



## Lasers for Cosmetic Therapy

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## Cosmetic Lasers - Overview

- Lasers have had applications in aesthetic photomedicine since their development in the **1960s**
- In 1981 Anderson & Parrish published work outlining principles of laser treatments – the Theory of Selective Photothermolysis
- Intense Pulsed Light (IPL) systems were developed in the early **1990s**
- Now ubiquitous in high street clinics and beauty salons



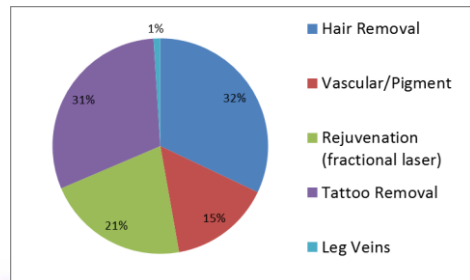
## Cosmetic Lasers - Overview

- The UK market for cosmetic interventions (consumer value) was worth £2.3 billion in 2010 and is estimated to rise to £3.6 billion by 2015\*
- Non-surgical interventions (which includes laser treatments) are estimated to account for 90% of all these procedures and 75% of the market value\*
- It was reported (at the recent BMLA conference) that in 2012 there were more laser tattoo removal treatments than Botox procedures undertaken in the USA

\* Review of the Regulation of Cosmetic Interventions (Department of Health April 2013) aka The Keogh Review



## Cosmetic Lasers - Overview



Proportion of total Laser treatments at The Lynton Clinic (Jan – May 2014)



## Who Can Do These Treatments?

- Anyone! No legal requirements to have any basic training
- Previously, there was a requirement (in England) to be registered with the Care Quality Commission, but since October 2010 this only applies to **Health Care Professionals** treating 'Disease, Disorder or Injury'



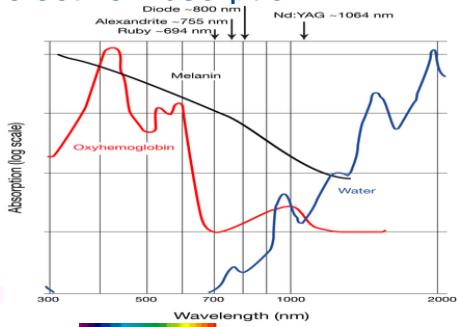
## Selective Photothermolysis

- Choose a wavelength that will be **preferentially absorbed** by the target (required to be destroyed) but NOT well absorbed by other chromophores in the skin.
- The irradiating pulse duration should match the **thermal relaxation time** of the target.
- The Fluence should be high enough to cause selective damage to the target

Reference:- Anderson R & Parrish JA. "Microvasculature can be Selectively Damaged using Dye Lasers: A Basic Theory and Experimental Evidence in Human Skin". *Lasers in Surgery and Medicine* 1: 263 – 276 (1981).



## Selective Absorption



Zachary CB, Gustavsson M (2012) TRASER - Total Reflection Amplification of Spontaneous Emission of Radiation. PLoS ONE 7(4): e35899. doi:10.1371/journal.pone.0035899

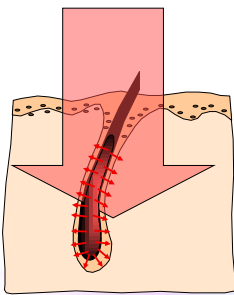
## Flashlamp or IPL Systems



Versatile, filtered broadband systems; used for hair removal (650-1100nm), vascular lesions and skin rejuvenation (550-1100nm)

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## Hair Removal



- Choose **wavelength** which **targets melanin** but is not well absorbed by other chromophores.
- The hair shaft acts as the target body and absorbs the energy
- Heat will thermally diffuse outwards into the surrounding follicle (but not the surrounding tissue)
- If **energy** is high enough, long-lasting damage will be sustained

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## Expectations and Outcomes

- Hair **must contain melanin** to be heated
- White/grey/blonde hairs cannot be treated
- Hair thickness change (terminal into vellus) or lightening is considered to be a good outcome
- Typically 6 – 12 treatments depending on hormonal conditions and hair growth cycle.
- **Maintenance** treatments are often necessary

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## Hair Removal



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## Hair Removal



After 4 Treatments



Notice remaining hair is finer and softer

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## Hair Removal



After 4  
treatments

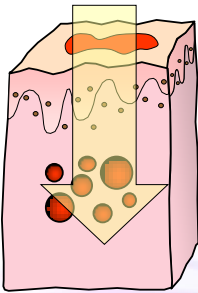


## Latest Advances – Mixing Wavelengths

- A number of laser systems now combine multiple wavelengths (usually Alex (755nm) and Nd:YAG (1064nm))
- Used for treatment of "border line" skin types where the Alexandrite alone may be too aggressive and the Nd:YAG 1064 nm alone not effective enough
- Treatment of sun exposed skins and fine hairs in darker skins
- Possible reduction in pain when compared to treating with Nd:YAG alone
- Possible improvement on fairer hairs (studies show up to 60% reduction in 4 sessions).



## Vascular Lesions



- Wavelengths absorbed by haemoglobin are used to create a heating effect which destroys the vessels.
- Shorter wavelengths are used for superficial lesions (e.g. PDL at 595nm, KTP at 532nm, IPL) while longer wavelengths treat deeper lesions (e.g. Nd:YAG at 1064nm)



## Facial Vessels



Before and after 3 IPL  
treatments (550-  
1100nm)



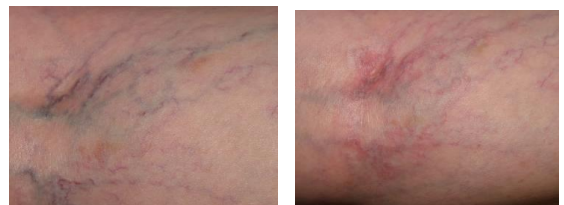
## Rosacea



Before and after only 1 IPL treatment at 30J/cm<sup>2</sup>



## Nd:YAG Vascular Treatments



Longer wavelengths (1064nm) are used for deeper vascular lesions such as leg veins



## Port Wine Stains



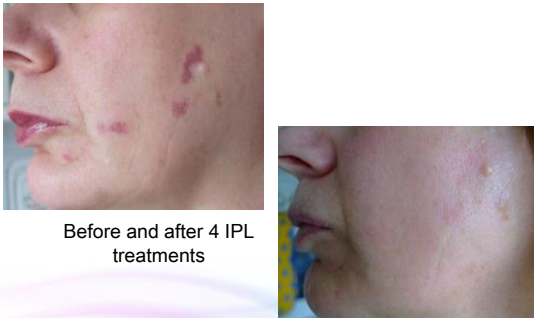
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## Port Wine Stains



After 12 treatments with the Pulsed Dye Laser (585nm).

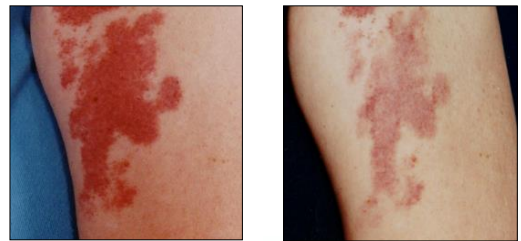
## Port Wine Stains



Before and after 4 IPL treatments

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## Port Wine Stains



After 2 treatments

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## PWS Response to Laser Treatment

- Complete clearance 10%
- Improvement 70%
- Little or no response 20%
- Face responds best, limbs worse.
- Pulsed Dye Laser at 585/595nm considered to be gold standard, but KTP, IPL, Nd:YAG and Alex all shown to be effective.

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## Lasers for Pigment

- Q-Switched lasers are 'Gold Standard' for treatment
- Superficial lesions (such as lentigines and seborrhoeic keratoses) may be treated with long-pulsed Alex or IPL

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## Pigmented Birthmarks



Treatment of  
café au lait  
macules



## Pigmented Birthmarks



## Sun-Induced Pigment

Before and after only 1  
IPL treatment



Left hand subsequently  
treated with the same  
result



## Sun-Induced Pigment



Before and after only 1 IPL treatment



## Melasma



- Hypermelanosis of sun exposed area related to hormonal activity
- Symmetrical hyperpigmented patches
- Can be confluent or punctate
- Commonly cheek, upper lip, chin, forehead
- IPL/lasers usually not recommended – recurrence is common



## Anti-Ageing Treatments



Prevention is better than cure – use sunscreen!  
Unilateral Photodamage - Case report in New England J.  
Medicine – 66 year old man was a Chicago truck driver for  
28 years



## History of Skin Rejuvenation

- **Ablative Resurfacing** (CO<sub>2</sub> & Er:YAG) is the Gold Standard for skin rejuvenation but has **significant side effects**
- **Non-ablative** procedures excellent for **improving skin tone/colour**, but efficacy is limited for skin texture/wrinkles
- Fractional rejuvenation was introduced in 2004 to overcome these problems – good for **acne scarring**, stretchmarks, overall skin rejuvenation

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## Before and After CO<sub>2</sub> Treatment



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## Before and After CO<sub>2</sub> Treatment



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## After CO<sub>2</sub> Treatment

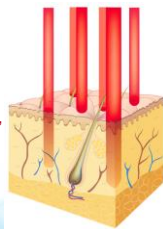


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## What is Fractional Photothermolysis?

Multiple microscopic laser beams create arrays of superheated thermal wounds that extend from the epidermis down to the reticular dermis (up to 1000µm)

- Multiple microscopic beams cause defined zones of thermal damage
- Diameter of each column is approx 50-350µm depending on system
- No thermal damage of surrounding tissue, leading to quick healing
- Induces synthesis and remodeling of collagen

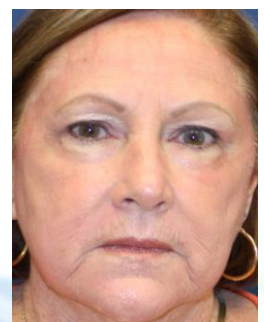


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## Fractional Ablative CO<sub>2</sub> Treatment



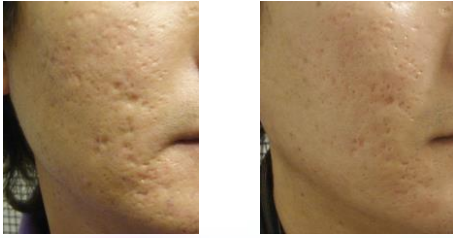
Baseline



7 days post Youlaser treatment

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## Fractional Treatment - Acne Scarring



Courtesy of Dr.Y.Lee

Pre-Tx

Post- 4<sup>th</sup> Tx with  
Fractional Er:Glass

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## Fractional Treatment - Stretchmarks



Courtesy of Dr.Y.Lee

Pre-Tx

Post-5<sup>th</sup> Tx

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## Fractional Treatment - Scarring



Courtesy of Dr.Y.Lee

Pre-Tx

Post- 3<sup>rd</sup> Tx

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## Photo-Mechanical Effect

- This effect occurs when tissue is rapidly heated using very high peak powers, causing thermal expansion of tissue and shock waves
- Q-Switched lasers are needed
- This effect is used in [Tattoo Removal](#)

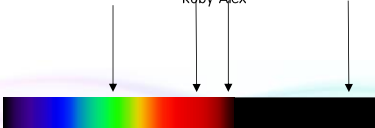


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## Tattoo Removal Lasers

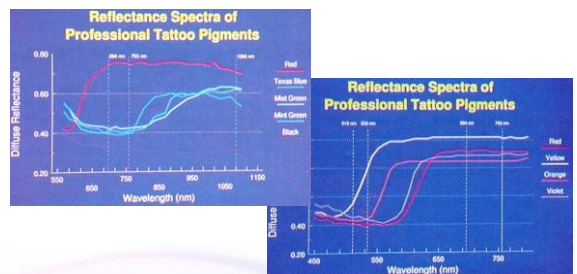
- A [Q-Switched laser](#) is required
  - Nd:YAG 1064nm (Black/Blue Tattoos)
  - Nd:YAG 532nm (Red Tattoos)
  - Alexandrite 755nm (Green Tattoos)
  - Ruby 694nm (Green Tattoos)

KTP      Ruby      Alex      Nd:YAG



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## Tattoo Removal Wavelength Selection



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## Tattoo Removal

Treatment of amateur and professional tattoos.



A whitening effect can be seen immediately. This is caused by the ejection of particles and vapor from the skin



## Before & After



Treatment of amateur tattoos. After 2 Nd:YAG treatments



## Before & After



## Before & After



After treatment with a Q-Switched Nd:YAG laser (1064nm & 532nm)



## Before & After



After 6 treatments with a Ruby (694nm) & KTP (532nm) laser



## After 6 Nd:YAG Treatments



30 year old cover-up tattoo. Note good clearance of black and red but no improvement of green

Photos courtesy of Woody's Tattoo Studio





## Fading for Cover-Ups



Photos courtesy of Woody's Tattoo Studio



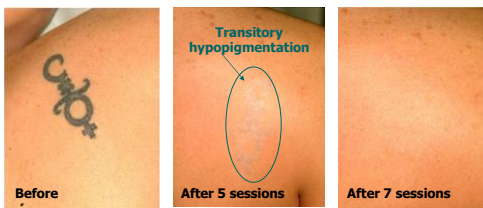
## Resistant Tattoos



Tattoo comprised of acrylic pigment before and after 7 treatments



## Pigmentation Changes



- Usually resolve in time
- Less likely with 1064nm



## Side Effects

- On the whole, side effects are minimal and transient (include mild burning or blistering, pigmentation changes, scarring)
- Usually related to operator error, using inappropriate wavelengths or treating suntanned skin
- Higher melanin content of darker skins means caution required



## Conclusions

- Lasers and IPL are **excellent tools for many skin applications**, but they are not a 'magic wand'
- Recent developments, such as fractional lasers and mixed wavelength systems may mean we're able to offer **safer, more effective** treatment of previously troublesome skin types and skin conditions



### THE UNIVERSITY OF MANCHESTER AESTHETIC LASER COURSES

- Suitable for anyone operating Laser or IPL systems, or those wanting to extend their background knowledge in this growing field
- All courses delivered by specialist tutors and university lecturers
- The first training course within the Aesthetic Laser Industry developed in collaboration with an Institute of Higher Education
- Delegates receive certification from the University of Manchester
- Courses are held in partnership with Lynton at their Centre of Excellence training facility in South Manchester



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