Number of studies have been performed testing the efficacy of pro-argin on dentin hypersensitivity.

Kleinberg, et al, demonstrated that application of the arginine-calcium carbonate in office desensitizing paste to sensitive teeth following dental prophylaxis resulted in instant relief from discomfort and that relief lasted for 28 days after a single application.

Clinical evaluation of the in-office desensitizing paste prior to dental prophylaxis revealed that there was a significant decrease of 83.94% in the hypersensitivity of subjects using the Test paste while the group using the Control paste showed a 13.43% desensitization.<sup>5</sup>



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When the clinical efficacy of a Pro-Argin paste with 1000 ppm fluoride was compared to a commercially available anti-sensitive toothpaste containing 2% Potassium ion, as potassium nitrate, on dentin hypersensitivity in a randomized clinical trial, the former combination showed greater efficacy after two, four and eight weeks of use.<sup>6</sup>

Comparison of the effects on dentin permeability of two commercially available sensitivity relief dentifrices, based on in vitro hydraulic conductance study, the dentifrice containing 8.0% arginine, calcium carbonate, and 1450 ppm fluoride was significantly more effective in reducing dentinal fluid flow after first application than the dentifrice containing 8% strontium acetate and 1040 ppm fluoride and the occlusion obtained with the Pro-Argin formula dentifrice was resistant to acid challenge.

Studies have shown that the whitening variant contains a high cleaning calcium carbonate system, which gives it a higher cleaning efficiency, allowing it to remove extrinsic stains but no difference was observed in the desensitizing efficacy between the whitening and non-whitening versions.<sup>7</sup>

In another study, Hamlin et al applied the products prior to a professional dental cleaning procedure and sensitivity measurements immediately thereafter. The results showed that the occlusion led to highly significant reductions in dentin fluid flow, and that the tubule plug is resistant to normal pulpal pressure.<sup>2</sup>

Together, these results have clearly demonstrated that the arginine-calcium carbonate desensitizing paste reduces dentin hypersensitivity. It is simple and has been proven to show strong efficacy, fast onset and long lasting effect. Significant reduction in hypersensitivity is obtained during and after scaling, post-operative due to bleaching, periodontal procedures and also in response to any other pathology leading to dentin exposure.

### **Application:**

The desensitizing paste is available both as in office and at home paste. The desensitizing paste is gentle to gingival soft tissue, with no pain on application and has a pleasant mint flavor. A small amount of paste is applied by the dental professional to sensitive tooth surfaces by burnishing it with a slowly rotating soft prophylaxis cup, using low speed and a moderate amount of pressure. Paste can also be applied to accessible spots by massaging thoroughly with a cotton-tipped applicator and to furcations and other hard-to-reach areas with a microbrush, focusing on the CEJ and exposed cementum and dentin. Studies have shown that a single direct topical application of the paste to sensitive teeth, with fingertip or cotton swab along with 1 minute of massage, resulted in immediate relief of hypersensitivity and that the relief was maintained with subsequent twice-daily brushing. The clinical effect of direct topical application by both cotton swab and fingertip, remains same.<sup>8</sup> Rinsing immediately after application is avoided.

### **Conclusion:**

Prior to initiating treatment, it is important to determine which patients are at risk for dentin hypersensitivity and may benefit from the arginine-calcium carbonate desensitizing therapy.

Treatment with a Pro-Argin product is only one aspect of the management of dentin hypersensitivity. Effective plaque control, dietary modifications and strategies to enhance flow of saliva, buffering capability and upsurge salivary pH may each be important in achieving lasting comfort. Controlling dentin hypersensitivity is an ongoing challenge that requires patient cooperation and participation.

Dentin hypersensitivity management is a quality of life issue. Left untreated, patients may suffer needlessly and risk further deterioration of valuable tooth structure. Taking better care of patients with dentin hypersensitivity using clinically proven, effective treatment products is both appropriate and responsible.

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