Effectiveness of nano-Hydroxyapatite (n-HA) In treatment of dentin hypersensitivity: A systematic review

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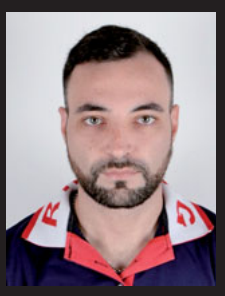


INTRODUCTION AND OBJECTIVES

Dentin hypersensitivity is a painful clinical condition which affects patients life quality. The mechanism responsible for this ailness remains uncertain, although the hydrodynamic theory is the most commonly accepted. The majority of desensitizing agents in DH treatment consists in the obliteration of dentinary tubules, thus controlling the flow movement. Nano desensitizers were recently introduced, specifically nano-hydroxyapatite, due to their biocompatibility properties and vast applications in dentistry, such as a bone substitute and remineralizing enamel. The nanometric proportions of n-HA allows an easier obliteration of dentinary tubules.[1;2;4]

This systematic review may answer the following question: Is nano-hydroxyapatite effective in dentin hypersensitivity treatment?

METHODS

The database of this research on pubmed central and pubmed/medline was conducted according to the keywords: dentin hypersensitivity, dentin sensitivity, n-HA, nano-HA, nano hydroxyapatite, combined with the connectors "AND" and "OR" (dentin hypersensitivity OR dentin sensitivity) AND (n-HA OR nano-HA OR nano hydroxyapatite).

The inclusion criteria comprehended: studies from the last ten years (2007-2017), randomized clinical trials with four weeks control, adults and adults who hadn't undergone teeth bleaching.

The exclusion criteria consisted in systematic or bibliographic reviews, in vitro studies, clinical trials under four weeks control, clinical trials under 20 participants and clinical trials where as the participants underwent teeth bleaching, and studies performed on children.

From a universe of 208 studies, 5 were included in this systematic review. The first analysis comprised in the titles and abstracts of scientific articles, from which 186 were excluded, upon reading the full text, 14 articles were excluded and 5 were included, and there were no further matches through crossed references.

The five included studies were enclosed in a resumed table for easier and better result interpretation, and also the bias risk of each article.

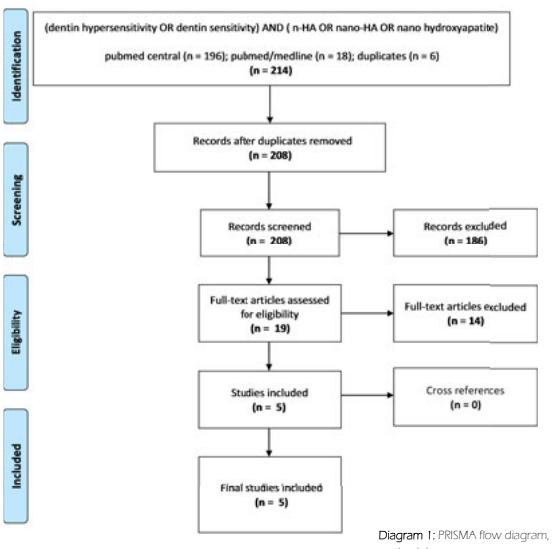
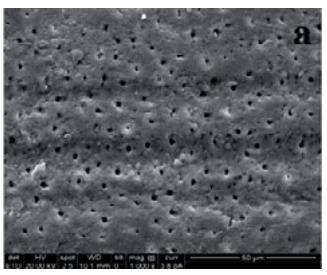


Diagram 1: PRISMA flow diagram, methodology

RESULTS

Included studies (authors)	Participants	Groups	Measure	Results	Conclusion
Nithin Manchery Gopinath, Joseph John, N Nagappan et al. (1)	n=36 (20 male and 16 female) age (18 - 60 years old)	Group I (n=18) 5% calcium sodium phosphosilicate (Shy-NovaMin®) Group II (n=18) n-HA (Aclaim®)	Tactile examination, VAS scale (0 to 10) Air blast test, VAS scale (0 to 10) Cold water test, VAS Scale (0 to 10)	Mean difference (4 weeks – baseline) Group I Cold/ Air / tactile 2.11/2.05 /0.94 p <0.05 Group II Cold/ Air / tactile 1.77/1.50 /0.88 p <0.01	NovaMin and n-HA showed significant reductions in dentin hypersensitivity at the end of 4 weeks.
Michele Vano,Giacomo Derchi, Antonio Barone et al. (2)	n=105 (48 male and 57 female) Age (20 - 70 years old)	Test group 15% n-HA toothpaste gel fluoride free Positive control group Fluoride toothpaste Placebo group	VAS scale (0 to 100) + Schiff Cold Air Sensitivity Scale (0 to 3) Air blast sensitivity (0 to 3) Tactile sensitivity (0 to 3)	mean for each treatment group Assesment Test group VAS / Air blast/ tactile Baseline: 56.25/2.82/2.54 2 weeks: 39.45/1.10/1.35 4 weeks: 36.08/1.20/0.95 Positive control group VAS / Air blast/ tactile Baseline: 54.77/2.80/2.60 2 weeks: 51.25/2.45/2.40 4 weeks: 50.11/2.45/2.50 Placebo group VAS / Air blast/ tactile Baseline: 57.45/2.88/2.50 2 weeks: 56.21/2.38/2.50 4 weeks: 54.24/2.30/2.50	Significant lower values of all sensitivity tests (p<0.01) were found for test group at 2 weeks and 4 weeks. 15% n-HA as an effective desensitizing agent.
Amit Jena; Govind Shashirekha et al. (3)	n=45 (17 male and 28 female) Age (18-50 years old)	Group I 5% NovaMin (Vantej Toothpaste) Group II 8% arginine (Colgate Sensitive Pro-Relief®) Group III 15% n-HA (nanoXIM®)	Tactile sensitivity, VAS scale (0 to 10) Schiff Cold Air Sensitivity, SCA scale (0 to 3)	Mean difference between the groups (immediate/ 1 week / 4 weeks) Group I and III (SCA) -1.09524/ - 1.42976/ -1.84048 (P <0.001) (VAS) -1.39167/ -3.06310/ -3.87619 (p<0.001) Group II and III (SCA) -0.27024*/ - 0.37976/-0.61548 (*P>0.05) (VAS) -0.71667/ -0.66310/ - 1.05119 (p<0.001)	Toothpaste containing 15% n-HA was found to be most effective in reduction of DH after a single application up to a period of 4 weeks.
Wang L, Magalhães AC et al. (4)	n=28 (137 teeths) (7 male and 21 female) Age: 18 - 60 years old	Group I (n=7) (30 teeth) 20% n-HA with potassium nitrate (Desensibize Nano-P®) Group II (n=7) (22 teeths) 20% n-HA with potassium nitrate (Desensibize Nano-P®) and experimental home-care paste containing 10% n-HA. (FGM-Dentscare®) Group III (n=7) (26 teeths) 8% arginine and calcium carbonate (Pro-Relief Colgate®) professional and home care Group IV (n=7) (45 teeths) Duraphat-NaF varnish	Air blast sensitivity, VAS scale (0 to 10)	difference between means for the baseline and the final VAS score Group I (1° month / 3° month) 4.08 / 4.52 (p <0.05) Group II (1° month / 3° month) 4.48 / 4.73 (p <0.05) Group III (1° month / 3° month) 4.13 /5.21 (p <0.05) Group IV (1° month / 3° month) 2.81 /2.53 (p <0.05)	Desensibilize n-HA (with or without home-care product association) was as effective as the other treatments for reducing DH over 3 months.
Vano M, Derchi G, Barone A et al. (5)	n=105 (65 female and 40 male) Age (20 - 70 years old)	Test group (n=35) n-HA 2% toothpaste gel fluoride free Positive control group (n=35) Fluoride toothpaste Placebo group (n=35)	VAS scale (0 to 100) + Schiff Cold Air Sensitivity Scale (0 to 3) Air blast sensitivity (0 to 3) Tactile sensitivity (0 to 3)	mean for each treatment group Assesment Test group VAS / Air blast/ tactile Baseline: 58.58/2.97/3.17 2 weeks: 43.21/1.72/1.98 4 weeks:41.38/1.64/1.83 Positive control group VAS / Air blast/ tactile Baseline:57.12/3.05/2.94 2 weeks: 53.25/2.65/2.69 4 weeks: 52.33/2.57/2.62 Placebo group VAS / Air blast/ tactile Baseline: 55.65/ 2.87/2.50 2 weeks: 57.51/2.58/2.83 4 weeks: 53.44/ 2.73/2.92	Significant lower values of all sensitivity tests (p<0.05) were found for test group at 2 weeks and 4 weeks. n-HA 2% gel dentifrice was effective in reducing dentin hypersensitivity.

Table 1: Synthesis of studies included in the review.



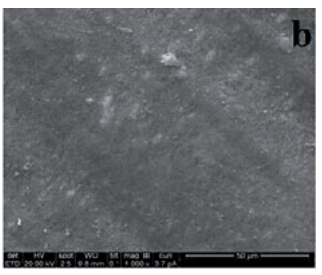


Figure 1: Obliteration of the dentinal tubules. **a-** Before application of n-HA. **b-** After application of n-HA.

Included studies (authors)	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other Bias	Risk of bias
Nithin Manchery Gopinath, Joseph John, N Nagappan et al. (1)	LOW	LOW	LOW	HIGH	LOW	LOW	HIGH	MEDIUM
Michele Vano, Giacomo Derchi, Antonio Barone et al. (2)	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	LOW
Amit Jena; Govind Shashirekha et al. (3)	LOW	HIGH	LOW	LOW	LOW	LOW	HIGH	MEDIUM
Wang L, Magalhães AC et al. (4)	LOW	LOW	LOW	LOW	HIGH	LOW	HIGH	MEDIUM
Vano M, Derchi G, Barone A et al. (5)	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	LOW

Table 2 : Risk of bias of the studies included in the review.

CONCLUSIONS

In this systematic review, all the included studies have shown the effectiveness of nano-hydroxyapatite by reducing dentin hypersensitivity in a minimal period of four weeks. When compared with other desensitizing agents, nano-hydroxyapatite has shown an equal or even superior effectiveness, nevertheless, more studies are required to extrapolate more accurate conclusions.

CLINICAL APPLICATIONS

Nano-hydroxyapatite desensitizing agents are a valid new treatment option for dentin hypersensitivity and can be used in ambulatory (in the form of gel or toothpaste) or in the dental office.

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Figure 1

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Table 2 adapted from:

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