

## **AN OVERVIEW OF THE SCIENCE AND TECHNOLOGY BEHIND COSMETIC TEETH**

### **WHITENING** – *Dr Jenny Shen, D.D.S., Tara Eriksen (Research Director of Beyond Dental & Health)*

Following the successful introduction of the BEYOND™ WhiteSpa® system as the original teeth whitening system for independent cosmetic teeth whitening practitioners, cosmetic teeth whitening has become a popular treatment option for Teeth Whitening Aestheticians, spas and salons looking to provide their clients with an instant and convenient beauty treatment. In general Dentists wishing to increase their market share have developed and marketed the new safer technology and whitening gels

Teeth whitening removes years of stains in one, simple treatment and for spas with a focus on anti-aging treatments and clients looking to maintain a youthful appearance, a healthy, white smile is an important cosmetic procedure.



#### **Understanding the Science behind the Treatment**

Although the cosmetic teeth whitening process is fairly straightforward, a thorough knowledge of the science behind the treatment will enable you to provide your clients with a more complete whitening experience and will assist you in developing effective treatment schedules to best suit his or her individual whitening needs.

Tooth colour is influenced by a combination of organic and inorganic stains found on the surface and inside the teeth (intrinsic and extrinsic stains).<sup>1,2</sup> These discolorations can be the result of several factors, including diet (drinking coffee, tea, or red wine), lifestyle choices (smoking), age, or exposure to certain medications (such as tetracycline or fluoride).

Different kinds of stains may require tailored treatment schedules to achieve the best results, with extrinsic stains (those caused by food, drink, and tobacco consumption) being the easiest to remove and intrinsic stains (age-related and resulting from use of certain medications) possibly requiring additional time or follow up treatments.

Tooth whitening is the process of breaking apart chemical bonds in these organic and inorganic stain-causing compounds through the application of a peroxide-based whitening gel to the teeth.<sup>3,4</sup>

**The terminology that whitening “removes” stains is technically incorrect**, albeit, useful in describing the visual effects of the treatment.

Either hydrogen peroxide or carbamide peroxide can be used, although hydrogen peroxide products are typically used for shorter daytime ‘in-chair’ treatments and carbamide peroxide is used for longer ‘take-home’ tray delivery overnight periods.

Around the early 1990’s, teeth whitening practitioners began using light sources in combination with peroxide-based whitening agents **to accelerate the chemical redox\* reactions** of the whitening process.<sup>5</sup>

The combination of a peroxide-based whitening gel and intense light source oxidizes the organic discolorations found on the surface and inside the teeth, rendering those stains neutral in colour and resulting in a brighter appearance.

\* **Redox** (is a blend of two words, **reduction-oxidation**)  
Redox reactions describe all chemical reactions in which atoms have their oxidation number (oxidation state) changed.

The term comes from the two concepts of **reduction** and **oxidation**. It can be explained in simple terms:

- **Oxidation** is the *loss* of electrons or an *increase* in oxidation state by a molecule, atom, or ion.
- **Reduction** is the *gain* of electrons or a *decrease* in oxidation state by a molecule, atom, or ion.



A typical Halogen Cold Blue light-accelerator. 0% UV

### The Technology behind Light-Acceleration

The combination of light-acceleration technology with peroxide-based teeth whitening treatments has brought this cosmetic procedure to a new level and the entire whitening process can now be performed in a single visit (as compared to being spread out over several weeks with non-light-accelerated treatments)

Typically using the same strength whitening gel, 1-hour light activation = 14-hours without light acceleration.

## LIGHT ACCELERATOR TYPES

Available light-acceleration technologies for cosmetic teeth whitening include



A Typical Light Emitting Diode (LED) Cold Blue light-accelerator.

- Halogen,
- Light-Emitting Diode (LED),
- Ultraviolet (UV),
- And Plasma Arc.

### A NOTE ABOUT 'LASER'

A common misconception is that light-accelerated whitening uses a laser to accelerate the whitening process.

A **laser** is a device that emits light (electromagnetic radiation) through a process of optical amplification based on the stimulated emission of photons.

**In fact, lasers are an older technology that was used before current technologies were developed.**

The term 'Laser' is sometimes used these days as a *marketing term*, however, **it is technically incorrect** (*unless the device that emits light uses optical amplification*). The term "laser" originated as an acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation

**LIGHT ACCELERATOR EFFICANCY** (*Efficacy* is the capacity to produce an effect)

It is important to note that the efficacy of light-acceleration technology does depend heavily on the strength and quality of the light used.

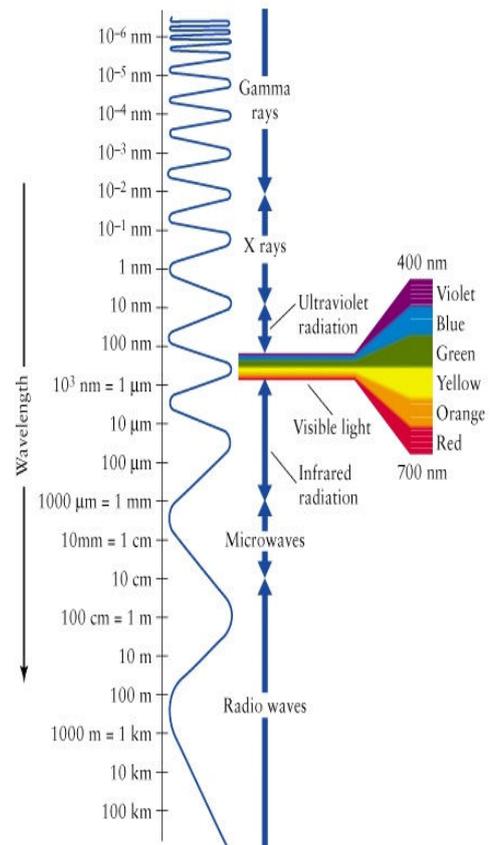
Most in-chair cosmetic teeth whitening systems use Halogen or Light Emitting Diodes (LED) lights or a combination of both these light sources

Because LED lights are cheaper to manufacture the market has become flooded with all sorts of Light Emitting Diodes (LED) lights.

Unfortunately, there is a huge variance in power, quality of light and effectiveness. Some are no more effective than shining a LED torch into the client’s mouth.

It is therefore important when assessing ANY LIGHT ACCELERATOR to study TWO things:

1. The **STRENGTH** of the Light output in terms of **LUMINANCE**, or LUX – The **Lux** (symbol: **lx**) is the international system of measuring units of illuminance and luminous emittance measuring luminous power per area
  
2. The **WAVELENGTH** of the light Emitted. Wavelength is usually measured as **nanometers** wavelength and 480-520 nanometers is considered best for optimum results



## UV LIGHT

In addition to the strength and wavelength of the light, it is also important to use a whitening system that minimizes client exposure to heat and UV light.

However, given the medical risks associated with excess exposure to UV light, the use of these systems is not recommended.

Aside from the obvious skin cancer risks associated with prolonged exposure to UV light, an increase in mouth temperature can increase the risk of a client experiencing sensitivity during or after the treatment because of nerve irritation in the teeth.

Therefore, light from a modern reputable Halogen Whitening Accelerator is usually filtered through over 12,000 optical fibres and 30 layers of coated optical glass before accelerating the whitening process.

Halogen and recently some newer LED systems deliver the most intense, tailored beam of blue light of any cosmetic system on the market without the risk of UV exposure and the hypersensitivity associated with other whitening systems.



Portable Light Emitting Diode (LED)  
 Cold Blue light-accelerators are  
 now globally available



Some of the new more powerful Cold Blue light-accelerators use a combination of both LED & Halogen & produce 0% UV light with Light Strengths as high as 250,000 Lux at a Wavelength of 480-520 nanometers

**Source:**

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- 8 BEYOND™ WhiteSpa® Select. BEYOND™ Dental & Health Inc.