



Low CHX concentrations with additives **effective against** biofilm

Curaden, Switzerland

A recent study at the University of Bern in Switzerland has yielded important findings on one of the most frequently used agents in dental care—chlorhexidine digluconate (CHX)—and the relatively newly discovered Citrox, both of which are in Curaprox's Perio plus range of mouthwashes, toothpaste and oral gel. According to the results, Perio plus formulations have a stronger inhibitory effect on plaque regrowth than do solutions with the same amount of CHX but no additional ingredients.

How do CHX and Citrox act in favour of oral health?

CHX is an effective broad-spectrum biocide, antiseptic and disinfectant agent that combats a wide range of Gram-negative and -positive bacteria, yeasts, fungi, and many other kinds of microorganisms. CHX has been proved to have a significant effect on dental plaque formation and accumulation, and therefore the agent is used in prophylaxis and treatment of dental caries, gingivitis and periodontitis. There are various concentrations of this formula in many specialised oral care products, suitable for both short- and long-term use.

A lesser-known ingredient is Citrox, a formulation of soluble bioflavonoids obtained from bitter orange that has a documented broad spectrum of antimicrobial, antiviral and antifungal activities against microorganisms present in the mouth. Furthermore, Citrox is praised for being non-toxic and non-allergenic, and not altering taste or staining teeth. The study by the University of Bern shows that Citrox combined with poly-L-lysine and CHX in the formulation of Perio plus supports the anti-biofilm activity and that this mixture can be even more effective than pure CHX of the same concentration.

What formulations were tested?

The study aimed to analyse, *in vitro*, new formulations containing Citrox and CHX regarding their antibacterial activity against planktonic bacteria and their potential to inhibit



biofilm formation or act on existing biofilms. The experiment tested five such oral healthcare products: four mouthrinses and one gel—all of which were from the Perio plus product line by Curaden. The mouthwashes contained the following concentrations of CHX: 0.20% CHX (Curaprox Perio plus forte); 0.12% CHX (Curaprox Perio plus protect); 0.09% CHX (Curaprox Perio plus regenerate); and 0.05% CHX (Curaprox Perio plus balance). The gel formulation contained 0.50% CHX (Curaprox Perio plus focus). All of the tested Perio plus products contained CHX, Citrox and poly-L-lysine, xylitol and PVP-VA. The negative control was a 0.9% w/v sodium chloride solution, and the positive controls were CHX solutions without additives at three different CHX concentrations.

How the researchers approached the analysis

Fifteen different bacterial strains were used in the experiments, in two settings—the first was designed to mimic cariogenic biofilm and the second was designed to emulate periodontal biofilm. The cariogenic biofilm was formed of all streptococcal strains, *Actinomyces naeslundii* and *Lactobacillus acidophilus*. The periodontal biofilm consisted of *Streptococcus gordonii*, *Actinomyces naeslundii*, *Fusobacterium nucleatum*, *Campylobacter rectus*, *Parvimonas micra*, *Eikenella corrodens*, *Prevotella intermedia*, *Capnocytophaga gingivalis*, *Porphyromonas gingivalis*, *Tannerella forsythia*, *Fillifactor alocis* and *Treponema denticola*. Two different experimental designs were employed: application of the product after mechanical removal of biofilm to investigate the influence on biofilm formation and application to established biofilm.

Key findings: Even low concentrations of CHX with additives are effective

The results showed that Perio plus CHX formulations were effective against the selected oral bacteria responsible for biofilm masses that are known to cause periodontal disease. The most important finding is that even the low-concentration CHX formulations with additives slowed down cariogenic biofilm formation to a greater extent than did additive-free solutions with the same or even higher concentration of CHX. The exact anti-biofilm efficacy depended on the CHX concentration. In the case of the 0.2% CHX concentration (Perio plus forte), there was a proven effect even in its activity on already existing biofilm.

New approach for home-based dental care to combat plaque

The findings of the study have clinically proved that the unique formula of Perio plus is more effective than CHX alone in limiting the formation of oral biofilm. Overall, the activity of these advanced CHX formulations was highly effective in reducing biofilm formation, but less so in removing periodontal biofilm that had already formed. Therefore, it is



important to emphasise the importance of proper mechanical removal of biofilm by scaling and root planing in the initial therapy for periodontitis. For more-effective home treatment, these procedures can be followed by the application of the tested Perio plus CHX and Citrox formulas, since it has been clinically proved that they are beneficial against oral microorganisms that cause many common dental diseases.

New findings on the Perio plus products and their effect on biofilm:

- Perio plus forte mouthrinse (0.2% CHX) and Perio plus focus gel (0.5% CHX) were the only solutions of all those tested that significantly reduced the activity of cariogenic biofilm.
- Perio plus forte killed all cariogenic bacteria in established biofilm.
- Perio plus protect mouthrinse (0.12% CHX) was as effective as a pure concentration of 0.2% CHX in delaying biofilm growth.
- All products from the Perio plus range can also reduce biofilm masses that are known to cause periodontal disease.

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