

 **nanoXim**  
CAREPASTE

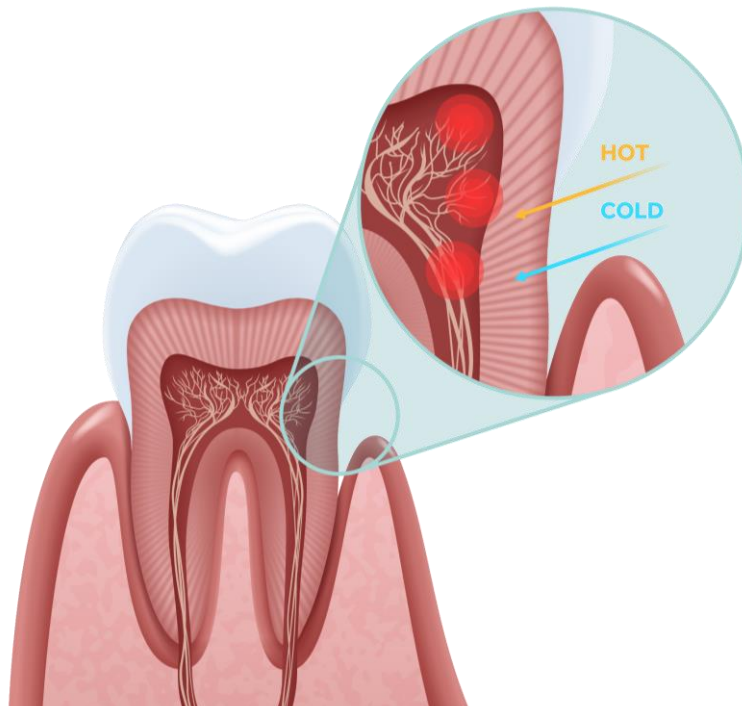


**WHITE PAPER**  
DENTAL HYPERSENSITIVITY

## Effectiveness of nanoXIM•CarePaste on dental hypersensitivity prevention

### Dental hypersensitivity

**Dental hypersensitivity** is a common dental condition, that **affects approximately 57% of adults**, and its prevalence may reach 98% among individuals with periodontal disease [1]. 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]. Dentin exposure typically occurs due to the loss of enamel or cementum, which can result from friction, abrasion, or erosion caused by the action of acidic foods and sugary drinks. When this protective outer layer is compromised, the dentin tubules become exposed, providing a direct connection between the internal pulp of the tooth and the external environment [3]. The contact between the external environment and the pulp triggers the nerves (Figure 1), causing intense pain that is a significant concern for patients.



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

Dental hypersensitivity is commonly managed with desensitizing toothpastes containing strontium chloride or potassium nitrate. However, these products do not simulate the natural composition and structure of dentin and enamel [4]. **The mineralized tissues in the human body are mainly composed of hydroxyapatite (HAp)**, a natural calcium phosphate ceramic that is abundant in bone and dentin (70%), and enamel (97%). Tooth enamel, the hardest tissue in the human body, is built up from HAp nanocrystals about 40 nm in size. Unlike bone, enamel is acellular and cannot be repaired naturally [4]. As a result, effective enamel regeneration represents a significant clinical challenge.

The nanoXIM•CarePaste is a nano-HAp 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-HAp is a calcium phosphate material widely accepted in dentistry and medicine, thanks to its exceptional biocompatibility and bioactivity. Its excellent performance comes from its nanometer size, which closely mimics 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**. Additionally, nanoXIM•CarePaste binds to the dentin apatite and tooth enamel, promoting the formation of a new apatite layer that **remineralizes the enamel and protects the tooth surface, while restoring its natural whiteness**.

## Mode of action



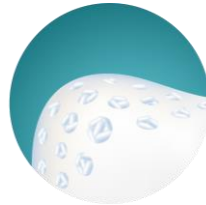
1.

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.



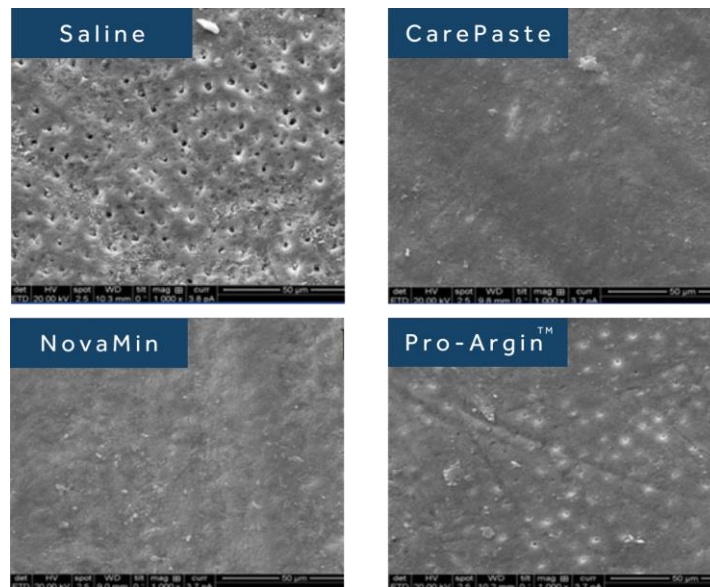
4.

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

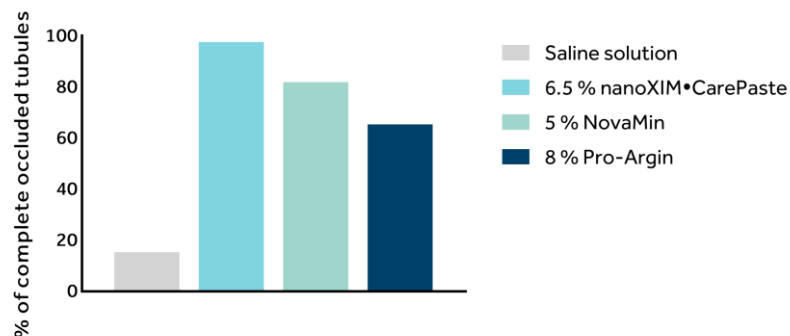
## The effectiveness of nanoXIM•CarePaste has been confirmed in numerous studies

### 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.

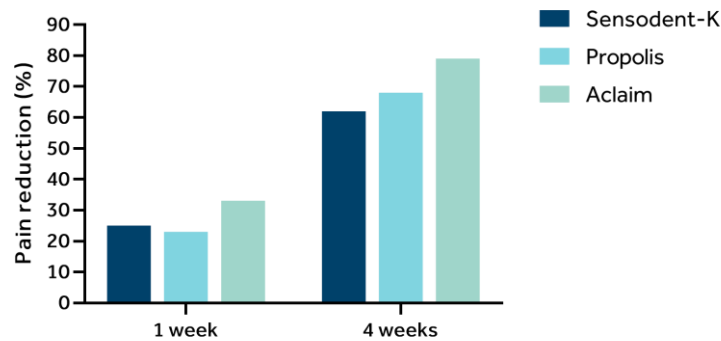


**Figure 3:** Percentage of completely occluded dentin tubules after seven days of treatment (two minutes daily treatment) with the different desensitizing agents.

- ✓ nanoXIM•CarePaste was the most effective desensitizing agent, 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 with forty-five patients evaluated the efficacy of Aclaim toothpaste (Group Pharmaceuticals, Ltd., India) containing 6.5% nanoXIM•CarePaste, in comparison with Sensodent-K toothpaste (potassium nitrate) and a propolis dentifrice for the management of dental hypersensitivity [6].

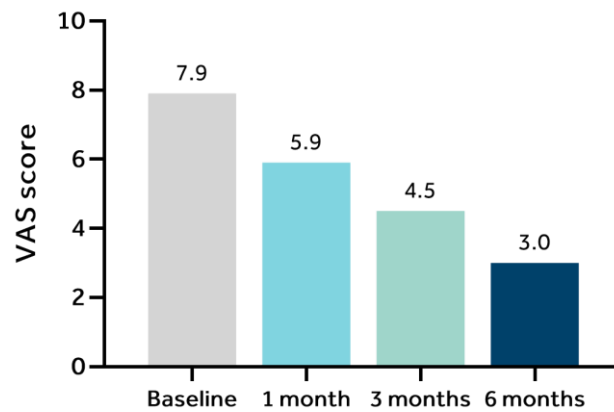


**Figure 4:** Reduction of dental hypersensitivity after treatment with Sensodent-K (potassium nitrate), Propolis and Aclaim (nanoXIM•CarePaste) during one and four weeks.

- ✓ Within the first week, treatment with nanoXIM•CarePaste resulted in a 35% decrease in pain, outperforming potassium nitrate and propolis dentifrices, which achieved only 25% reduction;
- ✓ The dentifrice containing nanoXIM•CarePaste was the most efficient in reducing dental hypersensitivity, allowing superior pain relief over the course of the study, achieving up to 80% pain reduction after four weeks.

## 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 daily, 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;
- ✓ Overall, the regular use of a toothpaste containing nanoXIM•CarePaste allowed patients to progress from severe or intense pain to mild level of sensitivity in six months.

## 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 adhered on the teeth even after rinsing. Moreover, research demonstrates the ability of nanoXIM•CarePaste to create a new and restored tooth surface.

## References:

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**FLUIDINOVA, S.A.**

Rua de Rosa Jácome Felgueiras 57, 4475-188 Maia

Phone: +351 22 011 9746 | Email: [nanoxim@fluidinova.com](mailto:nanoxim@fluidinova.com)