nanoXIM CarePaste

WHITE PAPER

DENTAL HYPERSENSITIVITY

Effectiveness of nanoXIM•CarePaste on dental hypersensitivity prevention

Dental hypersensitivity

Dental hypersensitivity is a major and common dental condition that **occurs in approximately 57% of adults**. Among individuals with periodontal disease, the prevalence can be as high as 98% [1]. This condition is considered a relevant clinical problem. It is characterized by a short and sharp pain that arises from exposed dentin in response to chemical, thermal, tactile or osmotic stimuli [2, 3]. Essentially, dentin may become exposed by the removal of enamel or cementum as a result of friction, abrasion or erosion (caused by the action of acidic foods and sugary drinks). Consequently, the dentin tubules are unprotected, providing a direct connection between the internal pulp of the tooth and the external environment [3]. The contact of the pulp with the external stimuli triggers the nerves (Figure 1), causing intense pain that is a considerable concern for patients.

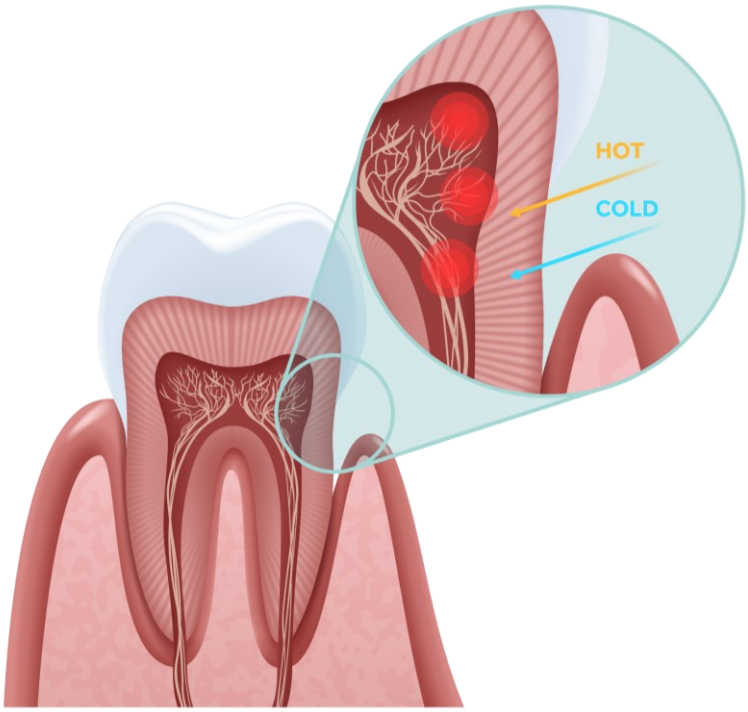


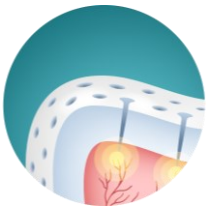
Figure 1: Dental hypersensitivity as a result of exposed dentin tubules in response to hot and cold stimuli.

Dental hypersensitivity is usually treated by applying desensitizing toothpastes composed mainly of strontium chloride or potassium nitrate. However, these products do not simulate the natural composition and structure of dentin and enamel [4]. **The mineralized tissues found in the human body are composed mostly of hydroxyapatite (HAp),** a natural calcium phosphate ceramic that is abundant in bone and dentin (70%), and enamel (97%). Tooth enamel is the hardest tissue in the human body and is made up of building blocks of HAp nanocrystals, 40 nm in size. The tissue is acellular and, unlike bone, cannot be repaired naturally [4]. Therefore, the regeneration of the enamel surface represents a significant challenge.

nanoXIM•CarePaste

The nanoXIM•CarePaste is a nano-hydroxyapatite (nHAp) ingredient produced and marketed by FLUIDINOVA. This synthetic water-based suspension ingredient has been **specifically developed for oral care applications**, such as toothpastes, gels, mouthwashes, dental floss, and other oral care products (personal and professional use). Nano-hydroxyapatite is a calcium phosphate material widely accepted in dentistry and medicine due to its exceptional biocompatibility and bioactivity. Its excellent performance is related to its nanometer size, being very similar to natural teeth and bone. nanoXIM•CarePaste contains high-purity nanoparticles under 100 nm in size, being much smaller than the dentin tubules. Therefore, they can be easily integrated inside the tubules, blocking them and **reducing the pain associated with dental hypersensitivity**. In addition, nanoXIM•CarePaste is able to bind to the dentin apatite and tooth enamel. Consequently, a new apatite layer is formed, **remineralizing the enamel, protecting the tooth surface, and restoring its natural whiteness**.

Mode of action



1.

Dental hypersensitivity, a short and sharp pain, prevents us from drinking hot coffee, ice cream, or even an orange juice without feeling pain. The action of certain food and drinks (hot, cold, acidic) are considered aggressions to our teeth, resulting in the exposure of dentin tubules and the underlying nerves to the external environment (the dentin loses its protective covering).

2.

HAp has a great potential in the treatment of dental hypersensitivity, as it can be incorporated inside the dentin tubules. Consequently, these become sealed and pain is reduced.

3.

As a result, a new layer is formed, remineralizing the tooth enamel and protecting the tooth surface, preventing the appearance of new cavities and making it resistant to acid attacks of our favourite meals.

4.

The deposition of HAp on the enamel surface improves its smoothness for better light reflection, and consequently brighter and whiter teeth.

The effectiveness of nanoXIM•CarePaste has been confirmed in numerous studies

Study 1

The purpose of this *in vitro* study was to evaluate the effect of three different desensitizing agents: 6.5% nanoXIM•CarePaste (Aclaim Toothpaste, Group Pharmaceuticals, Ltd., India), 5% NovaMin (Shy NM toothpaste, Group Pharmaceuticals, Ltd., India) and 8% Pro-Argin™ (Colgate sensitive pro-relief toothpaste, Colgate-Palmolive India Ltd., India) [5].

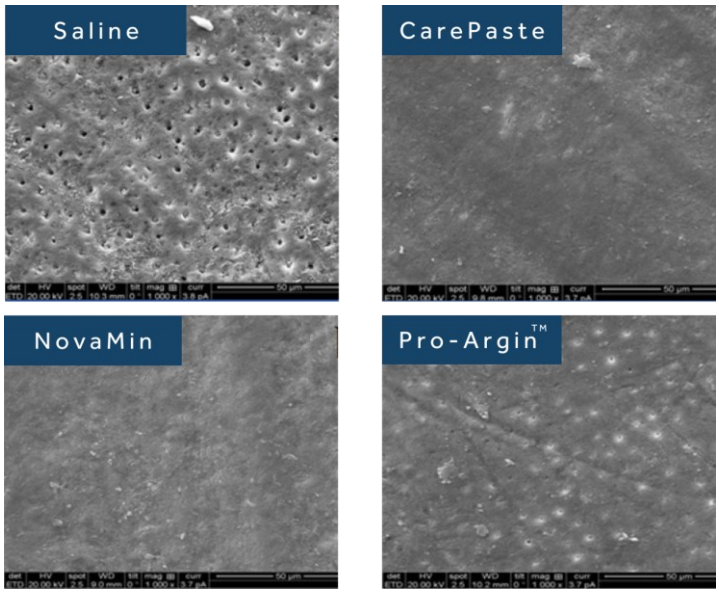


Figure 2: Scanning Electron Microscopy images of dentin discs treated daily with saline solution (negative control), nanoXIM•CarePaste, NovaMin and Pro-Argin™ for two minutes, for seven days.

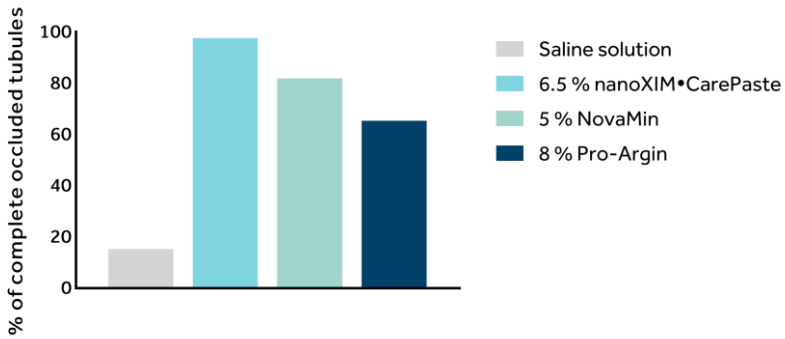


Figure 3: Percentage of completely occluded dentin tubules after seven days of treatment (two minutes daily treatment) with the different desensitizing agents.

- ✓ nanoXIM•CarePaste was the most effective desensitizing agent of this study, in comparison with NovaMin and Pro-Argin™ ingredients, showing almost complete tubule occlusion during the treatment period;
- ✓ A two-minute daily treatment for seven days with nanoXIM•CarePaste allowed 98% of completely occluded dentin tubules, in opposition to NovaMin and Pro-Argin™, with 82% and 65%, respectively.

Study 2

An *in vivo* clinical study of forty-five patients was performed to test the efficacy of Aclaim toothpaste (Group Pharmaceuticals, Ltd., India) containing 6.5% nanoXIM•CarePaste, Sensodent-K toothpaste (potassium nitrate) and a propolis dentifrices in controlling dental hypersensitivity [6].

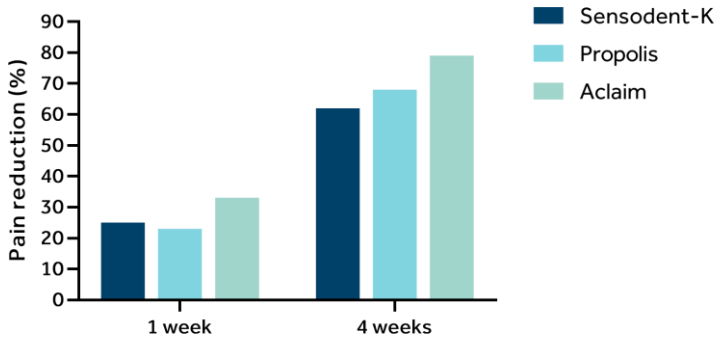


Figure 4: Reduction of dental hypersensitivity after treatment with Sensodent-K (potassium nitrate), Propolis and Aclaim (nanoXIM•CarePaste) during one and four weeks.

- ✓ Immediately after one week of treatment, a pain reduction of approximately 35% was observed among the patients treated with the nanoXIM•CarePaste. In opposition, the dentifrices containing potassium nitrate and propolis only decreased the hypersensitivity by 25%;
- ✓ The dentifrice containing nanoXIM•CarePaste was the most efficient in reducing dental hypersensitivity, allowing superior pain relief after one and four weeks of treatment with a final pain reduction of up to 80%.

Study 3

In this *in vivo* study, thirty patients diagnosed with dental hypersensitivity were treated with a commercially available toothpaste (Aclaim, Group Pharmaceuticals, Ltd., India) containing 6.5% nanoXIM•CarePaste. The patients were instructed to use the toothpaste twice a day and the treatment was performed for six months, with follow-up observations at one and three months [7].

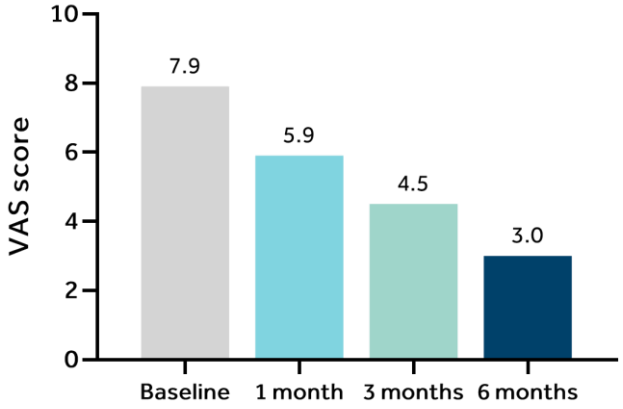


Figure 5: Hypersensitivity mean scores measured at baseline, one, three and six months after treatment, with Aclaim toothpaste (containing 6.5% nanoXIM•CarePaste).

- ✓ After one month of treatment, the patients treated with the Aclaim toothpaste containing nanoXIM•CarePaste experienced a pain reduction of 26%;
- ✓ An average hypersensitivity reduction of 62% was obtained after six months of treatment;
- ✓ On average, the regular use of a toothpaste containing nanoXIM•CarePaste allowed to reduce in six months from severe and intense pain to a mild level of pain.

Conclusion

The studies stated in this document evidence the **success of nanoXIM•CarePaste** as an oral care ingredient, demonstrating **excellent performance in treating dental hypersensitivity**, with successful dentin tubule occlusion and pain relief.

The nanoXIM•CarePaste achieves a higher rate of dental tubule occlusion than other commercial brands and remains on the teeth even after washing. Moreover, research demonstrates the ability of nanoXIM•CarePaste to create a new and restored tooth surface.

References:

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