Laser & IPL
Treatment of Veins
What Causes Varicose / Spider Veins?

The following can all be risk factors:

- Weak valves / venous insufficiency
- Inherited factors
- Hormone changes (puberty, pregnancy, menopause)
- Pregnancy
- Taking birth control pills
- Sun exposure (or wind exposure)
- Injury / trauma to the skin
- Standing for long periods of time
- Age
- Obesity
What To Treat - Vascular

- Facial broken thread veins
- Leg veins (up to 1.5mm diameter)
  - unless you are very experienced vascular surgeon
  - in which case, veins up to 3mm diameter can be treated
  - treating veins >1.5mm in diameter can be painful!
- Spider Nevi
- Cherry Angiomas (Campbell de Morgan spots)
- Venous Lakes (on lips)
- Diffuse redness on face
What Not To Treat - Vascular

- Port Wine Stains
  - Unless you are very experienced laser dermatologist or plastic surgeon
- Hemangiomas
  - Unless you are very experienced laser dermatologist or plastic surgeon
- Large, complex leg vein systems
- Varicose veins
- Any lesion within the orbit of the eye
Mechanism of Action

- Absorption of the LP Nd/YAG (1064 nm) or LP alexandrite (755 nm) laser wavelength by blood (oxy or deoxy hemoglobin)
- The blood vessel is heated up (coagulated) above 70°C
- Thus heating the endothelial lining of the blood vessel wall
- and causing collagen contraction of the vessel
- Which is then destroyed
- Over a period of time, the destroyed blood vessel is re-absorbed and eliminated by phagocytosis (weeks to months)
- Long-pulsed lasers usually work by a photothermal mechanism
- Shorter-pulsed lasers (e.g. pulsed dye lasers) can also destroy blood vessels by a combination of photothermal and photomechanical rupture of the blood vessels
Vascular Lasers

- Pulsed Dye (577 – 600 nm)
- KTP (532)
- Diode (810, 940, 980 nm)
- Long pulsed Nd/YAG (1064 nm)
- Long pulsed alexandrite (755 nm)
- IPL
- Argon (now discontinued)
Vessel diameter

- Key to successful treatment of veins is knowing what is diameter of vein
- Use a “Vein gauge” to measure diameter
- Standard paper clip is 0.9 mm in diameter
- Then choose appropriate laser wavelength
- Avoid complex leg vein systems
  - micro sclerotherapy still “gold standard” for these
Leg Veins

- A standard paper clip is about 0.9mm in diameter
- Don’t take on veins bigger than 1.5mm unless experienced laser practitioner!
Choose Appropriate Wavelength Laser

<table>
<thead>
<tr>
<th>Diameter of vessel (mm)</th>
<th>Laser Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red blush</td>
<td>Pulsed dye laser / IPL / KTP (LP Nd/YAG LaserFacial?)</td>
</tr>
<tr>
<td>&lt;0.2 - 0.3 mm</td>
<td>Pulsed dye laser / IPL / KTP / LP Nd/YAG</td>
</tr>
<tr>
<td>0.3 - 0.6mm</td>
<td>KTP / diode / LP Nd/YAG</td>
</tr>
<tr>
<td>0.6 - 1.0 mm</td>
<td>Diode / LP Nd/YAG</td>
</tr>
<tr>
<td>&gt; 1.0 mm</td>
<td>LP Nd/YAG</td>
</tr>
<tr>
<td>Blood lakes</td>
<td>LP Nd/YAG</td>
</tr>
</tbody>
</table>

Appropriate laser technology depends on size and depth of vessel to be treated!
LP Nd/YAG and Depth of Penetration

- The bigger the blood vessel diameter, the better the LP Nd/YAG works!
- But why?

<table>
<thead>
<tr>
<th>Laser Technology</th>
<th>Laser Penetration Characteristic</th>
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<tbody>
<tr>
<td>Pulsed dye laser</td>
<td>Well absorbed by blood and by pigment, therefore unable to penetrate deep into tissue or deep into a larger blood vessel</td>
</tr>
<tr>
<td>KTP</td>
<td></td>
</tr>
<tr>
<td>IPL</td>
<td></td>
</tr>
<tr>
<td>LP Alexandrite Diode</td>
<td>Relatively well absorbed by pigment, not so well absorbed by blood. Can penetrate deep into tissue and relatively deeply into a larger blood vessel. However, epidermal pigmentation can be a problem.</td>
</tr>
<tr>
<td>LP Nd YAG</td>
<td>Poorly absorbed by blood and by pigment, therefore able to penetrate deep into tissue and deep into a larger blood vessel, to give a more uniform heating of the vessel</td>
</tr>
</tbody>
</table>
Choose Appropriate Spotsize (1)

- LP Nd/YAG is a deep penetrating wavelength
  - 4 – 6mm with 12 – 15mm spots

- Can limit penetration using small spot sizes
  - For superficial vessels, use 1.5, 3mm or 3x10mm elliptical spots
  - 1.5 mm spot best for 0.1 – 0.3mm vessel diameters and for face
  - Will also require high fluences (due to poor Nd/YAG blood absorption and not much target)

- Large vessels require bigger spots
  - A good spot to use is 6 mm for veins up to 1.5mm diameter
  - 8mm spot best on vessels >1.5mm or for venous flares
  - Will require low fluences (why? large blood volume and cumulative heating)
Choose Appropriate Spotsize (2)

<table>
<thead>
<tr>
<th>Spot size (mm)</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 mm</td>
<td>Small diameter facial or leg veins (&lt;0.3 mm), usually red</td>
</tr>
<tr>
<td>3 mm</td>
<td>Medium diameter facial or leg veins (0.3 - 0.6 mm), usually blue</td>
</tr>
<tr>
<td>3 x 10 mm elliptical</td>
<td>Small to medium diameter straight facial or leg veins (0.1 - 0.6 mm)</td>
</tr>
<tr>
<td>6 mm</td>
<td>Deeper blue or purple leg veins upto 1.5 mm in diameter, venous lakes, cherry angiomas, spider nevi</td>
</tr>
<tr>
<td>8 mm</td>
<td>Deeper blue or purple leg veins &gt; 1.5 mm in diameter, for venous flares on legs, for large areas of fine diameter vessels on legs</td>
</tr>
</tbody>
</table>
Spot Size and Depth of Optical Penetration

Small spot size for superficial targets

Large spot size for deeper targets
Choose Appropriate Pulse Duration

- It is important to match the pulse duration to the vessel diameter
- Bigger veins require heating for longer periods
- Therefore require longer pulse durations
  - 0.5 – 1.5 mm veins may require 20 – 50 msec
  - and larger spot sizes to increase penetration depth
- Red vessels require shorter pulse durations
  - 0.1 - 0.5 mm red vessels may require 5 – 20 msec (fair skin types)
  - may also require high fluences
- Can use Target Diameter v Pulse Duration graph to help work out an appropriate pulse duration to start with
- Select pulse duration according to vein diameter (using vein gauge)
- If in doubt, choose slightly longer pulse duration to begin with. If no desired clinical response, reduce pulse duration gradually until desired clinical response seen
Fluence in J/cm² (LP Nd/YAG)

- Last thing that should be adjusted when treating veins
- Need to get the spotsize sorted out first
- Then adjust the pulse duration
  - to match vessel diameter you are heating
- And finally fluence
  - Because Nd/YAG is relatively non-selective and the margin between efficacy and over-treatment is small, there is a greater risk of adverse side-effects if relying on fluence alone to achieve successful outcome!!!
- Use lowest recommended fluences for relevant spotsize (from Treatment Chart or drop-down menu) to begin with, then adjust until desired clinical endpoint seen.
  - OK to increase in 10 J/cm² increments in range 80-200 J/cm²
  - OK to increase in 20 J/cm² increments in range 280-450 J/cm²
In general, use lower fluences for bigger, more “target-rich” areas
- such as larger blue leg veins
And higher fluences for smaller diameter, “target-poor” areas
- such as small red facial veins

* But is dependent also on spot size and pulse duration
Pigment/Water Absorption Spectrum

- Nd:YAG at 1064 nm is almost equally poorly absorbed by melanin, blood and water, and is therefore relatively non-selective
- is the reason why it penetrates so deeply
- and is the reason why treat with caution when using high fluences
Epidermal cooling

- Very important when treating veins
- Apply pre, peri and post-op cooling
  - minimal pre-op cooling, so as not to vasoconstrict vein
  - for peri-op cooling, cryogen spray or chilled-air cooling can be used
  - when using cryogen spray, refer to Candela Treatment Guide
  - if using chilled-air cooling, always apply thin layer clear gel pre-op
  - and fire laser through this / cannot be used with cryogen spray
  - watch for icing of the skin (turn chiller speed down if this occurs)
- For larger vessels, good post-op cooling essential
  - as vessels act as a heat sink
  - releasing heat back towards the epidermis many hours post op
Vessel Visualization (1)

- Is important to be able to see the veins you are treating!
  - Some very small veins can be difficult to see
  - If you can’t see them, the laser may also not see them easily
  - And you may not get the aiming beam onto the vessel, meaning no treatment and an unhappy patient!

- Adjust laser aiming beam - usually dimmer
  - allows easier visualization of vessels

- Pay attention to room lighting
  - and positioning of surgical / mobile spot lights
  - position on opposite side from where you are working, and keep angle of illumination low!
Consider buying a LED Headlamp from any DIY shop

- Eliminates the need for really good overhead lighting
- Are cheap to buy!
Vessel Visualization (3)

- For small diameter vessels, Syris Polarizing Lamp very useful
  - V300 or V600 from [http://www.syrisscientific.com/](http://www.syrisscientific.com/)
Clinical Endpoints (1)

- **Vasospasm (immediate disappearance of vessel)**
  - good, but not reliable predictor of result

- **Sticky blood vessels - check for vessel refill**
  - aim is to coagulate blood vessels / make them sticky
  - and to damage the endothelial lining of the vessel wall
  - if sticky, vessels should not refill with “Blanche Test”
  - best predictor of successful treatment

- **Vessel darkening**

- **Vessel shrinkage (for larger, deeper vessels)**
Clinical Endpoints (2)

- Swelling of the blood vessel (look like cat scratches)

Pre-op

Immediately Post-op
Treated with LP Nd:YAG
Over Treatment Indicators

- Blistering
- Pain
- Whitening of skin or vessels
- Indentations
- Popping of blood vessels during lasering

These adverse effects mainly occur because of too high an energy, too short a pulse duration or not enough cooling!
Using LP Nd/YAG for veins (1)*

- Photograph, then perform “blanche test”
  - confirm is vascular target
  - check for speed of vessel refill

- Determine vessel diameter (vein gauge)

- Decide spot size
  - facial 0.1 - 1mm (1.5 mm spot, best), >0.5mm blue (3mm spot)
  - legs 0.1 - 0.5mm (1.5 mm spot), 0.3 - 1mm (3 mm spot)
  - legs 0.3 - 1.5mm blue (3 or 6 mm spot)
  - small to medium diameter straight facial or leg veins (3x10mm elliptical)
  - Venous flares on legs (8 mm spot) - treat with caution!!
  - superficial veins, use smaller spot sizes
  - Deeper the vein, the bigger the spot used
Using LP Nd/YAG for veins (2)*

- Adjust pulse duration
  - With fluence fixed at lowest suggested value for spotsize (Treatment Chart)
  - Select appropriate pulse duration – to match vein diameter you are heating (Target Diameter v Pulse Duration graph, or Treatment Chart)
  - Shorten until you start to see desired clinical endpoints (darkening or sticky blood vessels – check with blanche test again)

- Ensure epidermal cooling switched on
- Fine-tune using fluence until vessels don’t refill
- Decide which way to treat
  - Feeder to periphery (probably best) or periphery to feeder??

- Can treat all vessels of same diameter and colour using this parameter combination
- Apply good post-op cooling
- Repeat all above steps for different diameter vessels
- Document
No Overlapping!

- Don’t overlap, pulse stack or double pass
- Spot weld the vessel i.e. leave small gaps between each shot
Other points

- If using chilled-air cooling only, fire through clear ultrasound gel
- Don’t overlap, pulse stack or double pass
- Spot weld the vessel i.e. leave small gaps between each shot
- Veins usually 1 – 3 treatments
- Simple post-op care
- Post-op Compression Stockings – not usually required
- Allow 4 – 6 weeks between facial treatments
- Allow 8 – 12 weeks between leg vein treatments
- Micro sclerotherapy still “gold-standard” for leg veins
- LP Nd/YAG best for leg veins
LP Nd/YAG for nasal veins

1 Tx with LP Nd/YAG
20 ms / 380 Jcm^2 / 1.5 mm spot

Photos courtesy of Dr. Chasin
LP Nd/YAG for leg veins

- Start on easy leg veins first (approx 0.5 mm isolated, superficial)
LP Nd/YAG for leg veins

- Start on easy leg veins first (approx 0.5 mm isolated, superficial)
LP Nd/YAG for leg veins

Photos courtesy of Cesar Arroyo, MD

 BEFORE

 AFTER 4 TREATMENTS
LP Nd/YAG for leg veins
LP Nd/YAG for leg veins (complex)
LP Nd/YAG for leg veins (complex)

Photos courtesy of Cesar Arroyo, MD
Rosacea

- Red blush
- Linear telangiectasias
- Mixture of red blush and linear telangiectasias
  - Most common
- Use pulsed dye laser or IPL to treat blush
  - Use first to “unmask” linear telangiectasias
  - Use biggest spot available to enhance overlap and avoid reticulation / “honey-combing”
  - Can also use LP Nd/YAG with “facial redness” settings
- Use KTP, diode or LP Nd/YAG to treat the linear telangiectasias
Rosacea / Diffuse Redness

Before

post 5 Tx*

* Nd:YAG 1064 / 10 mm / 0.5 ms / 9 J/cm2 / defocused “painting” technique/ no cooling
Rosacea / Diffuse Redness

Before

post 5 Tx*

* Nd:YAG 1064 / 10 mm / 0.5 ms / 9 J/cm2 / defocused “painting” technique/ no cooling
Rosacea / Diffuse Redness

Before post 5 Tx*

- Nd:YAG 1064 / 10 mm / 0.5 ms / 9 J/cm²
- defocused "painting" technique
- No cooling
Rosacea / Diffuse Redness

Before

3 month post 5 Tx
energy of the long-pulsed Nd/YAG is delivered superficially, into the epidermis (penetration depth approximately 1mm)

aim is to improve diffuse red blush, light brown pigmentation, soften lines and stimulate new collagen formation

suitable for mild to moderate sun-damaged skin

to give "IPL like" results

usually a course of 4-6 treatments at 3-4 weekly intervals

is a comfortable treatment with minimal downtime (skin remains slightly flushed for up to 4 hours)
LaserFACIAL settings (2) (feathering technique)

- Painting technique, delivered to whole face (approx 20 min treatment)
- 8 mm or more usually a 10 mm spot used in defocused mode / distance gauge O-ring approx 1 cm from skin surface
- Short pulse duration (0.5 msec) and 7-10 Hz repetition rate
- Low fluence (8-12 J/cm²)
- No cooling used
- Clinical endpoint is 41-42°C
  - As measured with digital thermometer
  - Skin should feel warm to the touch and red
- Only 1 published clinical paper on the technique
**Spider Nevi settings**

- Can use 1064 nm / 6mm spot / 20 msec pulse duration
  - Consider masking surrounding skin with white card
  - Start at 80 J/cm² for all venous lakes and for spider nevus / cherry on thin skin
  - Start at 100 J/cm² for spider nevus or cherry angioma
  - May fire a second shot at the same fluence if very little happens after the first pulse (but stop and check reaction first)
  - Use cryogen cooling or combination of chilled-air with clear gel
  - Usually one but occasionally two treatments required
  - Works well for spider nevi, cherry angiomas and venous lakes
  - Venous lake normally shrinks and decolourizes / spiders and cherry angiomas normally darken in colour, even to black
LP Alexandrite Treatment Vascular Lesions

- Is for Advanced Users ONLY
  - Dermatologists with laser experience
  - Everyone else should use LP Nd/YAG instead!!!

- Can be used to treat the following:
  - Port wine stains
  - Hemangiomas
  - Facial and leg veins (though LP Nd/YAG is easier, with less risk of hyperpigmentation)
  - Cherry angiomas (though LP Nd/YAG is easier)