

## Article

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### Teeth Whitening Improves Dental Health (Benefits of Blue Light Technology)

Everyone understands the benefits of a healthy, white smile. It brings confidence, charisma and people view you as healthier and more vital. Professional teeth whitening can actually improve your dental health.

As quoted in *Science Daily June 24, 2008*, the blue light and hydrogen peroxide used by professional teeth whitening systems are capable of reaching and treating bacteria in deep layers of biofilms that can cause cavities and gingivitis. Researchers at University of California San Francisco and Hebrew University exposed streptococcus mutans to the blue LED teeth whitening lights with hydrogen peroxide and determined this successfully penetrated and killed all layers of the biofilm creating an antibacterial effect.

Scientists at the Forsyth Institute have found that blue light can be used to selectively suppress certain bacteria commonly associated with destructive gum disease.

The research, published in the April Journal of Antimicrobial Agents and Chemotherapy, suggests that light in the blue region of the visible spectrum might be useful in preventing, controlling or treating periodontitis -- an oral infection that can lead to loss of bone and teeth.

"Some of the key bacterial pathogens associated with periodontitis produce and accumulate compounds that are sensitive to light," said Nikos Soukos, DDS PhD, Director of the Forsyth Laboratory of Applied Molecular Photo medicine and the principal investigator. "We found that, when exposed to particular wavelengths of light, a percentage of those pathogens were eradicated within seconds."

Another important finding was that when the proportion of such pathogens was reduced, the proportion of other, potentially helpful, bacteria increased. "This suggests that it might one day be feasible to use light to restore a healthy bacterial balance in the mouth," Soukos said.

The current research stemmed from an observation by Max Goodson DDS, PhD, Director of Clinical Research at Forsyth, that the blue light used in a tooth whitening procedure appeared to decrease inflammation of the gums.

The team is currently developing a hand-held, light-based device that might, one day, be used by consumers to help combat periodontal disease.

If proved effective in clinical trials Goodson said, "Technology employing blue light to improve oral ecology could be the most important advance in maintaining periodontal health since the invention of the toothbrush."

## **Background**

Previous Forsyth research had shown that as many as 700 different types of oral bacteria may be found in dental plaque that accumulates on teeth. While some bacteria appear to be benign or even helpful, others may invade and destroy gum tissue and bone -- leading to loss of teeth, and possibly to infection elsewhere in the body.

Among the more destructive bacteria are the so-called "black-pigmented bacteria" (BPB) which have been implicated as pathogens associated with periodontitis. Such bacteria accumulate black pigment consisting mainly of organic compounds called porphyrins. Some porphyrins are photosensitive, and, when activated by visible light, induce a photodynamic reaction that kills the microorganism within seconds.

The team employed a halogen lamp source commonly used for tooth whitening to shine broadband light comprised mainly of blue and a small percentage of green light (wavelengths ranged from 380 to 520 nanometers) on pure cultures of BPB and on dental plaque samples obtained from individuals with chronic periodontitis.

They found that the light rapidly killed BPB in pure cultures and that it selectively eliminated BPB in plaque samples containing 500-600 different bacteria. They also found that certain species were more readily inactivated by the light than others and that varying the intensity and exposure time had different impacts on different species.

The researchers conclude that intraoral light exposure can selectively reduce pathogens in dental plaque.

If proved effective in clinical studies, the findings could lead to new methods for preventing or controlling periodontal disease. Such methods would be rapid, non-invasive, and nontoxic, Soukos said.