“Studies funded by bleaching light and laser companies show lights and lasers work. Other studies show they cause pain with no benefit. Which is true?”

THE MYTH OF BLEACHING LIGHTS AND LASERS

By Rod Kurthy D.M.D.
INTRODUCTION

There has been great controversy regarding the effectiveness and advisability of bleaching lights and lasers for well over a decade.\textsuperscript{1,4} Manufacturers of these lights and lasers continue to claim they add great benefit to the whitening process, but the science, published clinical studies and general consensus of dentists disagrees.\textsuperscript{1,4-24}

Many dentists have a love/hate relationship with bleaching lights and lasers. They love the fact that various marketing, articles and media programs create excitement in the consumer public about whitening teeth with “magic” lights and lasers, driving new patients to their practices. But they hate the typical results and rapid rebound they see.\textsuperscript{1,4-24} They’ve read or at least heard about the studies that show bleaching lights and lasers are of no clinical benefit.\textsuperscript{1,4-24} Yet many dentists continue using these lights and lasers simply because they believe their patients, and especially potential new patients, demand it.

Dentists have also found that use of a bleaching light or laser greatly increases the discomfort patients feel during and after whitening.\textsuperscript{4,15,22,25,26} They have been told this discomfort is due to heat and/or dehydration caused by these bleaching lights and lasers\textsuperscript{21} (which, by the way, is not true).\textsuperscript{27-29}

The vast majority of dentists are extremely caring and ethical professionals. Understanding that bleaching lights and lasers are of no genuine benefit, yet cause patients needless additional discomfort, creates great frustration and even anger in many dentists.

At the end of this paper you will learn how to effectively respond (and how not to respond) to patients asking for whitening systems that utilize bleaching lights and lasers.

HOW DID WE GET HERE?

Teeth whitening of today has not been based in science. It was simply stumbled upon. It seems a group of dentists were discussing the treatment of inflamed gingival tissues, such as the inflammation seen in teenagers after the completion of orthodontic treatment. It was discussed that over-the-counter products like Gly-oxide\textsuperscript{®} are intended to reduce gingival inflammation. Some members of the group suggested that making custom trays to fit over the teeth and gingival tissues – and filling these trays with a product such as Gly-oxide – may help resolve gingival inflammation.

So this group of dentists decided to try this approach in their individual offices. They were shocked to see that the teeth appeared to get lighter in color. One ingredient of Gly-oxide is 10\% carbamide peroxide.

The eventual result was the manufacture of carbamide peroxide products specifically to be worn in custom trays for the explicit purpose of whitening teeth. Thus “vital tray bleaching” was born. It really had nothing to do with scientific research, or even remotely understanding the science behind whitening.

Of course the nature of human beings is that we want results quickly. So companies tried stronger peroxide-based formulations, but of course found they burned the gingiva. Rubber dam was then used to protect the soft tissues; however, the whitening results were disappointing.

Thinking back even to high school chemistry, we remember that chemical reactions proceed faster if we add energy – usually by placing the mixed reactants over a Bunsen burner to add heat energy.

So in the 1970’s heating lamps were tested to add heat energy to the breakdown reaction of hydrogen peroxide.

The radiant heat produced by heating lamps was so effective that it caused overheating of dental pulps, sometimes even necessitating endodontic therapy.

The next idea for adding energy was in the form of photon energy from lights and lasers.
If you’ve been practicing for twenty years or more, you may remember the plethora of bleaching lights and lasers that have been marketed for “power bleaching.” Some of these manufacturers even claimed to include ingredients in the peroxide gel intended to specifically absorb the particular wavelength produced by the light or laser.

This entire approach to the progression of whitening development was nothing more than “throwing ideas against the wall to see what would stick.” It certainly had no basis in genuine scientific understanding.

Of course dentists found the results of in-office whitening with lights and lasers was still extremely unpredictable and of very short duration. This was of particular concern to practicing dentists because of the high number of complaints received from patients, such as:

1) The whitening didn’t work, or

2) Any initial whitening relapsed almost totally within a very short time.

In an effort to reduce patient complaints, many dentists took it upon themselves to send their patients home with whitening trays and at-home whitening gel after the in-office whitening, because they understood that at-home tray whitening was at least somewhat effective.

This un-scientific protocol (with or without bleaching lights or lasers) has now become the standard whitening approach utilized by nearly all whitening systems. But as you can see, the above was not at all based on an understanding of science. It was simply a series of educated trial and error.

Knowledge of the chemistry, physics, physiology and microanatomy related to teeth whitening reveals that the above typical approach to whitening makes very little sense.

LET’S TALK SCIENCE

The use of photon energy from lights and lasers may have had at least some success if the breakdown of hydrogen peroxide were an endothermic reaction. But it’s not.

Think back to chemistry class. Remember that there are two very different general types of chemical reactions. Endothermic reactions and exothermic reactions.

Endothermic reactions require energy as a reactant. You add the chemical reactants and energy (usually in the form of heat), and this causes the reaction to proceed, resulting in your chemical products.

However, exothermic reactions require the release of energy (often in the form of heat) for the reaction to proceed. You add the chemical reactants together, the reaction proceeds and energy (usually heat) is released as the reaction proceeds.

The best example of an exothermic reaction in dentistry is the mixing of lab stone powder with water. As the stone sets, the exothermic reaction gives off energy (heat), and the stone models get hot.

It seems to have been overlooked that the breakdown of hydrogen peroxide is an exothermic reaction. You may have even heard that high concentration hydrogen peroxide is utilized in the propellant systems of various rockets because of its exothermic nature.

According to Le Chatelier’s Principle of Chemical Equilibrium, trying to force energy back into an exothermic reaction that must release energy may even impede the reaction. So where is the science behind the use of bleaching lights and lasers? There is none.

Of course the concentration of hydrogen peroxide used on teeth is so low compared to industrial uses of hydrogen peroxide, that any heat generated during the breakdown of hydrogen peroxide on teeth is negligible.

It is true that even exothermic reactions, such as the breakdown of hydrogen peroxide, typically do require some sort of initiator to trigger the start of the breakdown. This initiation may be accomplished with a chemical catalyst or energy such as heat or photon energy.
Though heat or photon energy may repeatedly initiate the reaction during storage and shipping, resulting in degradation of peroxide gels over time, heat or photon energy is incapable of continuous acceleration of the reaction during in-office whitening.12,13,25,30-31 Remember that after the initiation event, exothermic reactions must be allowed to give off energy during the reaction. And trying to force energy back into the reaction can disrupt the reaction.

Only chemical activation is capable of rapidly accelerating the breakdown of peroxide throughout in-office whitening. Even whitening systems using bleaching lights or lasers utilize chemical activators (dual barrel systems) to accelerate the breakdown of peroxide. One would assume if whitening lights and lasers were genuinely effective, the addition of chemical accelerators would be unnecessary. It is the chemical activators that catalyze and accelerate the continuous breakdown of peroxide, and not the lights or lasers.12,13,25,30-31

The increased discomfort often seen by dentists when using bleaching lights and lasers4,7,15,21,22,25-29 has routinely been attributed to heat generated by bleaching lights and lasers, and/or dehydration of teeth caused by these lights and lasers.21

In a 2005 clinical study by Rod Kurthy, D.M.D., subjects were treated with:
1) Various bleaching lights and lasers with no whitening gel applied to the teeth
2) Whitening gel applied to the teeth without the use of bleaching lights or lasers
3) The same whitening gels combined with use of these bleaching lights and lasers

What Dr. Kurthy found was zero sensitivity caused by bleaching lights or lasers alone. This finding refutes the cause of sensitivity due simply to the heat and/or dehydration caused by bleaching lights and lasers. He also found that use of only the whitening gel resulted in moderate to no sensitivity. However, the combination of bleaching lights or lasers and whitening gel resulted in several cases of severe sensitivity, as well as notably more cases of moderate sensitivity.

This study concluded that the increased sensitivity found when using bleaching lights or lasers in combination with in-office whitening gel was not due to the heat and/or dehydration caused by bleaching lights and lasers.

These same findings were later confirmed in a clinical study published in the Journal of Esthetic and Restorative Dentistry in 2009.7

In a clinical study published in JOE (Journal of Endodontics) in 2008, the actual cause of this increased sensitivity was revealed.27 It was found that the combination of high concentration hydrogen peroxide with photon energy from bleaching lights and lasers causes pulpal neurons to produce significantly higher levels of Substance P.27 Substance P is a neuropeptide – a neurotransmitter released by pain-transmitting neurons to communicate with each other. The sole function of Substance P is to cause pain and inflammation.27

Realize that the vast majority of research and development in healthcare is done in the private sector. University-based studies typically test products and systems developed by the private sector. Also, consider that there are often financial concerns and pressures involved – such as universities actively seeking research grants from private companies.
Numerous studies, as well as an understanding of the chemistry and physics of hydrogen peroxide, have proven the ineffectiveness of lights and lasers. The chemical breakdown of hydrogen peroxide is best directed and accelerated via the use of an appropriate pH, plus addition of true chemical catalysts when rapid reaction time is critical, such as during in-office whitening.

With the ability to predictably accelerate whitening gels via chemical activator formulations, there is no need to subject patients to the use of potentially harmful bleaching lights or lasers.

KöR Whitening utilizes this philosophy and approach to the chemical formulations of their in-office Dual Activated, Tri-Barrel® Hydremide® Peroxide formulations. Separating the whitening chemistry into three separate chambers (Tri-Barrel) instead of only two (dual-barrel) has enabled Dr. Kurthy to expand the chemical formulation; resulting in significantly more control over the whitening process.

Instead of educated trial and error, KöR Whitening has taken the approach of truly understanding the chemistry, physics, physiology and microanatomy of whitening, before developing and testing specific designs, products, formulations and whitening protocols.

Dr. Rod Kurthy, Founder, Chief Whitening Science Researcher, and developer of KöR Whitening; has utilized his scientific understanding from 39 years of teeth whitening research to develop a whitening system that works in cooperation with what science dictates to achieve genuinely white teeth.

This has been accomplished through the meticulous and science-based creation of new whitening protocols in combination with formulations having very specific chemical and physical properties to facilitate the breakdown reaction of hydrogen peroxide as well as enhancing the penetration of bleaching factors into tooth structure by chemical manipulation of surface tension, instead of utilizing bleaching lights and lasers.

Dental practices using the KöR Whitening System have routinely found the following reply to patients requesting whitening systems involving use of bleaching lights and lasers to be extremely effective.

An example of how NOT to reply to patients/callers asking for bleaching lights or lasers:

**Patient/caller:** Do you do XYZ Whitening with the XYZ bleaching light or laser?

**Dental office:** No. We no longer use bleaching lights/lasers. We have found that lights and lasers do not increase whitening results. In fact, they often cause discomfort. We have a far more effective whitening system that gets teeth much whiter, it is very long-lasting when you follow a simple...
at-home maintenance, and you don’t even have to give up your favorite coffee, tea or red wine. When would you like to schedule an appointment?

**Patient/caller:** (thinking to themselves) I don’t believe you. You probably just don’t have the bleaching light or laser!

(what they actually say) Okay. Thank you. I’ll give you a call when I’m ready.

An example of an effective way to reply to patients/callers asking for bleaching lights or lasers:

**Patient/caller:** Do you do XYZ Whitening with the XYZ bleaching light or laser?

**Dental office:** Yes! Absolutely! We have done many whitening cases with the bleaching light/laser…although we don’t use it much anymore because we have something much newer at the same cost that gets teeth many times whiter. But yes! We can absolutely use the system with the XYZ bleaching light or laser.

**Patient/caller:** Really? Tell me more about the newer system.

**Dental office:** Well, the newer system gets teeth several times whiter, it is very long-lasting with simple occasional at-home maintenance, and you don’t even have to give up your favorite coffee, tea or red wine. Our patients really love the results. But if you’d prefer the system with the XYZ bleaching light/laser, we’ve done many cases using that system. When would you like to schedule an appointment?
REFERENCES
