Apa Care®

Liquid Enamel

ApaCare Scientific Studies

Remineralisation / Caries Repair

Charité University Hospital Berlin: ApaCare remineralises enamel and dentine better than amine fluoride toothpaste

Study design:
In a study conducted at Charité University Hospital Berlin, toothpastes containing nano-hydroxyapatite were compared with an amine fluoride toothpaste. Demineralised bovine tooth specimens were deposited in artificial saliva (according to ISO 11609) for 2 and 5 weeks, and they were brushed twice daily with each toothpaste for 5 seconds (total contact time twice 120 s / d).

Results:
Under these conditions, both nano-hydroxyapatite (ApaCare Repair) and zinc-carbonate nano-hydroxyapatite showed a significantly higher mineralisation with regard to dentine, compared to the amine fluoride toothpaste.
For enamel, nano-hydroxyapatite (ApaCare Repair) shows significantly higher mineralisation compared to amine fluoride.

Ref.: Tschoppe P1, Zandim DL, Martus P, Kielbassa AM: Enamel and dentine remineralisation by nano-hydroxyapatite toothpastes. J Dent 39, 430-437 (2011).

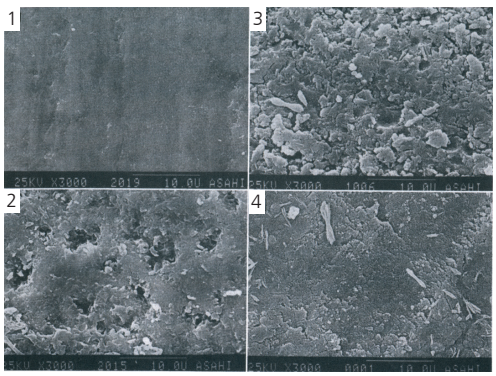
Hydroxyapatite suspensions speed up remineralisation (➔ ApaCare Repair Intensive Repair)

Study design:
Light microscope (polarized light microscopy), scanning electron microscope, x-ray (contact micro radiography) and microsensor study of artificial caries lesions on enamel before and after treatment with artificial salvia and a hydroxyapatite suspension.

Results:
Remineralisation of the enamel surface (A) and the subsurface areas (B) was increased by application of an aqueous hydroxyapatite suspension.

Ref.: Okashi T, Kani T, Isozaki A, Nishida A, Shintani H, Tokumoto T, Ishizu E, Kuwahara Y, Kani, M: Remineralization of artificial caries lesions by Hydroxyapatite. I Dent Health 41, 214–223 (1991).

Scanning electron microscope analysis of the examined enamel samples



1 Untreated enamel surface.
2 Situation after establishing an artificial caries lesion.
3 Situation after remineralisation with artificial salvia.
4 Situation after remineralisation with a hydroxyapatite suspension.

ApaCare remineralizes more strongly and significantly reduces roughness compared to a fluoride toothpaste

Study design:

90 human teeth are embedded into acrylic and polished. They are divided into two test groups and one control group. The microhardness is determined by the Vickers method, while the surface roughness is determined by means of a profilometer. The samples are demineralised to simulate tooth decay. Then half of the sample is covered with a paint and treated with either the two toothpastes or a placebo in a 3-week cycle.

Results:

The study hints at the added advantages of nano hydroxyapatite when used as an additive in fluoride toothpaste. Compared to a standard fluoride toothpaste, ApaCare leads to a greater increase in microhardness and a statistically significant decrease in roughness. We can conclude from these results that there is an additive effect of nano hydroxyapatite when used with fluoride. These observations support the assumption that nano hydroxyapatite can be incorporated directly into a carious lesion.

Ref.: Mielczarek et.al, The effect of nano-hydroxyapatite toothpaste on enamel surface remineralization. An in vitro study, American Journal of Dentistry 27, 287-290 (2014).

Nano hydroxyapatite inhibits new caries (➔ ApaCare Repair Intensive Repair, ApaCare Liquid)

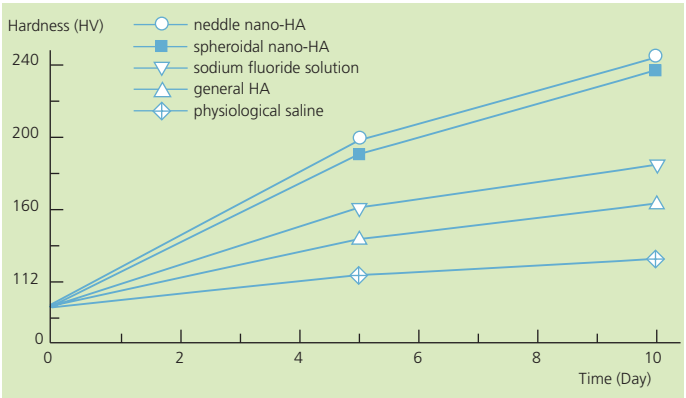
Study design:

Demineralised teeth were dipped in suspensions of needle-shaped and spherical nano hydroxyapatite, and the increase in hardness (Vickers hardness) was measured against physiological saline solution, fluoride solution, and a suspension of crystalline hydroxyapatite

Results:

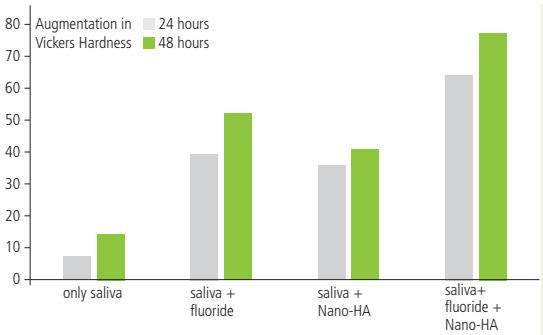
Nano hydroxyapatite causes strong remineralisation of affected dental enamel.

Ref.: Kuilong L, Xiangcai M, Jiuxing Z, Xingyi L, Xingyi L, Meiling Z: Inhibitory Effect of Synthetic Nano-Hydroxyapatite on Dental Caries. Key Engineering Materials 336–338, 1538–1541 (2007).



Increase of the surface hardness over time, depending on the active ingredient.

Combined Effects of Nano-Hydroxyapatite and NaF on Remineralisation of Early Caries Lesion (➔ ApaCare remineralising toothpaste)



Mineralisation of demineralised human Morar in artificial saliva with 0.05 % NaF and 10 % nano HA measured as an increase in Vickers hardness.

Mineralization of demineralized human Morar in artificial saliva with 0,05 % NaF and 10 % Nano-HA measured as an increase in Vickers hardness.

Ref.: M. Y. Kim et. al., Key Engineering Materials 330–332, 1347–1350 (2007).

	Group	N	Baseline (48 hours demin)		Remineralization (24 hours)		Remineralization (48 hours)	
D.W.	D.W.	6	36.3 ± 6.9	a	42.0 ± 2.7	a	49.9 ± 4.5	a
	1 % nano-HA	6	35.4 ± 5.8	a	47.7 ± 8.0	a	50.8 ± 6.27	a
	5 % nano-HA	6	35.9 ± 7.3	a	63.3 ± 5.7	b	68.7 ± 4.0	b
	10 % nano-HA	6	36.3 ± 6.7	a	71.1 ± 7.9	bc	76.5 ± 6.7	bc
NaF	NaF	6	36.1 ± 7.1	a		c	88.3 ± 5.3	c
	1 % nano-HA	6	34.9 ± 5.8	a	76.7 ± 7.7	c	90.3 ± 11.25	c
	5 % nano-HA	6	35.7 ± 8.2	a	79.0 ± 6.1	c	92.0 ± 6.1	c
	10 % nano-HA	6	36.3 ± 6.6	a	100.3 ± 13.1	d	113.4 ± 9.3	d

Table 1. VHN values of the nano-HA using the simple immersion model

Values are reported as the Mean ± Standard deviation. D.W.=Distilled Water. Concentrations of all NaF are 0.05 %. a, b, c, d The same letter indicates no significant difference at a=0.05 according to the Duncan's studentized range test.

Ref.: Kim MY, Kwon HK, Choi CH, Kim BI: Combined Effects of Nanohydroxyapatite and NaF on Remineralisation of Early Caries Lesions. Key Engineering Materials 330–332, 1347–1350 (2007).

Study design:

It is known that fluorides in mouthwashes can significantly accelerate the mineralisation of the tooth substance. In contrast, nano hydroxyapatite acts directly on the tooth substance and leads to an increase in mineral intake. The aim of this study is to determine the extent to which mineralisation effects are comparable to this and whether a combination of fluoride and hydroxyapatite can lead to an additional effect.

Results:

Both fluorides (combined with saliva) and nano hydroxyapatite (also without saliva) lead to a measurable increase in surface hardness, thereby causing remineralisation. The combination of fluoride with nano hydroxyapatite leads to a clear, synergistic increase in mineral intake.

Reduction of caries

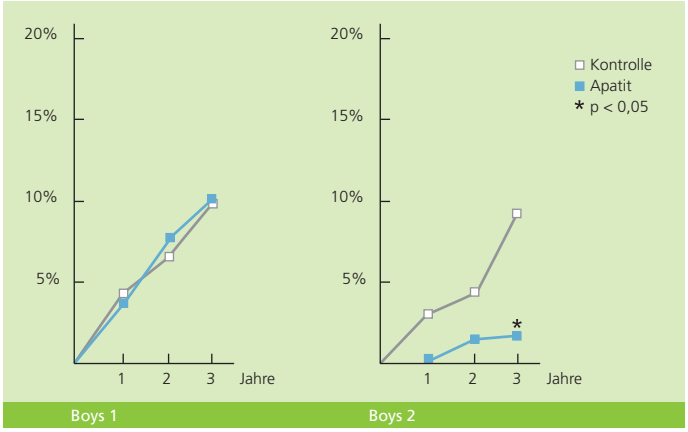
Hydroxyapatite tooth paste reduces children's caries inicidence (➔ ApaCare Remineralising toothpaste)

Study design:
Randomised study with 181 children (92 boys, 89 girls) from different japanese schools over a period of 3 years. After lunch the children brushed their teeth under supervision with a toothpaste containing 5 % hydroxyapatite and a control group with a paste without hydroxyapatite. Yearly controls of the DMFT index were diagnosed as well as the caries incidence on newly erupted teeth.

Results:
- The DMFT index was significantly deeper in the apatite group.
- The incidence for caries in newly erupted teeth was significantly lower compared to control.

Incidence of Caries (New DMFT rate)
1. Representing all healthy teeth at the start of the study.
2. Concerning all newly erupted teeth during study.

New-DMFT rate



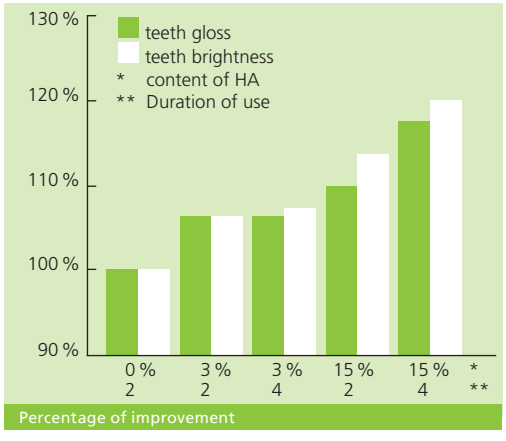
Ref.: Kani T, Kani M, Isozaki A, Shintani H, Ohashi T, Tokumoto T: Effect to apatite-containing dentifrices on dental caries in school children. I Dent Health 39, 104–109 (1989).

Brightening the teeth and higher gloss

Hydroxyapatite in toothpaste leads to brightening and higher gloss (➔ ApaCare Toothpaste, ApaCare Repair Intensive Repair)

Study design 1–Interactions with polishing properties:
The study was done with extracted teeth which were treated with toothpastes containing different amounts of hydroxyapatite (15 %, 3 % and 0 %) and special pastes (20 and 60 %). The pastes were mixed with water 1:1 dilution and the teeth were polished every 15 minutes over a 5 hour period.

Study design 2–Influence on brightnes and gloss:
12 Volunteers between 20 and 50 who had never used hydroxyapatite toothpaste before brushed their teeth for two weeks with a toothpaste without hydroxyapatite. The brightness and gloss were measured both before und after the two weeks.
This group was then separated in two groups, the first used a toothpaste containing 3 % and the other the same paste but with 15 %. After 2, 4 and 6 weeks the development of brightness and gloss was measured.



Development of gloss and tooth color related to the hydroxyapatite content.

Results:
- The variation of the hydroxyapatite content did not influence the polishing properties.
- Toothpastes containing hydroxyapatite lead to increased gloss and brighter teeth.
- Interactions between polishing properties and brightening properties could not be found.

Ref.: Niwa M, Sato T, Li W, Aoki H: Polishing and Whitening Properties of Toothpaste, J Mater Sci, Mater Med 12, 277–81 (2001).

Sealing enamel

Hydroxyapatite seals bleached enamel (➔ ApaCare Repair Intensive Repair)

Study design:

Cleaned samples of enamel from freshly extracted human teeth were sealed with nail varish leaving a window and were treated with a bleaching cream containing 35 % hydrogen preroxide. After the bleaching a part of the samples were polished with a hydroxyapatite containing suspension for 20 seconds.
The surfaces were examined and compared with a scanning electron microscope with a colour penetration test.

Results:

- The „cleaned" samples showed some signs from tootbrushing.
- The bleached surfaces were rougher than the nonbleached.
- The bleached samples treated with hydroxyapatite were smoother then without.
- The bleached as well as the hydroxyapatite treated samples showed some colour penetration whereas the penetration was deeper in the non hydroxyapatite treated group.

Ref.: Kawamata H, Nishio M, Fujita K, Ishizaki T, Hayman R, Ikemi T:
Posterpresentation 82nd General Session & Exhibition of the IADR / March 2004

Delayed plaque formation and smoother surfaces

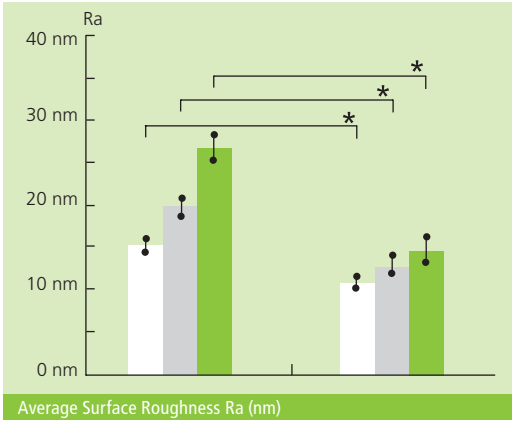
Hydroxyapatite suspensions lead to smoother teeth surfaces and reduce bacterial plaque formation (➔ ApaCare Professional, ApaCare Professional home)

Study design:

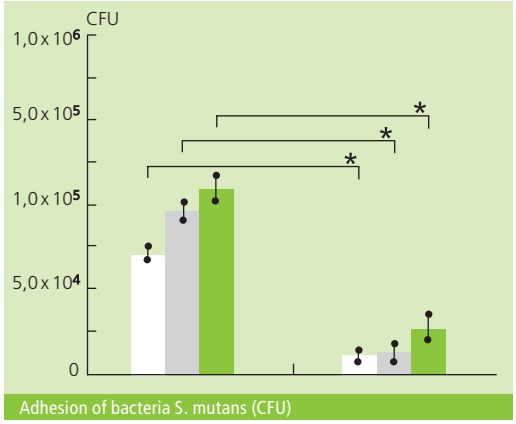
Under standardised conditions samples of enamel from freshly extracted human teeth were flat polished and treated with 3 polishing pastes with increasing RDA numbers (120/170/250) followed by remineralisation with a hydroxyapatite containing tooth cream. Examination of the surface was done by SEM (scanning electron microscope) for colonisation with streptococcus mutans bacteria.

Results:

- Roughness of the sample increased with the increased RDA numbers.
- Treatment with a hydroxyapatite paste formed a surface roughness lower than before polishing.
- After polishing, the speed of colonisation with SM germs increased significantly, and could be reduced successfully with the hydroxyapatite suspension.



Average surface roughness (Ra) of enamel samples after manual polishing with polishing pastes with different RDA numbers (PMTC) and with a hydroxyapatite suspension (PRTC-SF).



Colonisation of enamel samples with S.mutans bacteria after manual polishing with polishing pastes with different RDA numbers (PMTC) and with a hydroxyapatite suspension (PRTC-SF).

Ref.: Nishio M, Kawamata H, Fujita K, Ishizaki T, Hayman R, Ikemi T: A new enamel restoring agent for use after PMTC. Posterpresentation 82nd General Session & Exhibition of the IADR/March 2004.

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Last updated: June 2018

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