

List of Publications for ELT

	Author	Year	Title	Used Laser
1	Thomas M. Proebstle et.al.	2002	Endovenous treatment of the greater saphenous vein with a 940 nm diode laser: Thrombotic occlusion after endoluminal thermal damage by laser-generated steam bubbles.	Dornier Medilas D Compact
<p>With this first paper Dr. Proebstle wants to figure out the clinical and histopathological data for ELT. He made a treatment series with 26 patients and 31 limbs with incompetent GSV. He used the Medilas D compact (940 nm) with 15 W output power in a pulsed mode with a 600 µm fiber. On day 28 all limbs except of one (97%) were thrombotically closed. To figure out the process in the vein, Prof. Dr. Proebstle removed one GSV surgically after ELT treatment. He could see vein wall destruction by direct impact of the laser beam and heat-mediated vein wall injury caused by steam bubbles originating from boiling blood, with the help of microscopic examination of the two impacts of the laser beam. The latter effect causes the full length thrombotic occlusion of the vein. Furthermore, Dr. Proebstle measured the volume of the steam bubble in relation to the pulse energy. He showed that ELT is an effective treatment for thrombotic vessel occlusion.</p>				
2	Thomas M. Proebstle et.al.	2002	Thermal Damage of the Inner Vein Wall During Endovenous Laser Treatment: Key Role of Energy Absorption by Intravascular Blood	Dornier Medilas D Compact and 810/980 nm diode lasers
<p>Dr. Proebstle examined in this paper the role of intravascular blood for the transfer of the thermal damage. Therefore he made in vitro and in vivo examinations: He put stripped veins in a saline bath and filled 5 of them with blood and the others with saline. Then ELT was conducted at these veins. On two patients he made the experiment the other way round. He made first an ELT treatment and stripped this vein afterwards. One GSV was filled with blood and the other was washed out and filled with saline. At the saline filled veins, the wall damage was only at the side of the direct laser impact. The blood filled veins showed a thermal damage along the entire vein wall. Furthermore Prof. Dr. Proebstle measured the volume of the steam bubble in hemolytic blood, plasma and saline. He used lasers with the wavelength of 810, 940 and 980 nm. He figured out that steam bubbles could only be generated in blood. There was no major difference between the laser wavelength.</p>				
3	Thomas M. Proebstle et.al.	2003	Endovenous Laser Treatment of the Lesser Saphenous Vein With a 940nm Diode Laser: Early Results	Dornier Medilas D Compact
<p>This paper is the first treatment report of ELT of the LSV. 33 patients with 41 incompetent LSV were treated. The laser power of 15 W was applied either in a continuous way with a pull-back velocity of 0,5-1 cm/s or in a pulsed way with 1 s pulses every 3-5 mm. 39 treatments (95%) were successful. Short term side effects like pain, ecchymoses, palpable induration or paresthesias appeared. All in all, ELT was found to be a feasible and effective method for the treatment of incompetent LSV.</p>				
4	T.M. Proebstle et.al.	2003	Infrequent early recanalization of greater saphenous vein after endovenous laser treatment	Dornier Medilas D Compact
<p>The goal of this study was, to establish the incidence of early recanalization of the GSV after ELT. Prof. Dr. Proebstle made this study with 85 patients with 109 incompetent GSV, 104 of them were available for the 12 month follow-up. 90,4 % were closed at the 12-month follow-up, 4,8 % were completely recanalized and the other 4,8 % had an incomplete proximal recanalization. The reopening is sometimes caused by feeding vessels. There is no statistic for potential risk factors of early recanalization. Nevertheless most of the patients, where the ELT-treatment failed, have either a high body mass index or received anticoagulation therapy. The optimization of laser energy administration might improve the success rate for ELT.</p>				
5	T.M. Proebstle et.al.	2004	Nonocclusion and Early Reopening of the Great Saphenous Vein After Endovenous Laser Treatment is fluence Dependent.	Dornier Medilas D Compact
<p>In this study Dr. Proebstle wants to figure out which parameters are responsible for early recanalization after ELT treatment. 77 patients with 106 incompetent GSV were treated by ELT. 10 % of them showed a reopening of the vein after 3 months. The laser power was 15 W and an average continuous pullback-velocity of 0.6 cm/s was used. That is an average fluency of 23,4 J/cm. Dr. Proebstle showed, that the most important parameter, which causes ELT failure is low laser fluency. Other parameters, which need to be taken into account are the proximal vein diameter, laser power, number of pulses per cm and the pullback velocity.</p>				

6	T.M. Proebstle et al.	2006	Endovenous Treatment of the great saphenous vein using 1320 nm Nd:YAG laser causes fewer side effects than using a 940 nm diode laser	Cooltouch CTEV Dornier Medilas D Compact
The conclusion of this study is, that the ELT of the GSV using a 1320 nm Nd:YAG laser causes fewer side effects compared with 940 nm diode laser ELT. Pain is reduced from 81 % at the diode laser treatment to 50 % at the Nd:YAG laser treatment. Furthermore ecchymosis are significantly reduced. At the 3 month follow up the success rate for the diode laser treatment was 100 %, for the Nd:YAG laser treatment only 97 %.				
7	T.M. Proebstle et al.	2006	Reduced recanalization rates of the great saphenous vein after endovenous laser treatment with increased energy dosing : Definitio of a threshold for the endovenous fluence equivalent.	Dornier Medilas D Compact
Higher dosing of laser energy shows a 100% immediate success rate and significant reduced recanalization during the first year. There is a dose-response relationship between EFE (endovenous fluence equivalent) and the success rate of (ELT): An EFE of 20 J/cm ² was associated with durable GSV occlusion.				
8	P. Perkowski, et.al.	2004	Endovenous Laser Ablation of the Saphenous Vein for Treatment of Venous Insufficiency and Varicose Veins: Early Results from a large Single-Center Experience	Dornier Medilas D Compact
Ravi also conducted a study with the Dornier diode laser. He treated 165 patients with 203 incompetent GSV. He used the laser with 13 W/s in 1-2 mm increments. Post operative complications, like ecchymosis or induration were viewed and well tolerated. Ravi reached a success rate of 97 %.				
9	R. G. Bush	2005	940-nm Laser for Treatment of Saphenous Insufficiency: Histological Analysis and Long-Term Follow-Up	Dornier Medilas D Skinpulse S
Bush made a long-term follow-up study with the 940 nm Dornier Skinpulse S diode laser. All together there were 620 patients with saphenous insufficiencies treated. He used the laser in a pulsed mode with 18 W output power and a pulse duration of 1 to 1.3 s. The increments between the pulses were 1-2 mm. He could show a success rate of 95 % with no complications. Additionally he treated 15 patients with varying energy levels and time durations and made a histological evaluation.				
10	R. Ravi et al.	2006	Endovenous Ablation of Incompetent Saphenous Veins: A Large Single-Center Experience	Dornier Medilas D SkinPulse S / VNUS closure system
Ravi made all together 1250 treatments of varicose veins, 1091 were made by laser treatment, and 159 were treated by RF. Recanalizations occurred for 3,3 % of the laser treatments and 3,7 % of the RF treatments. With the laser he treated both, GSV and SSV, the RF treatment was accomplished only at the GSV. At both treatment methods only minor complications occurred.				
11	L. Mundy	2005	Systematic review of endovenous laser treatment for varicose veins. British Journal of Surgery; 92:1189-94	Several devices
This paper is a summary of several papers, including studies of Min, Proebstle, oh, Navarro, Chang, Gerard and Perkowski.				
12	Robert J. Min, et.al.	2001	Endovenous Laser Treatment of the Incompetent Greater Saphenous Vein	Diomed D15
R.J.Min wanted to show the safety and efficiency of EVLT with this multicenter study. He used the Diomed D15 laser (810 nm) with a 600 µm fiber. The laser was used at an output power of 10-12 W CW. He withdrew the fiber 1-2 mm after 1-2 s. 84 patients with 90 incompetent GSV were evaluated for the study. 3 % had a reopening after 1 week and were retreated with EVLT. At the 9 month follow up the success rate was 99 %. Therefore the conclusion of this study is that EVLT is an extremely safe technique with impressive short term results.				
13	Robert J. Min, et.al.	2003	Endovenous Laser Treatment of Saphenous Vein Reflux: Long-Term Results	Diomed D15
In this study R.J. Min shows long-term results for the EVLT. Again the Diomed D15 laser is used (810 nm), but this time at continuous mode with 14 W output power. The pull-back velocity was 3 mm/s. He evaluated 423 patients with 499 incompetent GSV. After the initial treatment he had a success rate of 98,2 %. All incompetent GSV except for one were closed after the first retreatment. At the one year follow-up 310 of 318 veins were still closed (97,5 %). All in all he concluded that EVLT has comparable efficiency to other treatment methods, but it has a lower rate of complications and avoids general anesthesia.				

14	Luis Navarro et.al.	2001	Endovenous Laser: A New Minimally Invasive Method of Treatment for Varicose Veins - Preliminary Observations Using an 810 nm Diode Laser	810 nm
<p>Navarro also used an 810 nm laser with a 400-750 µm bare fiber. The output power was 10-14W CW. He withdrew the fiber in increments of 3-5 mm with 1-2 s pulse duration. He evaluated 33 patients with 40 GSV and had a success rate of 100 % at a mean follow-up of 4,2 month. Side effects were ecchymosis and induration. He also reports 80 cases of GSV treated by a Spain doctor with the same laser, who also had no reopenings even after a follow-up of two years. He concludes, that ELT is a safe and well tolerated in-office procedure.</p>				
15	Mitchel P. Goldman	2004	Intravascular 1320nm Laser Closure of the Great Saphenous Vein: A 6-ro 12 Month Follow-up Study	Cooltouch CTEV
<p>Goldman made a small study that included 22 patients with 24 incompetent GSV to show, that a wavelength of 1320 nm is also possible for ELT. The difference between the 810-1064 nm lasers is, that the energy is absorbed by water and not by hemoglobin, so that no blood needs to be in the treated vessel. The laser parameter were 5 W output power, a frequency of 30 Hz and a pull-back velocity of 1 mm/s. To verify this velocity, an automatic pullback-mechanism is required. This also verifies an equal treatment between surgeons. He used a 500-600 µm diffuser-tip fibre. Goldman showed a success rate of 100 %.</p>				
16	Chang-Keun Oh	2003	Endovenous Laser Surgery of the incompetent Greater Saphenous Vein With a 980nm Diode Laser	Biolitec Ceralas D
<p>Oh made the endovenous laser treatment with a 980 nm laser (Ceralas D, Biolitec) and a 600 µm bare fibre. The output power was 10-12 W in 1-2 s pulses. During the off period the fibre was 3-5 mm withdrawn. He treated 12 patients with 15 limbs. During the treatment he had no complications. The study obtained 100 % occlusion at 12 weeks follow-up.</p>				
17	Paul E. Timperman	2004	Arteriovenous Fistula after Endovenous Laser Treatment of the Short Saphenous Vein	Diomed D15
<p>Timperman showed a case report of a major complication he had at an EVLT treatment. Major complications are very rare. Nonetheless, one of his patients created an arteriovenous fistula between the short saphenous vein and a superficial sural artery in the popliteal fossa. Attention has to be paid if the both veins are very close together. There were no abnormalities detected immediately during postprocedural US, but at the one week follow-up the fistula could be seen by US. Timperman used a 810 nm laser from Diomed with 12-14 W and a pull-back velocity of 1,2 mm/s. He concludes that pull-back rate and wattages similar to those shown to be save and effective should minimize possibility of an arteriovenous fistula.</p>				
18	Paul E. Timperman, et.al.	2004	Greater Energy Delivery Improves Treatment Success of Endovenous Laser Treatment of Comonpetent Saphenous Veins	Diomed D15, Angiodynamics
19	Steven E. Zimmet et.al.	2003	Temperature Changes in Perivenous Tissue during Endovenous Laser Treatment in a Swine Model	Diomed D15
20	Michael J. Sichlau	2004	Cutaneaos Thermal Injury after Endovenous Laser Ablation of the Great Saphenous Vein	Angiodymanics, Vascular Solutions
21	A. Forschner et.al.	2001	Strippingoperationen der V.saphena magna und parva	