High power, diode-pumped Er:YAG laser for dentistry

3m.i.k.r.o.n.™ is your reliable, miniaturized minimally-invasive laser technology for soft and hard tissue treatment in dentistry

Clinical and academic research has demonstrated the usefulness of traditional flash-lamp pumped Er:YAG lasers because of their wavelength of 2.94 µm, which corresponds to the water absorption peak and allows minimally-invasive treatments of water containing human tissue. The unique diode-pumped laser technology 3m.i.k.r.o.n.™ even brings additional benefits compared to these traditional Er:YAG lasers. Its flexibility with variable energy, repetition rate and pulse duration combined with the high beam quality ensures precise and controllable treatments of soft and hard tissue. Optionally heat stacking can be induced by highly repetitive low energy pulses in order to coagulate the tissue (e.g. for hemostasis). The very compact size of 3m.i.k.r.o.n.™ results inter alia from the high efficiency causing low waste heat.

To further refine hard dental tissue drilling performances and in particular enamel ablation speed, three main routes can be identified:

- Higher pulse intensity
- Higher average power
- Better beam profile

Higher dental tissue drilling performance
Better focusing
Higher enamel ablation speed

3m.i.k.r.o.n.™ benefits

- High beam quality (beam diameter < 100 µm)
- Precise treatment
- High intensities
- High repetition rates (up to 2 kHz)
- Very compact size
- Fast and continuous cuts
- Optional coagulation (heat stacking)
- High efficiency (~ 10 %)
- Low waste heat
- Optimized for hard and soft tissue
- Minimally invasive
- Sterilizing effect
- Selective effect
- Reduced down-time period

First experiment: Tooth is kept fixed in position.

Crater with 4.3 mJ pulse energy. Minor ablation can be seen.

Crater with 12.6 mJ pulse energy.

Crater with 39.1 mJ pulse energy. Significant change in dental enamel can be seen even without microscope.

All experiments were conducted with the 3m.i.k.r.o.n.™ Er:YAG DPM-15 laser module.

DPM-15 module

Specifications (Start of Life)

Optical parameters

- Wavelength: 2940 nm
- Average Output Power: up to 15 W
- Pulse Energy: up to 50 mJ
- Pulse Repetition Rate: up to 2 kHz
- Pulse Duration: 1 to 200 µs
- Duty Cycle [max]: 10 %
- Mode of Operation: QCW
- Beam Quality: M² < 20
- Efficiency [optical-optical]: ~ 10 %
- Power Fluctuation [rms]: < 1 %

Second experiment:

Absorption is about twice as high for dentin compared to enamel.

Cut in dentin with 39.1 mJ pulse energy.

Clear cutting line with minor carbonization effect in the laser-induced area.