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Allgäuer Latschen Kiefer®

LACALUT

Expert opinion

on the mode of action

of *Lacalut white* toothpaste

for:
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Tooth decay and diseases of the gingiva belong to the most frequent diseases in man. While tooth decay or caries is found predominantly in younger individuals, inflammatory diseases of the gingiva rather prevail in an advanced age.

The reasons for this development are clear:
Even clean teeth develop a thin film, the so-called enamel surface cuticle.
In lacking or deficient oral hygiene micro-organisms and dead cells will gradually accumulate on this film and will be connected by the sticky proteins present in the saliva. This layer is called dental plaque. During the first days of its development this mass is soft and can easily be removed. But it will gradually solidify and develop into tartar or calculus, which is very difficult to remove.

This is the beginning of a process that ends with the destruction of teeth and gingiva.

Dental enamel – why does it need to be protected?

Dental enamel consists of the extremely hard substance hydroxyapatite which is the hardest tissue in the human body. Hydroxyapatite covers the crown of the tooth like a protective layer. Hydroxyapatite consists of positively charged calcium ions, neutral calciumphosphate molecules and negatively charged hydroxide ions.

Hydroxyapatite is also present in the human saliva – but broken down into its individual components: calcium, phosphate and hydroxide ions. Saliva could therefore be called "liquid dental enamel".

In a healthy set of teeth, hydroxyapatite will constantly "dissolve" from the dental enamel. This is a natural process. However, the dental enamel will not decompose completely, because in a constant process of degradation and building-up the same amount of hydroxyapatite is reincorporated into the dental enamel from the saliva. Thus in a healthy tooth there is always a balance between demineralisation and remineralisation.

The oral bacterial flora is thriving on any type of sugar. Among those bacteria the main enemy of our teeth is Streptococcus mutans.

The digestion product of those bacteria is lactic acid, which creates an acid environment in the place where it develops. This disturbs the physiological balance in the mouth.

Nature, however, has provided a solution for this problem: Whenever acid is produced, there is a strong tendency to neutralise it.

- Certain minerals, mainly calcium and phosphorous, are leached out from the dental enamel. This process is called demineralisation. It leads to small gaps in the dental enamel.

- Now the saliva with its mineral components gets into action. The calcium phosphates, that are, among others, present in the saliva, are taken up by the dental enamel –

comparable to the action of a sponge – and are integrated into the protective layer. The dental enamel becomes dense and solid again.

This is the already mentioned balance between demineralisation and remineralisation which prevails in healthy teeth.

However, if too much acid is produced or if the acid level cannot be reduced, e.g. as a consequence of sweet snacks, the process of demineralisation will be predominant. The dental enamel does not get sufficient calcium phosphate from the saliva and the gaps will get bigger and bigger and tooth decay rapidly progresses.

This demineralisation process can be prevented with components that support remineralisation, e.g. calcium, phosphate and fluoride.

Particularly **fluoride** can contribute in several ways to the protection of the dental enamel.

Fluoride - Mode of action

Firstly:
Fluorides support remineralisation, i.e. they help to incorporate calciumphosphate more rapidly into the dental enamel. The bacteria have less time to make use of the weak spots in the dental enamel. This reduces the risk to develop tooth decay.

Secondly:
The fluorides are also incorporated into the dental enamel – just like the calciumphosphates. As soon as a higher acid level triggers the process of demineralisation, the fluorides are already there to accelerate remineralisation.

Thirdly:
Fluorides, that get on the teeth with the toothpaste, form a kind of protective film around the teeth, a covering layer consisting of calcium fluoride. As soon as acid is produced, it is neutralised with components from this covering layer, and the minerals from the dental enamel stay in place, the enamel layer remains hard. Moreover, hydroxyfluoroapatite is much more resistant to acid than the actual hydroxyapatite.

Fourthly:
Fluorides are also ingested by the bacteria and disturb their metabolism. This again inhibits the production of acids which is so dangerous for our teeth.

Thus fluoride has many ways to interfere with the process of tooth decay, and can help keep our teeth healthy and strengthen the natural mechanism of protection.

Strengthening the dental enamel with the help of fluoride is very important. But at the same time it is crucial to prevent dental plaque and to fight developing and existing tartar.

What is tartar?

Unfortunately, the components of dental enamel that are present in the saliva are also incorporated into the dental plaque where they accumulate with other substances.

If the accumulations are not removed regularly, they gradually harden, calcify and develop a slightly porous surface. This layer is called tartar or calculus. Tartar mainly consists of hydroxyapatite, but also of organic components. Tartar is an ideal environment for all types of bacteria which flourish on its rough, porous surface. Moreover, tooth discolorations will develop much faster on tartar than on a normal dental enamel..

Because of the discolorations, tartar is a cosmetic problem. It is also a health problem because of its rough surface and porosity which offers an excellent environment for metabolically active plaque bacteria.

Tartar is always preceded by dental plaque. So if plaque is not regularly removed by thorough tooth brushing, the inorganic plaque components will crystallise and calcify. Thus all compounds that disturb the crystallisation of tartar, are suitable toothpaste components that help prevent tartar.

For this purpose there are several phosphate compounds available with exactly those properties.

Phosphates – mode of action

Although the phosphates act as inhibitors of tartar (crystallisation inhibitors), they cannot completely prevent the formation of tartar.
Phosphates in toothpastes take care that stains of coffee, tea, or red wine are gradually dissolved and/or reduced. The following paragraph describes how phosphates act and how they can remove or reduce unpleasant discolorations.

The following modern and common active ingredients are used today to counteract or inhibit the formation of tartar:

- Pentasodiumtriphosphate
- Tetrapotassium-pyrophosphate

Pentasodiumtriphosphate: The American Food and Drug Agency (FDA) has authorised this substance for use in foods and has declared it as safe. This active ingredient removes the plaque from the teeth.

Pentasodiumtriphosphate forms water soluble complexes with polyvalent metal ions, a process which is particularly marked in calcium ions. The precipitation of hardly soluble calcium salts is prevented, already existing precipitations will redissolve.

According to studies of M. Miyake et al. performed with rats, it could be shown that sodiumtriphosphate can distinctly inhibit the formation of tartar. (Nippon Shishubdyo Gakkai Kaishi **30**, 860, 1988, jap.)

The substance has a marked dispersing effect against inorganic pigments and fillers.

Tetrapotassium-pyrophosphate forms complexes with alkaline earth and heavy metal ions. It has an excellent dispersing effect against inorganic fillers and pigments. Its use is recommended where a comparable high phosphate concentration in liquid and pasty products is needed and crystallisation must be avoided.

It is known that soluble alkaline polyphosphates inhibit the crystallisation of hydroxyapatite. It could be shown in long-term studies that the use of toothpastes containing alkaline pyrophosphate may reduce the re-formation of tartar by up to 50 %.

Purpose of toothpastes / Mode of action of *Lacalut white*

Apart from ensuring an impeccable oral hygiene, it is important to protect, maintain and strengthen the dental enamel with suitable means. This is, in addition to a good cleaning capacity, the main purpose of a toothpaste.

The main active ingredients in toothpastes which shall prevent the development of tartar and tooth decay, are the following:

- Fluoride compounds
- Phosphate compounds, e.g. sodium and potassium-pyrophosphate, sodium and potassium-polyphosphate
- Cleansing particles / tensides.

These active ingredients are contained in ***Lacalut white.***

The fluoride ions in the form of sodium fluoride, supplied with the toothpaste, may act in the above described way and can thus support remineralisation.
In Germany a maximum content of 0.15 % of active fluoride ions, expressed as fluoride, are admitted in the finished product. Higher fluoride concentrations are neither allowed nor necessary, since the admitted concentration may reach a sufficient reduction of tooth decay.

The **phosphates** pentasodiumtriphosphate and tetrapotassium-pyrophosphate act in the above described way and are contained in ***Lacalut white*** in a quality meeting the requirements to food additives.

The abrasive **cleansing particles** are there to support the mechanical cleaning of the toothbrush. The tooth surface should be cleaned in such a way to remove the soft dental plaque and the hard tartar, without attacking the dental enamel.

The cleaning effect of the abrasive cleansing particles is attributable to a removal of yet uncalcified dental plaque and a certain polishing effect on the dental surface together with the desired abrasive effect. With the use of suitable cleansing products the development of soft dental plaque into tartar can be prevented right at the beginning.

The most modern cleansing particles with different grades of abrasive effect are silicium compounds which are also used in ***Lacalut white.***
The measured RDA-value is approximately 120.

Silicium compounds are compatible with the active ingredients and have excellent cleansing and polishing properties.

The importance of the tensides in toothpastes with regard to the cleansing effect should not be underestimated. They are used as foaming agents that facilitate the entry of the active ingredients into the smallest fissures and gaps during tooth brushing. They are meant to facilitate the wetting and loosening of the foreign substances present in those fissures and gaps and enhance the subsequent rinsing out of those foreign substances and the polishing agents. They are also meant to prevent that the once removed dental plaque can resettle on the tooth surface. Moreover, they also support the anti-caries effect of the fluoride.

Conclusion:

Among the afore mentioned explanations the following statements can be confirmed:

- ***Lacalut white*** contains a combination of fluorides, phosphates and cleansing particles. The specific properties of those active ingredients ensure whiter teeth, provided they are used regularly.

- Discolorations of teeth that are due to smoking or the consumption of coffee, tea, red wine, and several, specific foods, can be prevented or reduced by the regular use of ***Lacalut white.***

- ***Lacalut white*** contains sodium fluoride, which protects against tooth decay, hardens the surface of teeth and supports and enhances remineralisation of the dental enamel.

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