Cetylpyridinium Chloride, An innovative molecule

The use of physical and chemical components for oral hygiene dates back to approximately 3000 years before Christ. Throughout history, man has developed tools to take care of teeth and prevent bad odour. Later, with the emergence of microbiology, it was found that those responsible for bad breath and the most common oral diseases were bacteria, and removing them with antiseptics was proposed.

Until now, a series of compounds with the ability to eliminate microorganisms have been tested; however, it has been discovered that not all of them can be used in the oral cavity, because they can potentially damage soft tissues, mucosa or teeth; or because they have an unpleasant taste or smell. These difficulties still exist today and should be resolved in order to come up with effective oral hygiene tools.

A series of compounds that are capable of combating dental plaque exist and have been classified as follows:

- **Antiplaque agents** that prevent proliferation and/or eliminate microorganisms that form plaque.
- **Antibiotics** capable of inhibiting or killing specific bacterial groups.
- **Enzymes or enzyme combinations** that can break up or dissolve the extracellular matrix of the biofilm or act upon the community physiology.
- **Non-enzymatic** dispersing, denaturalising or modifying agents that can alter plaque structure or the metabolic activity of plaque.
- **Agents** that can interfere with the adhesion of the acquired pellicle.

Currently, a great number of toothpastes and mouthwashes are available on the market that present as products that are efficient in maintaining optimal oral health. Different antigingivitis and antiplaque products are formulated with active ingredients such as triclosan (toothpastes), triclosan fluoride (toothpastes), chlorhexidine (CHX) (mouthwash and toothpastes) and cetylpyridinium chloride (CPC) (mouthwash and toothpastes). Pros and Cons of CHX, alcohol and CPC (CPC) (mouthwash and toothpastes).

Currently, the majority of mouthwashes use CHX, alcohol and CPC as their active ingredients or mixtures of these. However, different studies have found that alcohol can present some adverse effects, such as oral or oesophageal cancer and the deterioration of synthetic dental reconstruction materials and is contraindicated in patients with mucositis, immunocompromised patients, patients undergoing head and neck irradiation, patients with AIDS and pregnancy.

**DIFFERENT STUDIES HAVE SHOWN THAT MOUTHWASHES CONTAINING CHX, CPC AND A COMBINATION OF BOTH ACT EFFICIENTLY AS ANTIPLAQUE AGENTS ON HALITOSIS AND ON GINGIVITIS.**

Different studies have shown that mouthwashes containing CHX, CPC and a combination of both act efficiently as antiplaque agents on halitosis and on gingivitis (CSD). CHX is probably the most frequently used molecule in different health disciplines due to its excellent antibacterial effect. Particularly in the oral cavity, it shows the best results for treating periodontal disease. However, it is also observed that it possesses some adverse effects, such as promoting the formation of calculus, tooth staining and a bitter taste. Also, some clinical studies have described that it may cause mucosal irritation and desquamation. Because of CHX’s side effects, certain molecules such as CPC have become very important. Currently, new formulations are being developed to improve the effectiveness of CPC either alone as the main active ingredient or in mouthwashes combined with CHX.

**DIFFERENT STUDIES HAVE SHOWN THAT CPC IN DIFFERENT CONCENTRATIONS IS EFFECTIVE IN REDUCING SUPRA- AND SUBGINGIVAL DENTAL BACTERIAL PLAQUE.**

Nowadays, CPC is being used in various applications in the food industry, since it is capable of eliminating pathogens such as Salmonella spp. and Campylobacter spp., as well as killing Staphylococcus spp. bacteria in proportions of 1:5000 in merely 10 minutes. Its ability to be used in pharmaceutical and cosmetic industries and as a cleaning and disinfecting agent 10, 11.

Cetylpyridinium Chloride (CPC)

N-hexadecylcetylpyridinium chloride or CPC is classified as a cationic quaternary ammonium surfactant, is soluble in alcoholic and in aqueous solutions; it can act as a detergent and as an antibiotic; it is non-soap-forming and non-comogenic and has a neutral pH. Its molecular structure is made up of a polar and a non-polar region, as shown in figure 1.

This molecule has bactericidal and bacteriostatic activity against Gram positive and Gram negative bacteria, although evidence suggests that it is more effective against the first ones. It is thought that its mechanism of action on bacteria is at the plasma membrane level (Mandel, 1988) where the positive charge creates an attraction between the molecule and the negative charge of the phospholipids that make up the bacterial cell membrane. Once the molecule attaches to the membrane, the non-polar side of the CPC penetrates and damages the cellular membrane. This alteration causes an osmotic imbalance and causes loss of cytoplasmic material and cell death.

Even though it can also stain enamel, it does this at a much lower degree than CHX. Different in vitro and in vivo studies have proven that CPC at different concentrations is effective in reducing supra and subgingival dental bacterial plaque, which in turn improves inflammatory responses12, 13. Likewise, work carried out by Robidet et al in 2003 clearly describes that a formulation with CPC, CHX and Zinc Lacotate has very good results, significantly eliminating anaerobic microorganisms, such as F. nucleatum and P. intermedia from the tongue surface and from the saliva.

Similarly, a clinical study comparing different mouthwashes showed a reduction in anaerobic microorganisms in patients’ saliva samples. This same study also measured the quantity of volatile sulphur compounds (responsible for the bad odour of halitosis) and proved that they were reduced considerably when using mouthwashes with CPC as one of its active ingredients14.

In a review from year 2008, van den Broek et al compared results from different clinical studies where the activity of different mouthwashes against halitosis was tested. They point out that studies in which products like HALITA, which contains CPC, CHX and Zinc Lacotate is the one that yielded the best results.

Other clinical studies have tested mouthwashes with different formulations and concentrations of CPC15, 16. In general, they result show that this compound, by itself at different concentrations has antiplaque effects. It has also been combined with Sodium Fluoride, alcohol and CHX with the intention of reducing the concentration of the two latter compounds because of their adverse effects.

Thus, it has been proven that CPC can be used as a treatment for certain oral pathologies, like for instance, mucositis, especially in patients who have undergone irradiation for head and neck cancer or those who suffer from periodontitis or gingivitis.

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**What research has Dentaid carried out on the CPC molecule?**

At Dentaid, a number of studies have been performed using this molecule, that have led to the confection of diverse formulations that currently aid in human oral hygiene. Also, among these, we have studies on antimicrobial activity, stability studies of the formulations for replacing alcohol in mouthwashes and improving CPC’s bioavailability.

We have also carried out different clinical studies with national and foreign universities that shown how products containing this molecule are among the most efficient on the market.

**Hapitosis?**

**What is the best?**

- **HAPITOSIS AGENTS ON HALITOSIS AND ON GINGIVITIS.**
- **BOTH ACT EFFECTIVELY AS ANTIPLAQUE AGENTS ON HALITOSIS AND ON GINGIVITIS.**
- **DIFFERENT STUDIES HAVE SHOWN THAT CPC IN DIFFERENT CONCENTRATIONS IS EFFECTIVE IN REDUCING SUPRA- AND SUBGINGIVAL DENTAL BACTERIAL PLAQUE.**
- **Dentaid has developed a line of products that contain CPC among its active ingredients, products that are meant for care and treatment of pathologies like periodontitis, gingivitis, halitosis or maintenance in patients that have been treated for periodontitis.**
- **Exclusive Distributor: Pharmapal Drug Store**

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