LIGHT ACCELERATED ORTHODONTICS
CLINICAL AND SCIENTIFIC SUMMARY

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 resorption[1]
- 46% increase in rate of space closure in adults; 28% increase in rate of space closure in adolescents compared to control[2]
- 54% reduction in time to achieve anterior alignment[3]
- 2.3x faster mean alignment rate[4]
- No significant changes in root resorption greated than .32mm[5]

[1] Nimeri et al, **The effect of photobiomodulation on root resorption during orthodontic treatment.** *Clin Cosmet Investig Dent* 6:1-8.

[2] Samara et al. **Velocity of en-masse space closure with and without Photobiomodulation: a prospective RCT.** *In review.*

[3] Shaughnessy et al. **Intra-oral Photobiomodulation induced orthodontic tooth alignment: pilot feasibility study.** *Forthcoming 2015.*

[4] Kau et al. **Photobiomodulation accelerates orthodontic alignment in the early phase of treatment.** *Prog in Ortho., 14:30. 2013*

[5] Shaughnessy et al. **Intraoral photobiomodulation and orthodontic treatment-induced root resorption: A preliminary study.** *In review.*

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 submited 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 submited 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]

[1] Yen et al. **Visible red and infrared light stimulates differential gene expression in human MSF cells. Orthod Craniofac Res.** 2015 Apr;18 Suppl 1:50-61

[2] Iscan et al. **Photobiostimulation of gingival fibroblast and vascular endothelial cell proliferation.** *Presented in Annual Meeting of Turkish Society of Orthodontics, October 26-30, 2014 Ankara, Turkey.*

[3] Le et al. **Human osteoblast response to LED photobiomodulation.** *Presented at IADR 2015 General Session. Boston, MA. March 14, 2015.*

[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]

[1] Ekizer A et al. **Effect of LED-mediated photobiomodulation therapy on orthodontic tooth movement and root resorption in rats.** *Laser Med Sci.*, 2012 Aug 29.

[2] Ekizer A et al. **Light-emitting diode photobiomodulation: effect on bone formation in orthopedically expanded suture in rats-early bone changes.** *Laser Med Sci.*, 2012 Nov 9.

[3] Uysal T et al. **Resonance frequency analysis of orthodontic miniscrews subjected to light-emitting diode photobiomodulation therapy.** *Eur J Orthod.*, 2012 Feb; 34(1):44-51.

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

OrthoPulse™ has received 510(k) marketing clearance from the US Food & Drug Administration and is available for purchase in the European Union, Canada, Switzerland, Australia, New Zealand as well as the United States.

Biolux Research is a world leader in the development of innovative Light Accelerated Orthodontics™ technology and products for use in orthodontics, implantology, and other dentistry markets. Biolux focuses on product development and clinical research, and its proprietary, patent-pending technologies have been developed to enhance clinical outcomes and dramatically reduce treatment timelines in orthodontics and dentistry in a safe, effective and non-invasive approach.

BIOLUX RESEARCH

To view the comprehensive OrthoPulse™ Clinical and Scientific Dossier visit orthopulse.com