eraser

DIODE LASER 1318 NM | 150 WATT
MEDICAL LASER FOR SURGERY
1985-1987
Experiments
University Munich

1996-2006
Development 1st. 1318 nm laser
generation (Nd:YAG), clinical
trials, center of excellence

2006
Rolle + Rolle GmbH & Co. KG, Patents, Certification

2009
Clinical trials Urology

2010
150 Watt eraser

2007, 2008
Development eraser 1318 nm
Highpowerdiodelaser 100 Watt

2014
5th generation laser improved UI

HISTORY ROLLE + ROLLE
CHALLENGES FOR ANY SURGICAL INSTRUMENT

- CUTTING
- HEMOSTASIS
- SEALING
WHY LASER?

- TISSUE SPECIFIC
- WAVELENGTH SPECIFIC
- UNIFORM EFFECT
- WARRIANTED PENETRATION DEPTH
- FLEXIBLE FIBERS
- LAPAROSCOPIC APPROACH
QUALITIES OF LASER LIGHT

- COLLIMATION
- COHERENCE
- MONOCHROMASITY

LAMP

LASER

intensity

wavelength
LASER FORMULA

ABSORPTION + SCATTERING + REFLECTION + TRANSMISSION = DENSITY + WATER CONTENT + HEMOGLOBIN + PROTEIN

WAVELENGTH + POWER = POWER DENSITY

INTERACTION TIME

LICHT + GEWEBE = LASER
### TISSUE COMPONENTS

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume %</th>
</tr>
</thead>
<tbody>
<tr>
<td>OXYHAEMOGLOBIN</td>
<td>~ 9</td>
</tr>
<tr>
<td>PROTEINS</td>
<td>6</td>
</tr>
<tr>
<td>WATER</td>
<td>0.2 - 99</td>
</tr>
</tbody>
</table>

### WATERCONTENT

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight %</th>
</tr>
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<tbody>
<tr>
<td>ENAMEL</td>
<td>0.2</td>
</tr>
<tr>
<td>ADAMANTINE</td>
<td></td>
</tr>
<tr>
<td>LIVER</td>
<td>70 – 80</td>
</tr>
<tr>
<td>SPLEEN</td>
<td>76</td>
</tr>
<tr>
<td>PANCREAS</td>
<td>78</td>
</tr>
<tr>
<td>LUNG</td>
<td>78 – 80</td>
</tr>
<tr>
<td>KIDNEY</td>
<td>77 – 80</td>
</tr>
<tr>
<td>VITREOUS BODY</td>
<td>99</td>
</tr>
</tbody>
</table>
THERMAL EFFECTS

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 42°C</td>
<td>NO EFFECT</td>
</tr>
<tr>
<td>42°C - 60°C</td>
<td>CELL DEATH, NO HEMOSTASIS BUT NECROSIS</td>
</tr>
<tr>
<td>60°C - 100°C</td>
<td>COAGULATION, HEMOSTASIS</td>
</tr>
<tr>
<td>100°C - 300°C</td>
<td>VAPORISATION, CUTTING</td>
</tr>
<tr>
<td>&gt; 300°C</td>
<td>CARBONISATION</td>
</tr>
</tbody>
</table>

LASER FIBER

TISSUE

PENETRATION DEPTH
PENETRATION DEPTHS

1064 nm 9xx/8xx nm 1318 nm 1470 nm 2140 nm 1940 nm 10600 nm

10 mm 8 mm 3 mm 1 mm 0,2 mm 0,1 mm <0,1 mm

CUTTING

HEMOSTASIS
Rolle + Rolle GmbH & Co. KG

Whatever it takes!

0.0002
0.001
0.005
0.025
0.125
0.625
3.125
15.625
78.125
390.625
1953.125

ABSORPTION COEFFICIENT CM⁻¹

WAVELENGTH NM

WATER
HAEMOGLOBIN
OXIHAEMOGLOBIN

INFRARED
VISIBLE
UV

980 NM DIODE
1064 NM ND:YAG
1318 NM DIODE
1450 NM DIODE
1940 NM THULIUM
2010 NM HO:YAG
2940 nm Er:YAG
10600 NM CO₂

488, 514 NM ARGON LASER, KTP LASER

FIBER TRANSMISSION

PENETRATION MM
1064 nm vs. 1318 nm

WAVELENGTH SPECIFIC THERMAL EFFECTS!

Lower absorption → deeper penetration → less heat → less coagulation → less hemostasis

Higher absorption → lower penetration → more heat → more coagulation → better hemostasis

Higher absorption → lower penetration → more heat → carbonisation → less hemostasis
Thorax - Metastases

WEDGE RESECTION
LOSS: 173 CM³

PRECISION RESECTION
LOSS: 27 CM³
THORAX - METASTASES

MULTIPLE METASTASES

eraser

PRECISION RESECTION
FURTHER INDICATIONS

I. OPEN THORACIC SURGERY

1. PARENCHYMAL RESECTIONS, ONLY PERFORMABLE WITH THE 1318 NM ERASER SYSTEM

- RESECTION OF MULTIPLE, CENTRALLY LOCATED, BIG FOCUSES (UP TO 8 CM) WITH PRESERVATION OF THE LUNG LOBE

  EXAMPLES:
  - METASTASES FROM DIFFERENT PRIMARY TUMORS (KIDNEY, COLORECTAL CARCINOMA, MALIGNANT MELANOMA, BREAST CANCER)
  - BENIGN FOCUSES (E.G. CHONDROHAMLARTOMA, BIG PHLOGISTIC INFILTRATES) WITH PRESERVATION OF THE LUNG LOBE
  - RESECTION OF BIG PHERIPHERAL TUMORS ABOVE LOPE LIMITS (UP TO 14 CM) FOR AVOIDING A PNEUMECTOMIA (COMPLETE LUNG LOBE) WHEN LUNGFUNCTION IS NOT SUFFICIENT

NOTE: LASER PARCHENGYMAL RESECTION TECHNIQUE IS A SO CALLED „PRECISION RESECTION“. DISTANCE OF RESECTION TO TUMOR TISSUE: 3 TO 5 MM.

2. LASER RESECTIONS AS AN COST-SAVING ALTERNATIVE TO OTHER OPERATION TECHNIQUES

- WEDGE RESECTIONS
- ATYPICAL SEGMENTAL RESECTIONS
- TYPICAL SEGMENTAL AND BISEGMENTAL RESECTIONS
- LOBE STRAP TRANSECTION
- UPPER RESECTIONS IN COMBINATION WITH LOBERESECTIONS
- RESECTIONS OF BULLAE
- BIOPSY OF THE LUNG
- COAGULATION UND SEALING OF PARCHENGYMAL CLEFTS DURING OPEN THORACIC SURGERY, E.G. AFTER DECORTICATION
II. THORACOSCOPIC OR MINIMALINVASIVE OPERATIONS (VATS) WITH BARE FIBER

- PHOTOTHERMAL PLEURECTOMIA
- SHRINKING, COAGULATING AND SEALING OF PERIPHERAL BLEBS AND EDGE EMPHYSEMA
- ABLATION OF SUPERFICIAL FOCUSES AND BULLAE WITH HISTOLOGICAL EXAMINATION
- BIOPSY OF THE LUNG
- COAGULATION AND SEALING OF PARENCHYMAL CLEFTS
- TRANSECTION OF ADHESIONS

III. BRONCHOSCOPY

- ABLATION OF ENDOBRONCHIAL BENIGN AND MALIGN TUMORS, WHICH CLOSE THE AIR PASSAGES
- COAGULATION OF MUCOSA BLEEDING
CLINICAL BENEFITS

R0 RESECTION, DUE TO HIGHER SURVIVAL RATE

p = 0.0001
ECONOMICAL BENEFITS

Kosten Laser vs. Stapler

Annahmen:
- Anschaffungspreis Laser € 49.000
- Verbrauchsmaterial pro Eingriff € 300
- Kapitalkosten 4%
- Metastasen/ Patient 3
- Klammernahtmag./ Metastase 2
- Klammernahtmag. sonst. Resektionen 2
- Klammernahtger. Preis € 90
- Klammernahtmag. Preis € 250
Zeit bis zur Gewinnschwelle in Jahren

Annahmen:
- Anschaffungspreis Laser € 49.000
- Verbrauchsmaterial pro Eingriff € 300
- Kapitalkosten 4%
- Metastasen/ Patient 3
- Klammernahtmag./ Metastase 2
- Klammernahtmag. sonst. Resektionen 2
- Klammernahtger. Preis € 90
- Klammernahtmag. Preis € 250
- Neue Patienten bei Metastasen 0,1
- DRG Metastasen € pro Seite 4.800
- Deckungsbeitrag aus DRG 37,50%

(3 Std. OP je 800 €, 600 € sonst. Kosten)
**KIDNEY TUMOR AFTER LASER RESECTION**

Due to the *eraser* and its special wavelength which causes good hemostasis, time of ischemia was reduced from 20 min. to 9 min.

**OPERATION PROCEDURE - CHRONOLOGICAL**

1. **First step**: laser resection along the parenchyma without ischemia
2. **Second step**: resection along kidney fat tissue during clamping of the artery with normal scissors due to big vessels under the tumor.

**38 mm TUMOR**

- **PARENCHYMAL TISSUE**
- **FAT TISSUE**
- **BLOOD VESSELS**

* ! 9 min. of ischemia ! *
PROSTATE SCENARIOS

SMALL PROSTATE 40-80 ML
- TURP
- GREENLIGHT

BIG PROSTATE >80 ML
- OPEN RESECTION/LAP. RESECTION
- LASER ENUCLEATION (HOLEP, THULEP, ELEP)
PROSTATE

E.L.E.P.
ERASER LASER ENUCLEATION OF PROSTATE

BARE FIBER

RESECTED LOBES TO BE SHRED
eraser

DIODE LASER 1318 NM | 150 WATT | 55 KG
MEDICAL LASER FOR SURGERY

TOUCHSCREEN

RFID CODED Fibers
QUALITY CONTROL

TEC COOLING System
ROBUST, NO MAINTAINANCE, SMALL

230 V POWER INPUT

+ OPTIMIZED WAVELENGTH
+ HIGHLY ENERGY EFFICIENT DIODE SYSTEM
+ SMALL, LOW MAINTENANCE
+ HIGH POWER OUTPUT

Rolle + Rolle GmbH & Co. KG
Whatever it takes!
TECHNICAL FEATURES

- Standby
- kontinuierlich
- intermittierend
- 50W
- 50W
- 40W
- 70W
- 60W
- 2.0s
- 1.0s
- 10.0s
- 10.0s
GREEN LASER DIODE

http://www.vitavonni.de/facharbeit/Prinzip_Lasers.html
LASER BARS
LASER DIODES

WERNER E., WOLF J.
Grundlagen der Faserkopplung von Diodenlasern: Unterschiedliche Konzepte im Überblick
50 LTJ September 2008 Nr. 4, 2008 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
LASER BASICS

PUMP SOURCE

LASER MEAN

LOOP BACK
1.2 GENERATION eraser 120 WATT, ROLLE + ROLLE

REVOLIX – THULIUM:YAG 120 WATT, LISA LASER

SPHINX - HOLMIUM:YAG 80 WATT, LISA LASER
**Limax® 120 with Integrated smoke evacuation**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser type</td>
<td>Diode-pumped Nd:YAG laser</td>
</tr>
<tr>
<td>Laser wavelength</td>
<td>1,320 nm ± 10 nm</td>
</tr>
<tr>
<td>Laser output power</td>
<td>2 – 120 W</td>
</tr>
<tr>
<td>Pulse type</td>
<td>Continuous pulse</td>
</tr>
<tr>
<td>Pilot laser wavelength</td>
<td>635 nm</td>
</tr>
<tr>
<td>Pilot laser power</td>
<td>5 mW, adjustable 2–100%, pulsating</td>
</tr>
<tr>
<td>Beam delivery</td>
<td>Laser fibers, focusing handpiece</td>
</tr>
<tr>
<td>Laser beam quality</td>
<td>Numerical aperture &lt; 0.22</td>
</tr>
<tr>
<td>Light guide connector</td>
<td>SMA plus socket, mechanically coded SMA socket</td>
</tr>
<tr>
<td>Control and monitoring</td>
<td>2 microprocessors</td>
</tr>
<tr>
<td>Operation</td>
<td>Rotary pushbutton and membrane keypad, 8.4&quot; color display</td>
</tr>
<tr>
<td>Cooling</td>
<td>Compressor air cooling</td>
</tr>
<tr>
<td>Mains power supply, version E (U)</td>
<td>230 V ± 10%, 50/60 Hz (110–230 V ± 10%, 50/60 Hz)</td>
</tr>
<tr>
<td>Mains current</td>
<td>Max. 16 A (max. 30 A)</td>
</tr>
<tr>
<td>Mains fuses</td>
<td>2 x T 16 A and 2 x T 6.3 A (2 x T 30 A and 2 x T 16 A) [I = slow-blow]</td>
</tr>
<tr>
<td>Power input</td>
<td>3,300 VA</td>
</tr>
<tr>
<td>Laser class</td>
<td>4</td>
</tr>
<tr>
<td>Protection class</td>
<td>I</td>
</tr>
<tr>
<td>Type of protection</td>
<td>IP X1</td>
</tr>
<tr>
<td>Classification acc. to MPR/MDD</td>
<td>III b</td>
</tr>
<tr>
<td>Pilot laser</td>
<td>3R</td>
</tr>
<tr>
<td>Noise level</td>
<td>Normal/no-load: 51 dBA; full load: 60 dBA</td>
</tr>
<tr>
<td>Smoke evacuator (VAC)</td>
<td>Integrated plug-in unit</td>
</tr>
<tr>
<td>VAC control</td>
<td>CAN bus control via Limax®</td>
</tr>
<tr>
<td>VAC mains power supply</td>
<td>110–230 V ± 10%, 50/60 Hz</td>
</tr>
<tr>
<td>VAC mains current</td>
<td>Max. 16 A</td>
</tr>
<tr>
<td>VAC mains fuses</td>
<td>2 x T 16 A (slow-blow)</td>
</tr>
<tr>
<td>VAC power input</td>
<td>400 W</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>50 x 107 x 59 cm</td>
</tr>
<tr>
<td>Weight (laser with integrated VAC)</td>
<td>120 kg</td>
</tr>
</tbody>
</table>

**COMPETITORS**

- **KLS Martin LIMAX 120**

**Rolle + Rolle GmbH & Co. KG**

Whatever it takes!

**INTENSE MAINTENANCE, LOW ENERGY EFFICIENCY**
GAS COOLED!
TRANSMISSION LOSSES
HYGIENIC PROBLEM?

UNERGONOMIC DUE TO SIZE AND NON
HAPTIC FOCUS

The fully autoclavable focusing handpiece enables precise laser application on a non-contact basis. Ultra-high power densities guarantee optimal results when sealing, cutting or coagulating parenchymal tissue.

In short, the focusing handpiece makes laser application still safer and more convenient.

Perforation risks due to tissue sticking to contact fiber tips (bare fibers) are absolutely eliminated. Moreover, the autoclavability of the entire system guarantees perfect hygiene in the surgical field.

WHERE IS THE FOCUS?
Overview

Built on the GreenLight HPS™ system, the GreenLight XPS™ system increases the power and area of the laser beam by 50%, providing a wider tissue vaporisation effect without sacrificing depth of vaporisation or coagulation. Its 532nm wavelength vaporises prostate tissue without charring and limits penetration, leaving a thin rim of coagulated tissue that aids in haemostasis. It has been found to cost less than TURP while providing similar clinical outcomes. The system can be used for patients on anticoagulants, in urinary retention, or who have large glands >100 ml.
The Question of Cost: Economic benefits of GreenLight™ Laser Therapy

The cost considerations of a procedure like GreenLight therapy go beyond an equipment investment; they include procedure costs, capital costs and most importantly the potentially unexpected costs of post-procedure complications and lengthy hospital stays.

In the case of GreenLight Laser Therapy, the most significant cost consideration should NOT be the device. It should be the fact that with its proven clinical benefits — decreased recovery time, shorter hospital stays and fewer serious adverse events—it may lead to overall lower hospital costs.
Case Study 2

A multi-center, retrospective study conducted in Spain in 2013 that analysed the costs of GreenLight Laser Therapy versus TURP.12

**Key Takeaway:**

While the pre-surgical and surgical costs of the GreenLight procedure were shown to be higher than those related to TURP, its significantly lower post-surgical costs outweighed the initial investment and surgical cost per patient, ultimately resulting in GreenLight therapy being less expensive overall.
Total Cost Savings Scenario
100 Annual Patients with Medicare Average Length of Stay Costs

- **Cost Savings:** $210,095
- **Length of Stay:** $112,792
- **Cost of Procedure:** $90,000
- **Cost of Complications:** $92,904

Only TURP

GreenLight Laser Therapy

0% 25% 50% 75% 100%
Specs

Console: XPS
- Laser type: solid state, frequency doubled
- Wavelength: 532 nm
- Max. power output: 180 W
- Nominal optical hazard distance (NOHD): 33.0 meters (MPE = 1×10⁻³ W/cm²)
- Eye protection: OD ≥ 0
- Working distance: 0.5–5.0 mm
- Vaporisation beam mode: quasi-CW (15 kHz–25 kHz)
- Coagulation beam mode: pulse modulated by 12 Hz, 25% duty cycles
- Compatible fibres: MoXyTM fibres (750 µm core diameter), HFS fibres (900 µm core diameter)
- Optical penetration: 0.8 mm
- Coagulation depth: 1–2 mm
- Coagulation mode: yes, TruCoagTM 5–40 W
- FiberLifeTM: yes
- MoJOTM Software enabled: yes
- Current draw: 20 A
- Cooling water: internal
- Dimensions: 26” W x 36” D x 43.5” H (66 cm x 91.4 cm x 110.5 cm)
- Weight: approximately 420 lb (190 kg)
- Length of power cord: 15 ft (4.6 m)

Fibre: MoXy
- Laser compatibility: XPS
- Firing angle: ~70–80°
- Power range: ≤ 180 W
- Beam area at working distance: 0.44 mm²
- Energy limit: 550 J
- Fibre core diameter: 750 µm
- Fibre tip O.D.: 2.3 mm
- Active Cooling: CapTN: Yes
- Use environment: moist 22–20 FR continuous flow endoscopy/cystoscopy
• **RISK OF DAMAGING FIBER WHEN TOUCHING TISSUE SURFACE**
• **NO MATERIAL FOR PATHOLOGIST**
• **SLOW PROCEDURE – LIMITED BY SIZE OF GLAND**
• **EXTREMELY EXPENSIVE**
RevoLix™ - why 2 micron continuous wave?

The RevoLix wavelength at 2.0 micron is known for its suitability for resection and ablation, safe application in an aqueous medium and it generates excellent haemostasis. These excellent properties are due to the efficient absorption at this wavelength by water which is ubiquitous in any tissue. At the RevoLix wavelength of 2.0 micron the absorption is 2.5 times stronger than at the Holmium wavelength providing even more precise cutting in soft tissue surgery. In soft tissue surgery efficient and even cutting combined with strong haemostasis is required. This is provided by the RevoLix laser in an unmatched manner. The RevoLix laser operates in a continuous wave mode and cuts and vaporises vascular and white tissue without deep penetration or uncontrolled haemostasis. Clean cuts and excellent haemostasis are achieved by moving the beam across the surgical site. Generous laser power capacity allows high vapourisation and resection rates at no bleeding and short theatre time.

This graph shows the absorption of the most important body chromophores (RED for blood, BLUE for water, BROWN for melanin) at different wavelengths. Depth of penetration is shown at the right. Laser wavelengths are vertical lines. KTP: In the absence of hemoglobin the KTP laser at 532 nm experiences close to no absorption. At the KTP wavelength water as the main body constituent is almost transparent. Under laser treatment hemoglobin bleaches due to the temperature increase in tissue caused by the laser. This explains the ever decreasing ablation efficiency during a KTP treatment. Diode: At 980 nm neither water nor hemoglobin is a strong absorber. This explains the deep penetration at this wavelength. RevoLix and Holmium: Both lasers are of similar wavelength which is selectively absorbed by the water molecule. Other than hemoglobin water retains its absorptive properties under the temperature increase in tissue caused by the laser. This explains the everlasting ablation efficiency during RevoLix treatment.

RevoLix - why is it safe?

In an aqueous medium the laser effect to tissue is restricted to less than 2 millimetres in front of the tip of the fibre. Any tissue further off is shielded by the medium. The same mechanism is protecting tissue and organs adjacent to the cut. Any tissue more distant than 2 millimetres is unaffected by the RevoLix laser. Opposed to KTP this property eliminates the risk of unintentional tissue damage during laser surgery.
Lumenis® Pulse™ 100H*

The most acclaimed and clinically proven VersaPulse® PowerSuite™ 100W for BPH and stones just got better

The trusted VersaPulse® PowerSuite™ 100 Watt system just got better with additional features for enhanced safety and improved user experience.

Lumenis Pulse 100H is a versatile laser system for the treatment of extensive clinical urologic indications such as: Benign Prostatic Hyperplasia (BPH), stones, tumors or strictures, as well as a range of applications in other surgical fields such as, General Surgery, ENT, Gynecology and Pulmonary Surgery.

Better Safety

Innovative pulse-reshape function and green aiming beam
The pulse reshaping technology is designed to better address bleeder and to minimize retropulsion.
SUMMARY COMPETITORS

KLS MARTIN – LIMAX
- INEFFICIENT TECHNOLOGY
- PRICE 85.000 €
- THORACIC SURGERY ONLY
- LENSE HANDPIECE

GREENLIGHT
- INEFFICIENT TECHNOLOGY, GREEN LIGHT IN OR
- PRICE 150.000 €, FIBERS 1.000 €
- BHP USE ONLY
- SLOW PROCEDURE, LIMITED IN SIZE OF GLAND
- NOT ONCOLOGICAL SAFE
- ALREADY BAD SCIENTIFIC REPUTATION
+ EASY TO LEARN

HOLMIUM
- INEFFICIENT TECHNOLOGY
- PRICE 150.000 €, FIBERS UP TO 500 €
- BHP USE, LITHOTRIPSY
- PULSED, LIMITED DUE TO LOW HEMOSTASIS
- DIFFICULT TO LEARN
+ ONCOLOGICAL SAFE
+ GOOD SCIENTIFIC REPUTATION

THORACIC SURGERY

THULIUM
- INEFFICIENT TECHNOLOGY
- PRICE 150.000 €, FIBERS UP TO 500 €
- BHP USE, NEUROLOGY
- CARBONISATION, LIMITED DUE TO LOW HEMOSTASIS
- DIFFICULT TO LEARN
+ ONCOLOGICAL SAFE

UROLOGY

 Rolle + Rolle GmbH & Co. KG
Whatever it takes!
eraser

+ HIGHLY EFFICIENT
+ REASONABLE PRICED
+ MULTIDISCIPLINARY USE
+ EXCELLENT HEMOSTASIS
+ ONCOLOGICAL SAFE
- DIFFICULT TO LEARN COMPARED TO GREENLIGHT