Photomodulation

The application of therapeutic light in the near infrared wavelength (800 - 1000nm) has been shown to produce beneficial biological effects in stressed and ischemic tissue. (3000+ published research articles) Mitochondrial enzymes can absorb these photons and increase the production of ATP (energy) allowing tissue to metabolize normally.

Three Clearly Defined Mechanisms of Action of Photobiomodulation

1. Mitochondrial chromophores (inc. Cytochrome C Oxidase) absorb photons, proton pumping and ATP production. 
   Increased energy available to the cell -> increased / normalized metabolism

2. Reactive Oxygen Species (ROS) production and mitochondrial signaling 
   Stimulates/suppresses transcription factors, DNA/RNA synthesis -> plethora of tissue/cellular activity

3. Inducible Nitric Oxide (NO) production through absorption of photons by Nitric Oxide Synthase 
   Increased micro and regional blood flow and osteoclastic activity

Light Accelerated Orthodontics™

OrthoPulse™ photobiomodulation enhances and accelerates bone and soft tissue remodeling leading to faster tooth movement and decreased orthodontic treatment time.

Biolux sponsors and supports research at these leading research institutions:

- Forsyth Institute, USA
- University of Alabama at Birmingham, USA
- University of Southern California, USA
- Kyung Hee University, Korea
- European University College, UAE
- University of Sydney, Australia
- Tufts University, USA

Since 2003, Biolux has sponsored over 15 university- and clinician-based in vitro, in vivo studies and clinical trials.

350+ patients treated in clinical trials worldwide.

Human Clinical Research

Fixed Appliances

- No clinically significant root resorption¹
- 46% increase in rate of space closure in adults; 28% increase in rate of space closure in adolescents compared to control²
- 54% reduction in time to achieve anterior alignment³
- 2.3x faster mean alignment rate⁴
- No significant changes in root resorption greater than .32mm⁵

² Samara et al. Velocity of en-masse space closure with and without Photobiomodulation: a prospective RCT. In review.
⁴ Kau et al. Photobiomodulation accelerates orthodontic alignment in the early phase of treatment. Prog in Ortho., 14:30. 2013
Aligners

- 66% reduction in the average duration per aligner during OrthoPulse™ treatment as compared to the conventionally recommended aligner wear duration.\(^1\)

- No measurable root resorption over 6 months.\(^2\)

\(^1\) Dickerson, T. *The effect of OrthoPulse™ on the rate of progression through Invisalign® aligners: a pilot study.* To be submitted for publication.

\(^2\) Dickerson, T. *A randomized controlled crossover trial on the effect of OrthoPulse™ on the rate of orthodontic tooth movement during alignment with Invisalign® aligners.* To be submitted for publication.

Cellular (in vitro) Research

- Modulated gene expression in human MSF cells.\(^1\)

- Increased proliferation of gingival fibroblasts and endothelial cells.\(^2\)

- Stimulated proliferation and mineralization of human osteoblasts.\(^3\)

- Inflamed PDL cell response modulated.\(^4\)


\(^4\) Konerman et al. *Impact of LED photobiomodulation on the gene expression profile of PDL cells under simulated inflammation.* To be submitted for publication.

Animal (in vivo) Research

- 46% acceleration of tooth movement in 620nm treated animals & 80% less root resorption.\(^1\)

- Significantly more mature bone in expanded sutures.\(^2\)

- Significantly lower failure rate of immediately loaded TADs.\(^3\)

- 2.8 – 3.7x faster rate of tooth movement.\(^4\)


\(^4\) Chiari S et al. *Photobiomodulation-induced tooth movement using extra-oral transcutaneous phototherapy on the rat periodontium.* To be submitted for publication.