OrthoPulse® is a Class II medical device and has received FDA clearance, CE Mark, and regulatory approval in over 40 countries. The OrthoPulse® device is intended to accelerate orthodontic movement of teeth and reduce the overall treatment time for patients. The device is designed to be used in conjunction with traditional orthodontic treatment, with brackets and wires or aligners.

The Science of Photobiomodulation
The application of therapeutic light in the near infrared wavelength (800-1000 nm) has been shown to produce beneficial biological effects in stressed and ischemic tissue (3000+ published peer-reviewed articles). Mitochondrial enzymes absorb these photons and increase the production of Adenosine Triphosphate (ATP, “energy”), allowing enhanced tissue metabolism.†

In 1903, Niels Ryberg Finsen won the Nobel Prize in Medicine in recognition of his contribution to the treatment of diseases with concentrated infrared and red light. Otto Warburg then went on to win the Nobel Prize in Medicine in 1931 for discovering Cytochrome c Oxidase (CCO), the terminal enzyme in the mitochondrial oxidative respiration chain. He demonstrated that the mitochondrial CCO was responsive to light stimulation.

Photobiomodulation Mechanisms of Action

1. Increases mitochondrial chromophores (inc. Cytochrome C Oxidase) absorption of photons, proton pumping and ATP production
   - Increased energy available to the cell
     - increased/normalized metabolism

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

3. Induces 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 stimulates the bone surrounding the roots of teeth, leading to faster tooth movement and decreased orthodontic treatment time. Biolux Research continues to sponsor and support research at leading research institutions including:

- Forsyth Institute, *Harvard University affiliate*, USA
- University of Southern California, USA
- Tufts University, USA
- University of Alberta, Canada
- University of Alabama, USA
- Boston University, USA

Clinical Research
Fixed Appliances
• No increase of root resorption compared to standard orthodontic treatment\(^1\)
• 54% reduction in time to achieve anterior alignment\(^2\)
• 26% increase in rate of space closure in adults\(^3\)
• 73% reduction of peak pain compared to sham-controls\(^4\)
• Two-fold faster rate of tooth movement during alignment\(^5\)

Aligners
• 63% reduction in the average time per aligner during OrthoPulse\(^\circledR\) treatment as compared to conventionally recommended aligner wear time\(^6\)
• No measurable root resorption in six months\(^6\)

Case Reports
• The use of OrthoPulse\(^\circledR\) allowed for faster aligner change rates compared to conventional protocol\(^7\)
• Two long-distance OrthoPulse\(^\circledR\) patients, unable to attend frequent and regular appointments, were able to complete treatment more quickly than anticipated\(^8\)
• A patient using OrthoPulse\(^\circledR\) changed aligners every three days throughout treatment and achieved successful results\(^9\)

Cellular Research
• Increased gene expression in human cells\(^10\)
• Increased proliferation of gingival fibroblasts and endothelial cells\(^11\)
• Increased proliferation and mineralization of human osteoblasts\(^12\)

Animal Research
• Up to 3.7-fold faster rate of tooth movement\(^13\)
• 80% less root resorption\(^14\)
• Increased mature bone in expanded sutures\(^15\)
• Lower failure rate of immediately loaded temporary anchorage devices (TADs)\(^16\)
• Increased mandibular growth stimulation\(^17\)

6 Dickerson, T. A randomized controlled crossover trial on the effect of OrthoPulse\(^\circledR\) on the rate of orthodontic tooth movement during alignment with Invisible\(^\circledR\) aligners. *Data on file*.

For abstracts and full articles, visit: orthopulse.com/evidence