



High Power Laser in Surgical Applications

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Laser

Wellenlänge
Leistungsdichte
Bestrahlungsfläche
Evtl. Pulsdauer
-energie
-wiederholfreq.

Gewebe

Optische Eigensch.
Wärmetransporteig.
Chem. Zusammens.

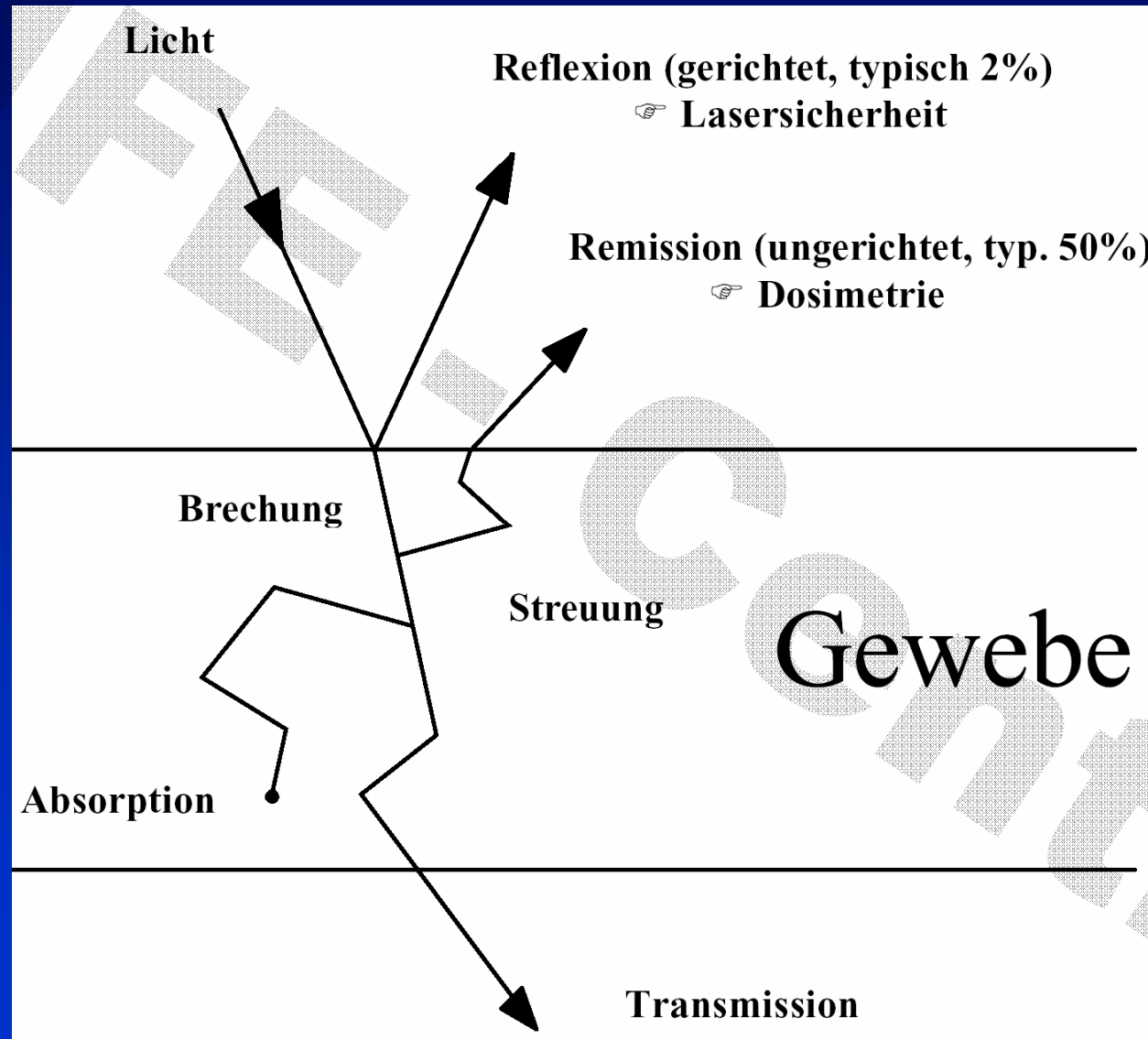
Effekt

Lichtverteilung
Wärme
Chemische Reaktionen
Materialabtragung
Ionisation
Schockwellen

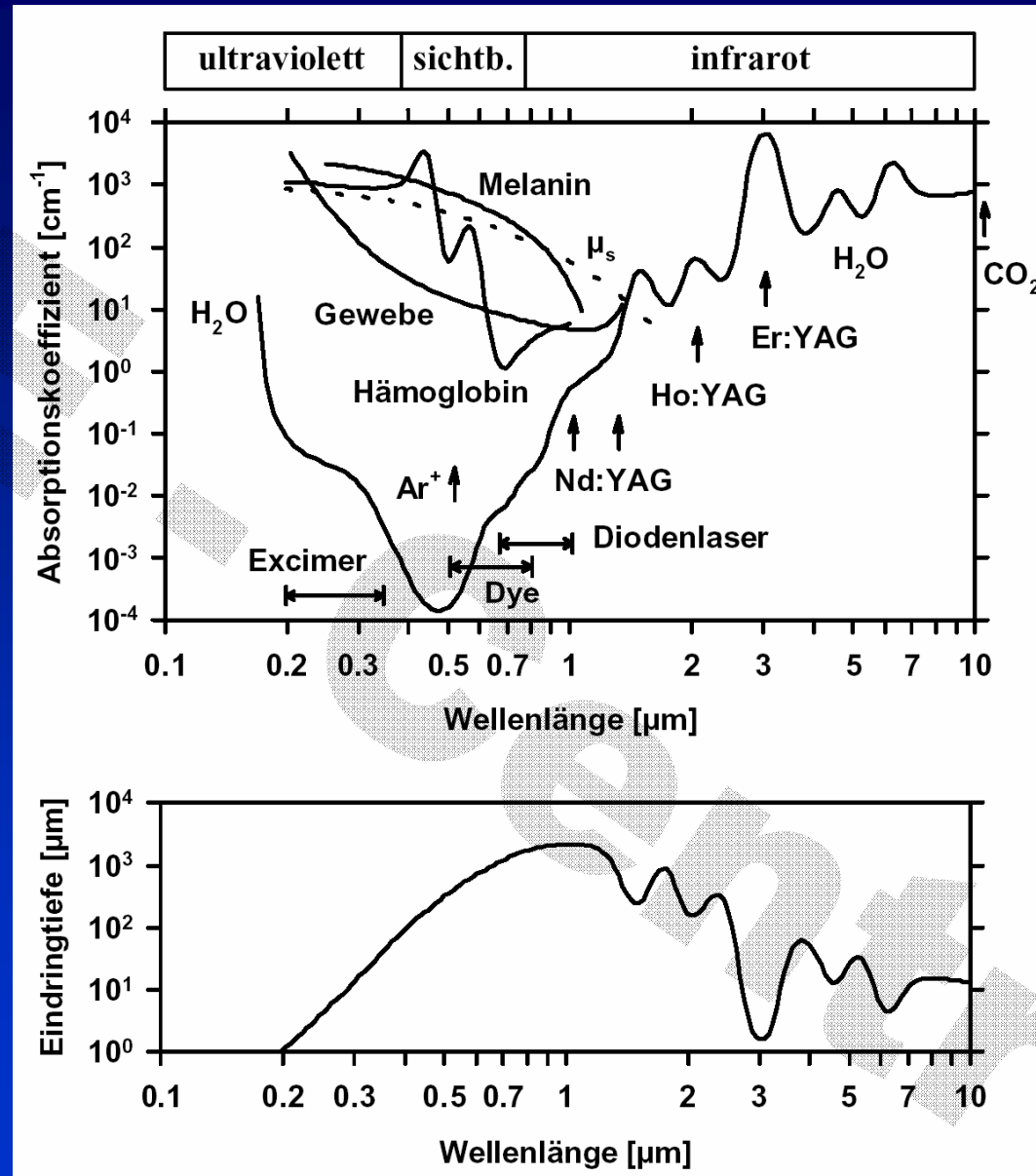
Anwendung

Biomodulation
Photodynamische Therapie
Koagulation
Gewebeabtragung
Verdampfen
Ablation
Disruption
Fragmentation

Light – Tissue Interaction



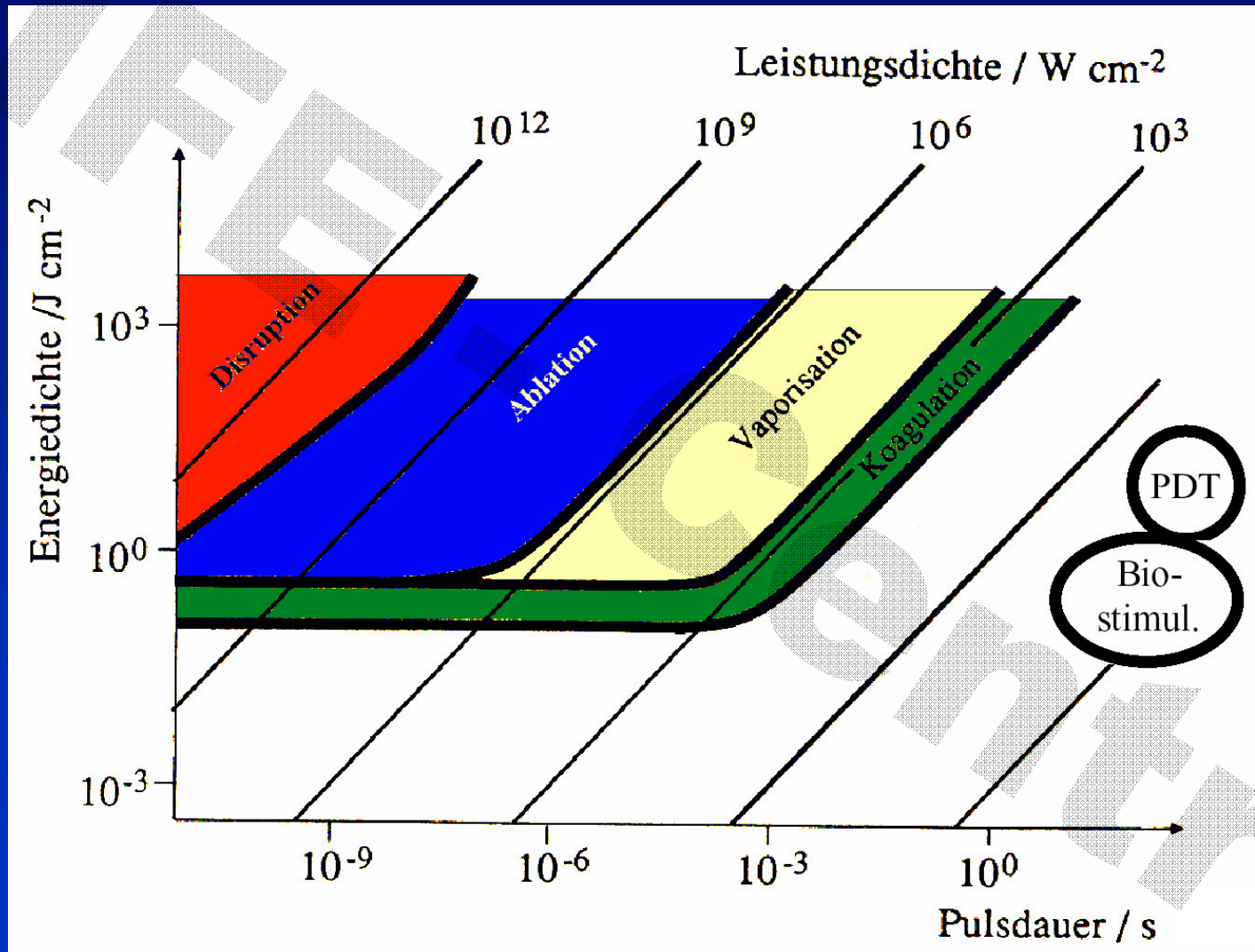
Light Absorption



Optical Penetration



Light – Tissue Interaction



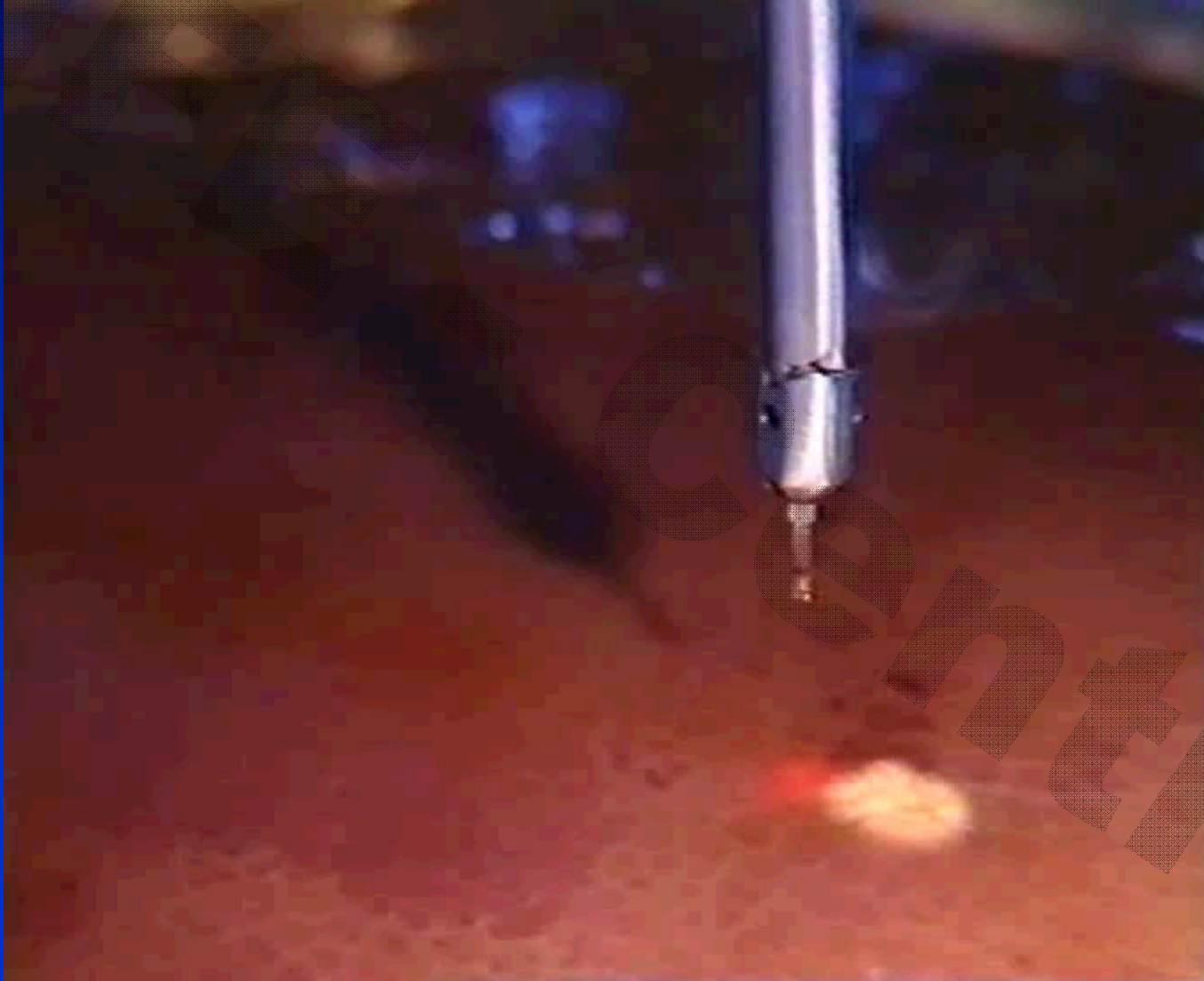
Thermal Biological Effects



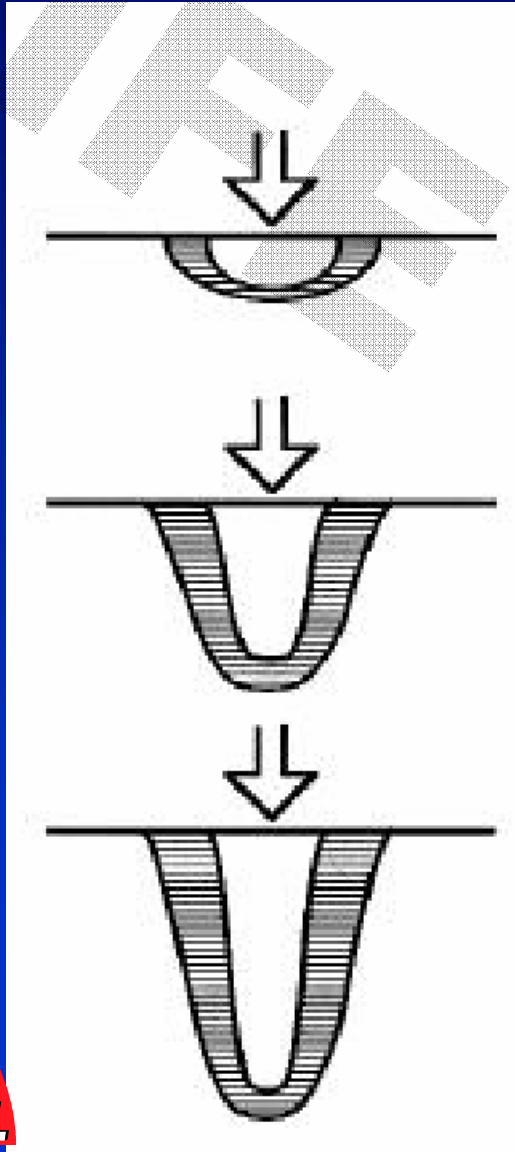
Heat Induction

Temperatur	Wirkung	optische und mechanische Änderungen
> 40°C	Enzyminduktion, Membranauflockerung, Ödeme	
45° - 65°C	Gewebeschädigung, je nach Expositionszeit reversibel oder irreversibel	
> 65°C	Koagulation	μ_s nimmt zu
> 100°C	Austrocknung	χ nimmt ab
> 150°C	Karbonisation	μ_a nimmt zu
> 300°C	Vaporisation, Ablation, Verbrennung	Abtragung
einige 1000°C	Ionisation	Schockwellen

Coagulation



Cutting - Vaporisieren

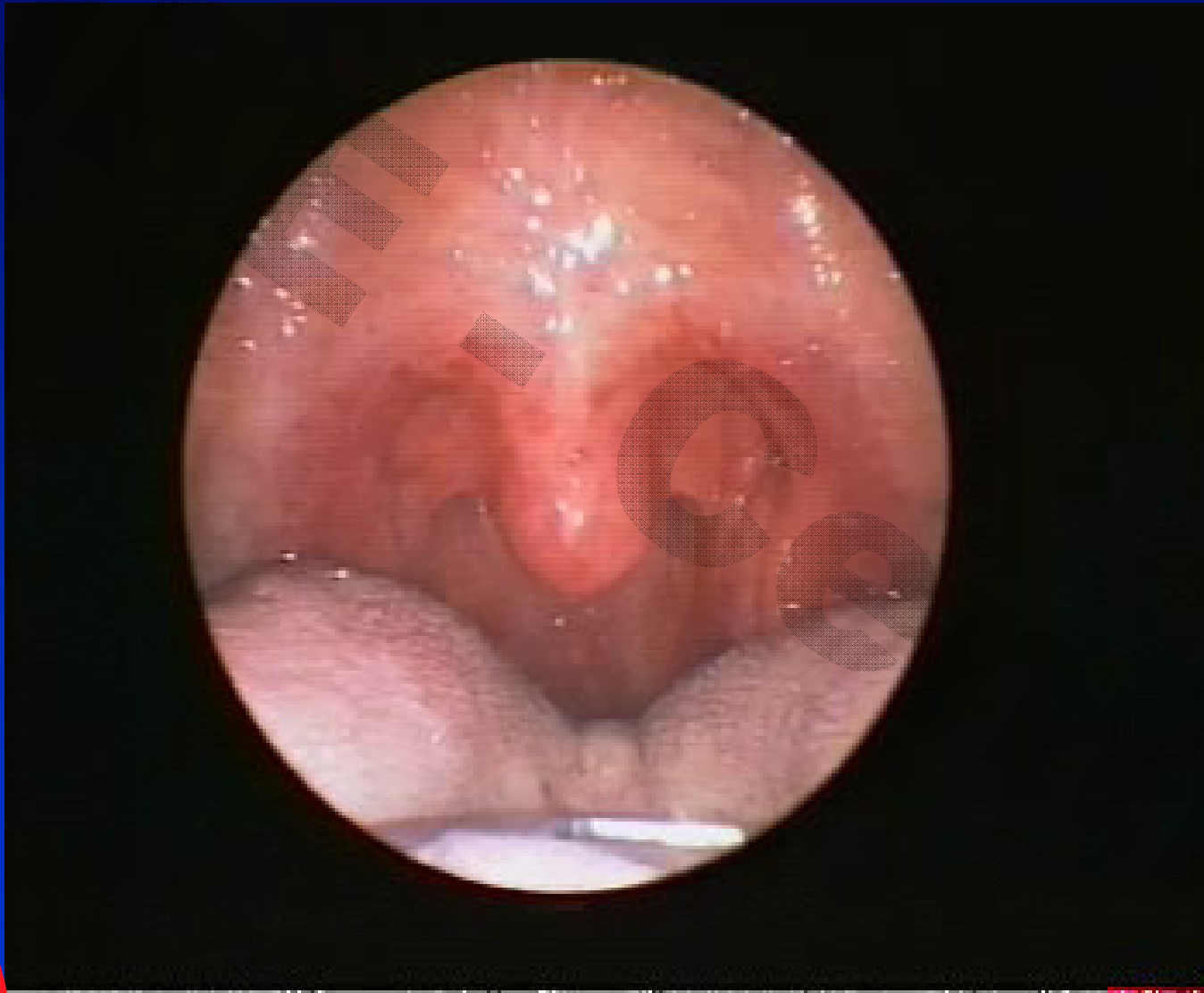


with

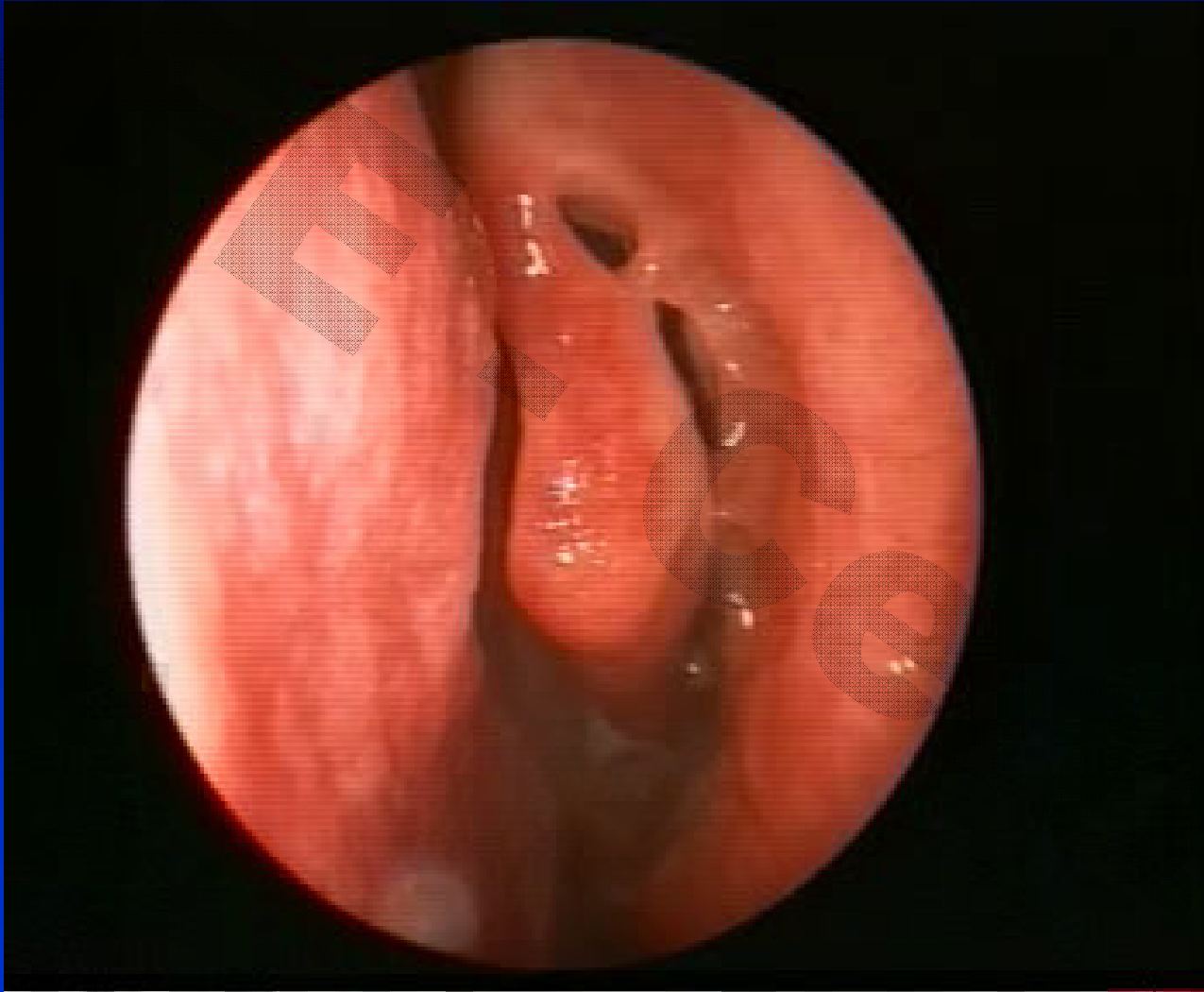
without

cooling

LAUP – CO₂-Laser - Cutting



Synechie – Ho:YAG-Laser - Cuttung

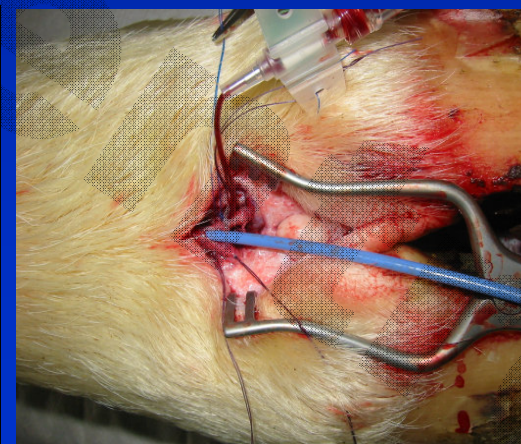
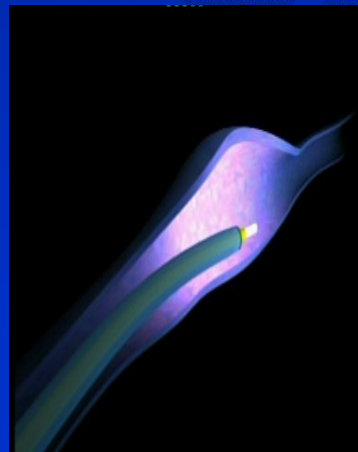
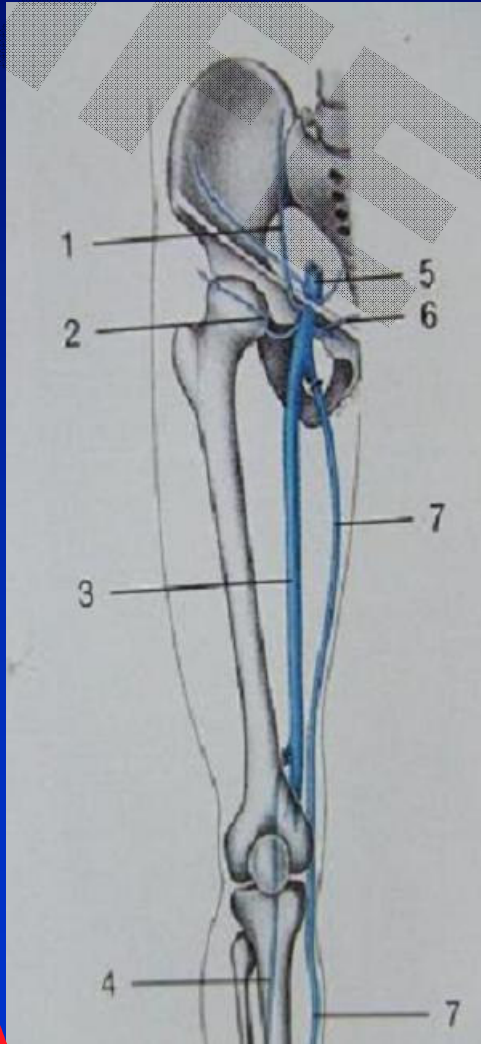


Teleektasie - Diodenlaser Skinpulse – selective Vessel-Closure Outside

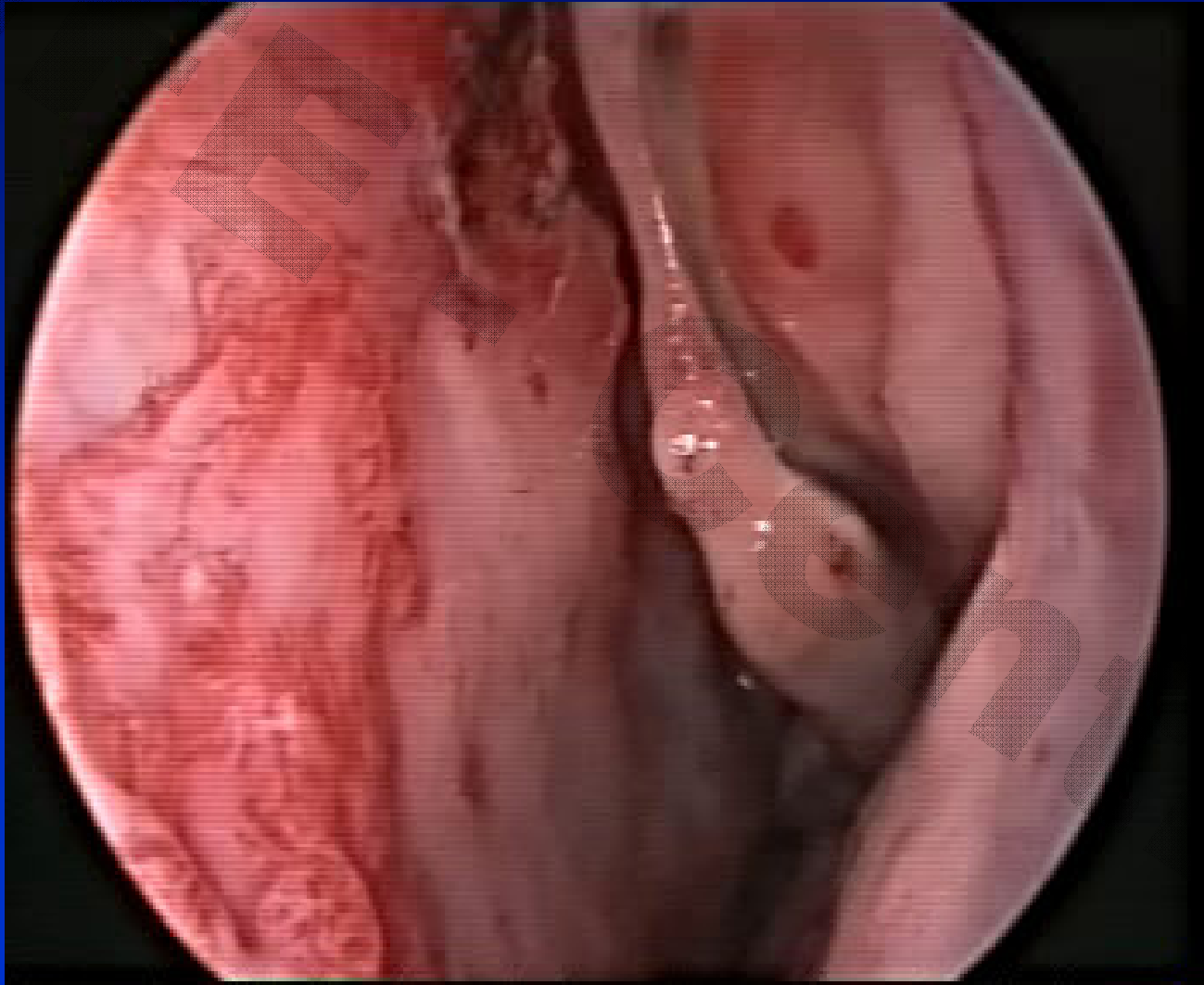


Varicosis

Endoluminal Vessel-Closure



Morbus-Osler Turbinate Diodenlaser - Coagulation



Non-Linear Interaction



Ablation

immediate vaporisation

vaporised tissue takes all energy

small thermal rime

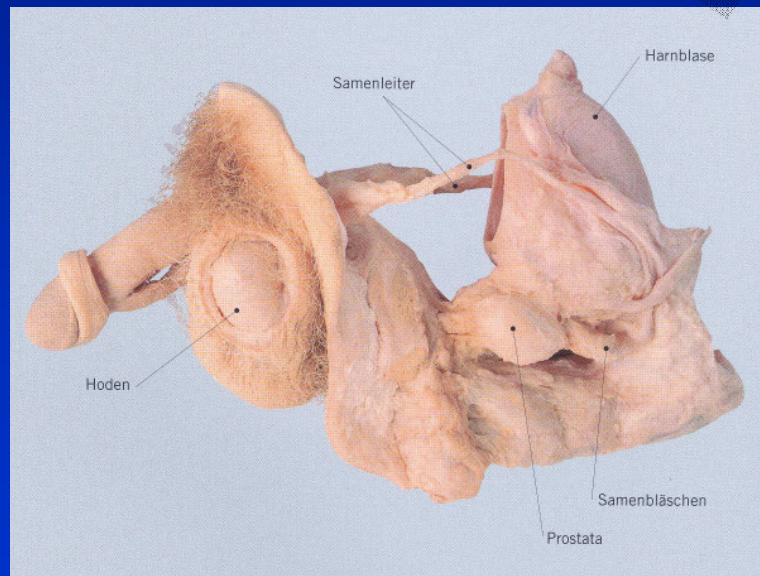
Pulsenergydensity: 0.1 – 10 J/cm²

Pulsduration: ns - μs Pulse

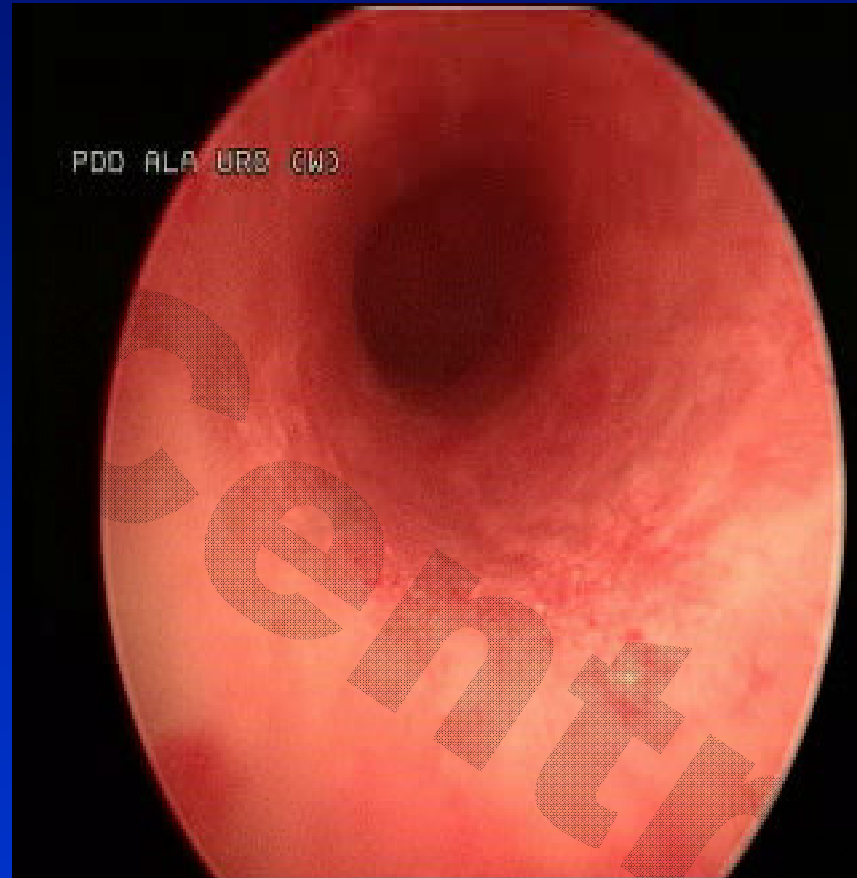


Bladder & Prostate - Diagnostic -

Cystoscopie



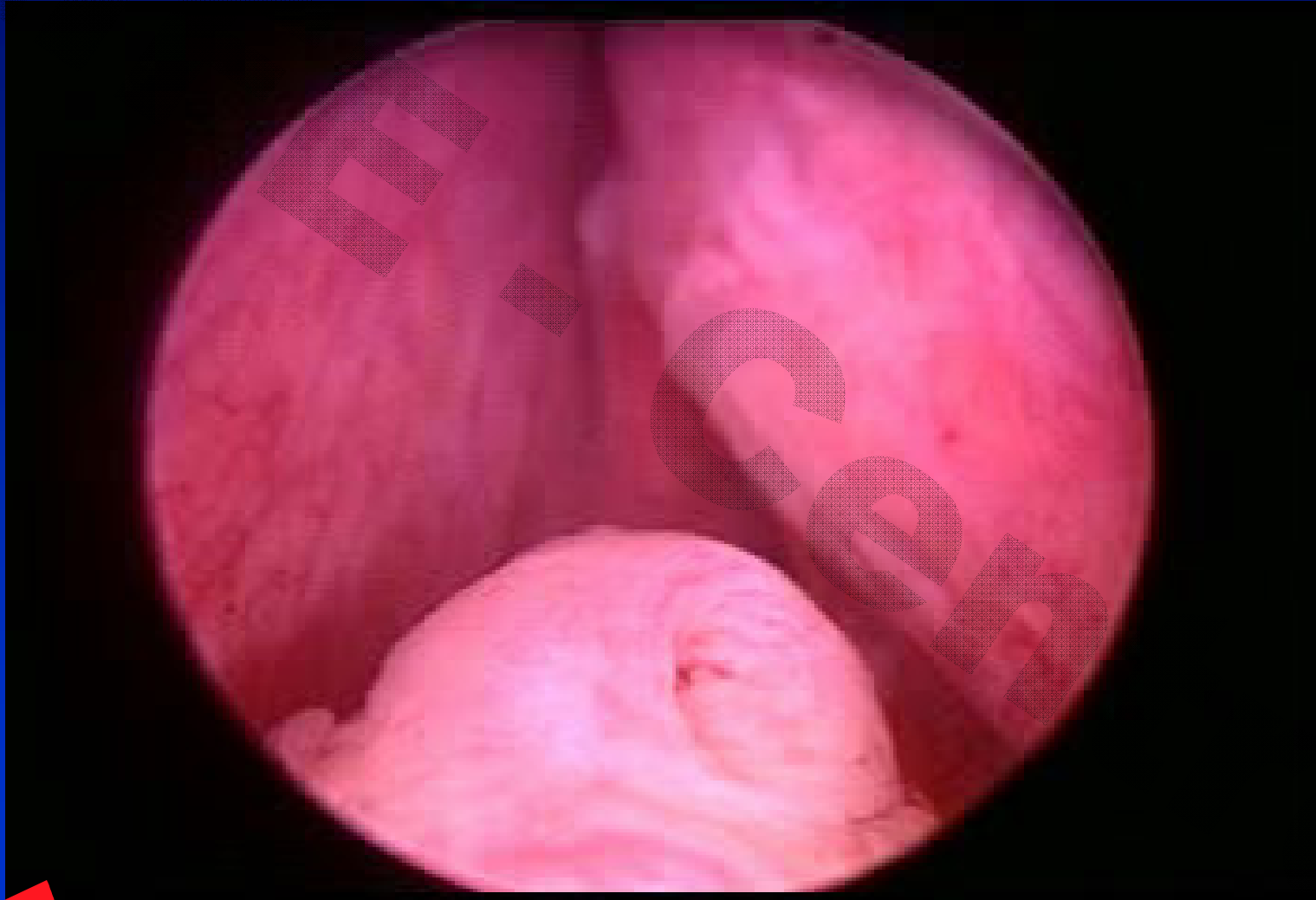
aus: Körperwelten (v. Hagen)



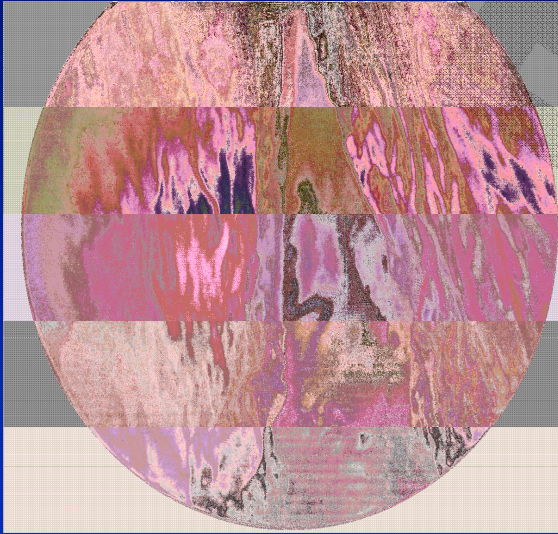
Benigne Prostata Hyperplasie



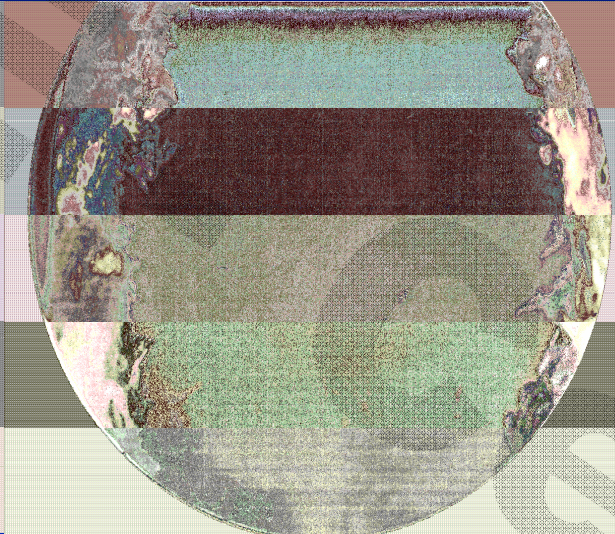
BPH – KTP – Laserung - Ablation



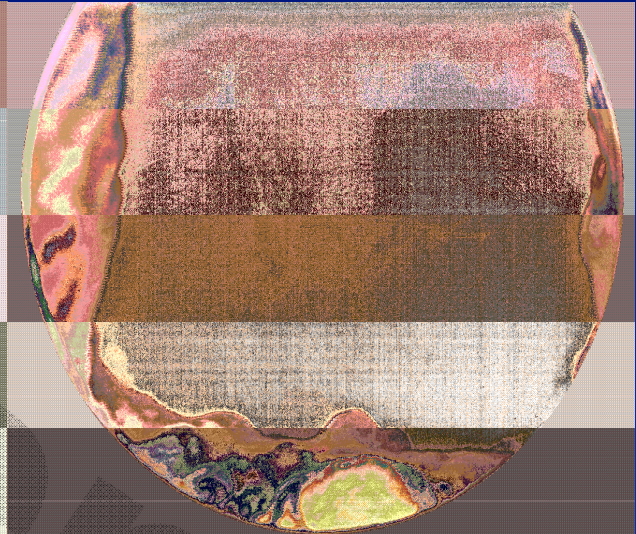
Clinical Result



präoperativ



postoperativ



2 Monate postop.

A. Bachmann, Basel

Ablation Applications

LASIK

Excimer, fs-Laser

Laserangioplastie

pulsed Dye-Laser

Orthopädie

Er:YAG, Ho:YAG

Prostata Ablation

Ho:YAG	100W
KTP	120W
DL 980nm	120W up
DL 1470nm	50W up

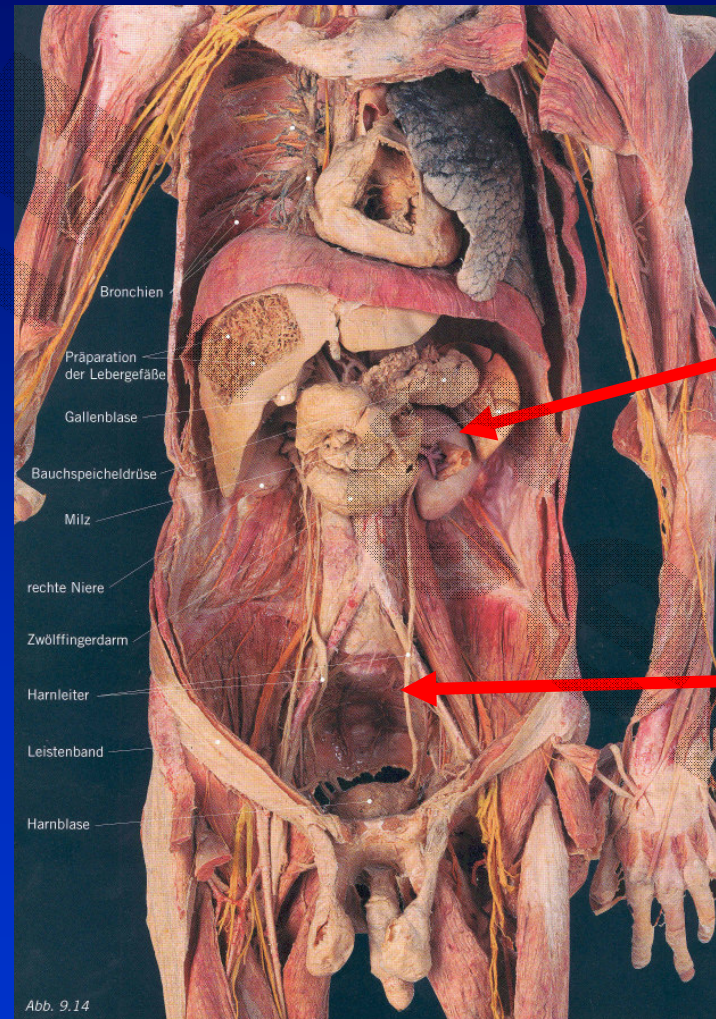


Laser induced Shockwave Lithotripsy LISL

Lasertyp	Wellenlänge	Parameter	Gewebe-Stein-Unterscheidung
FreDDY F REquency- D ouble D ual Pulse Nd:YAG-Laser (U100plus – WOM)	532nm plus 1064nm	E (puls) = 160 mJ t(puls) = 1,2 μ s Rep.rate = 1-20 Hz	ja
Blitzlampen-gepumpter Farbstofflaser (FLPD) (Lithognost - Baasel, Wavelight)	594 $\pm$ 3nm	E (puls) = 60-150 mJ t(puls) = 2,5 μ s Rep.rate = 1-10 Hz	ja
Ho:YAG (AURIGA – Wavelight)	2100nm	E (puls) = 0,3–3 J t(puls) = 200–600 μ s Rep.rate = 1-25 Hz	nein



Laser – Lithotripsy Endoscopically



kidney

urether

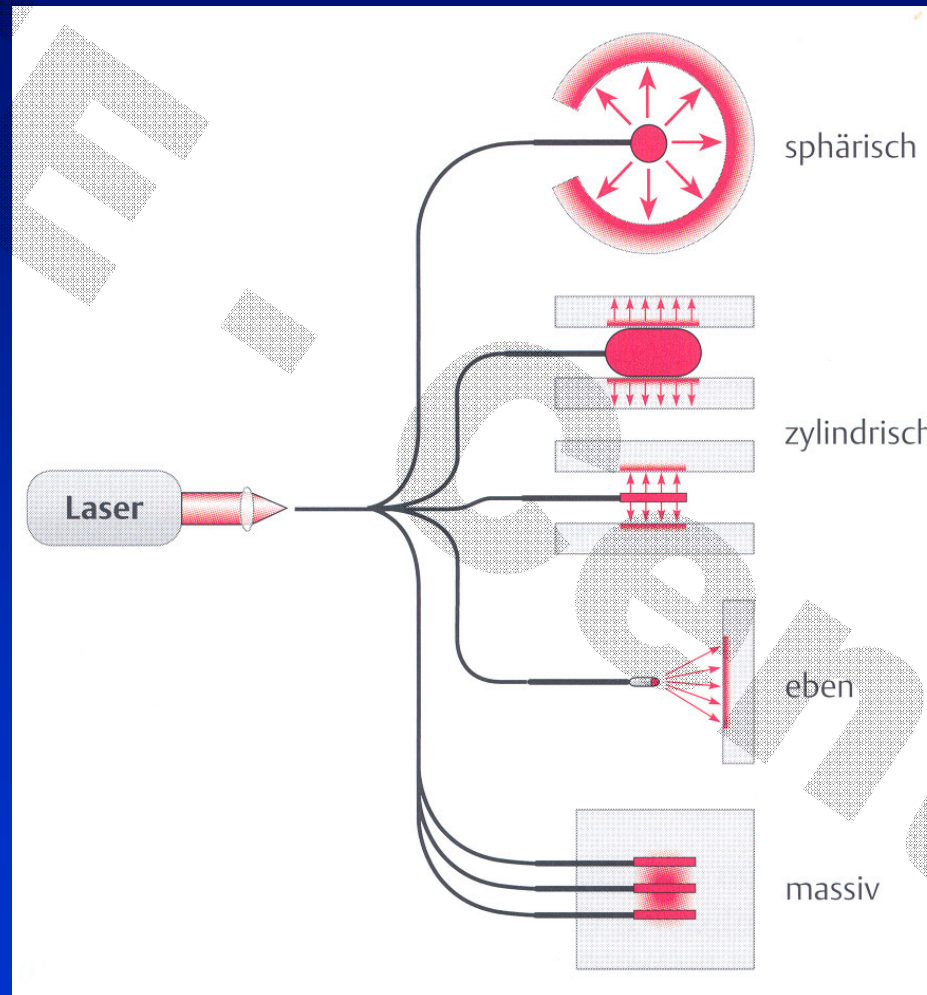
Laser – Lithotripsy Endoscopically



Lasers in Clinical Use

	Excimer	Kr	Ar	KTP	FLPD	Dye	Diode	Alexandrit	Ti:Sa	Nd:YAG contact/non contact	Ho:YAG contact/non contact	Er:YAG	CO ₂
	308 nm	400 / 647 nm	488 / 514 nm	532 nm	504 / 590 nm	550-700 nm	650-1000 nm	730-780 nm	650-1100 nm	1064 nm	2130 nm	2930 nm	10 600 nm
Biostimulation		X	X	X	X	X	X			X			X
PDT						X	X	X	X				
Koagulation			X	X			X			X	X		
Gewebefusion			X							X	X	X	X
Schneiden				X			X			X	X	X	X
Ablation	X				X		X			Q-Switch	X	X	X
Disruption										Q-Switch	X		
Fragmentation	X				X			X		Q-Switch	X	X	

Laserfiber – Emission



High Power Resistant Fibers

**Cylindrical Diffusor
Side-Firing
Bare Fiber**

more than 150kJ



High Power Resistant Equipment

Endoscopes

Guide wires

Endoscopic Forceps

Dormia-Baskets

Endotracheal Tubes

Stents /Catheter

OR-safety

sroka brighter
18.06.07 28/30



High Power Laser in Medicine

*)	Excimer	Kr	Ar	KTP	FLPD	Dye	Diode	Alexandrit	Ti:Sa	Nd:YAG contacthon contact	Ho:YAG contacthon contact	Er:YAG contacthon contact	CO ₂
	308 nm	400 / 647 nm	488 / 514 nm	532 nm	504 / 590 nm	550-700 nm	650-1000 nm	730-780 nm	650-1100nm	1064 nm	2130 nm	2930 nm	10.600 nm
Dermatologie	x		x	x	x	x	x	x	x	x	x	x	x
Gefäßchirurgie	x									x	x	x	x
Gynäkologie						x	x			x			x
Herzchirurgie	x	x								x	x		x
HNO			x	x	x	x	x	x		x	x	x	x
Innere Medizin			x	x	x	x	x			x			
Kinderchirurgie			x	x		x	x			x			
Neurochirurgie	x									x			
Ophthalmologie	x	x	x	x		x	x			x	x	x	x
Orthopädie	x			x			x			x	x	x	x
Pulmologie				x		x				x			
Urologie		x	x	x	x	x	x	x	x	x	x	x	x
Zahn- und Kieferheilkunde	x						x			x	x	x	x

*) Zusammenstellung ohne Anspruch auf Vollständigkeit. Jeder Einzelfall bedarf individueller Überprüfung. Empfehlungen sind damit im Einzelfall nicht verbunden.





**Thank you
for your
attention !**

