# Laser Certification Review

Certified Laser Operator / Aesthetic

www.LaserCertification.org



## Written Examination

- 100 (CLO-A) Multiple Choice Questions
  - 1 Correct (Best) Answer
- 70% Required for Passing
  - can miss up to 30 Questions
- 3.0 Hours allotted for completion
- Closed Book. “Controlled” breaks allowed.

## Certification Status

- Full Certification requires successful completion of the proctored examination, plus the experience and background requirements.
- Course participants may submit the additional materials at a later time, and have up to 5 years to complete the experience requirement.
- Those passing the exam but still awaiting completion of other requirements are designated a “Certification Candidate” and will receive the appropriate Certificate.

## Exam Content Areas

The examination tests for a knowledge of medical laser and energy concepts, and safety. It is not a test of specific medical procedures, though the exam sometimes uses a clinical setting to test for the underlying concepts. Specific clinical aesthetic laser concepts will be tested.

## Exam Content Areas

The areas of testing for various NCLC Laser Certifications basically boil down to the areas of:

(1) Laser Concepts
(2) Tissue Effects, and
(3) Safety

- as defined by the American Society for Laser Medicine & Surgery, and ANSI in their recommendations.

## Exam Content Areas

For the CLO-A Credentials:

| | | |
|---|---|---|
| Safety – | 60% | 60 Q |
| Laser & Energy Concepts – | 25% | 25 Q |
| Tissue Interactions – | 15% | 15 Q |

## # of Questions by Area

SAFETY

- Administrative – 3
- ANSI Regulations – Agencies – 8
- Eye-Skin Hazards – 12
- Non-beam Hazards – 2
- Hazard Evaluation & Control – 1
- Safety Practices - 15

## # of Questions by Area

SAFETY

Additional Safety Related Questions come under specific questions related to Aesthetic Laser Procedures

13 Questions

# # of Questions by Area

Anatomy & Physiology

- Skin & Hair Biology - 9

# # of Questions by Area

LASER & ENERGY CONCEPTS

- Physics - 2
- Optical Principles - 3
- Energy Concepts - 5
- Wavelength Identification - 7
- History - 1
- Equipment Considerations - 7

# # of Questions by Area

TISSUE INTERACTIONS

- Thermal – 12
- PhotoAcoustic – 0
- PhotoChemical – 0
- PhotoDisassociation – 0
- Stimulative Effects - 0

# Review Format

Each slide in this review will relate to the “Content Area” classification of a specific question on the exam, but will not be specific about the question asked, although the answer to a question will be on that slide.

Each slide will note the category of the content area covered, and it is possible that more than one question is asked within that slides content area.

## Review Format

This Laser Certification review is NOT intended to be a primary teaching program. It is intended to review the key concepts covered in the NCLC Laser Certification examinations.

Those not having previous training in these areas are referred to outside courses & home study programs.

See www.LaserTraining.org

## Anatomy & Physiology

### Skin Anatomy

- Epidermis – outer layer of skin
  - Stratum Corneum – the outermost layer of the epidermis
  - Melanin – contained within the epidermis and is a major absorber of laser light – competing with the hair follicle
  - Preventing excessive heating of the epidermis (mostly because of melanin absorption) is a critical consideration in all dermatological skin procedures including laser hair removal and treatment of vascular lesions

## Anatomy & Physiology

### Skin Anatomy

- Dermis – deeper middle layer
  - Papillary Dermis – the first layer of the dermis – looks pink when doing ablative resurfacing
  - Reticular Dermis – the deepest layer of the dermis – has a yellowish “chamois cloth” appearance when doing ablative resurfacing. Never “lase” deeper than this level.

## Anatomy & Physiology

### Skin Anatomy

- Dermal/Subcutaneous Fat Interface – below Dermis
  - separates the reticular dermis from underlying subcutaneous tissues. Ablating past this level in ablative resurfacing, or lethally heating it in laser hair removal or other procedures, causes a third degree burn and possible keloid scars since the dermis cannot regenerate.

## Anatomy & Physiology

### Skin Anatomy

- Subcutaneous Tissues
  - Everything below the dermis. Includes subcutaneous fat and is the source of blood vessels & nerves entering the dermis. Destroying skin to this level will create a third degree burn.

## Anatomy & Physiology

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## Anatomy & Physiology

### Skin Color

- The primary determinant is skin melanization
- Skin vascularity and thickness also serve to determine general skin color

## Anatomy & Physiology

### Skin & Hair Biology
### HAIR TYPES

- Terminal Hairs – Course hairs found on the scalp, eyebrows, armpits & bikini area
- Velus Hairs – fine “peach-fuzz” hair covering most of the body
- Hair growth from either arises within the hair follicle.

## Anatomy & Physiology

Skin & Hair Biology
Hair Growth Phases

- Anagen – Growth phase where it is most susceptible to laser treatments
- Catagen – Regression/atrophy phase where nourishment is cut off
- Telogen – Dormant phase where the follicle falls out (sheds). The hair bulb can survive laser treatments in this phase.

## Anatomy & Physiology

Skin & Hair Biology
Hair Growth Phases

- Different body areas have differing time periods for growing & dormant stages. These vary from 2-6 years (growth cycle) for the scalp, to 3-4 months in the bikini or axillary (armpits) area. Most are 4-12 months.

(HINT: If you see only ONE bullet point on a slide like this, you're pretty much assured that you are looking at the answer to a question on the test ! )

## Anatomy & Physiology

Skin & Hair Biology
Hair Growth Phases

- Not all of the hairs in any given area are in the same phase at the same time. That is why multiple laser treatments are required. If they were all in the same phase, then we would completely shed hair in that area at certain intervals.

## Anatomy & Physiology

Fitzpatrick Skin Types I-VI

- The higher the number, generally the darker the skin, but is primarily an indication of how one burns in the sun. The darker the skin, the harder it is to treat by laser without burning.
- This scale is the primary determinant of choice of laser type and settings for laser hair removal
- Darker skin types generally require longer wavelengths (and pulse widths) to prevent skin burning (i.e. diode or Nd:Yag lasers)

## Anatomy & Physiology

Fitzpatrick Skin Types I-VI

- I – Fair Transparent Skin that always burns in the sun – never tans.
- II – Fair Skin that always burns, but sometimes tans with difficulty
- III – Fair to light olive Skin that sometimes burns mildly, and tans slowly

## Anatomy & Physiology

Fitzpatrick Skin Types I-VI

- IV – Olive to light brown Skin that rarely burns and tans easily
- V – Dark brown Skin that very rarely burns and always tans
- VI – Black Skin that never burns and always tans

## Anatomy & Physiology

Skin Anatomy

Apocrine Glands:

Glands in the skin responsible for “Pheromes” and sexual arousal.

They secrete out the hair follicle channel along with the Sebaceous Glands

## Anatomy & Physiology

Skin Anatomy

Eccrine Glands:

Glands in the skin responsible for Sweat. This helps regulate body temperature through evaporation.

## Anatomy & Physiology

Skin Anatomy

Sebaceous Glands:

Glands in the skin responsible for production of oils for lubrication of the skin and help retain fluids. They are also the site of the P. Acne bacteria responsible for Acne.

## Laser & Energy Concepts

LASER ACRONYM

L IGHT
A MPLIFICATION, by the
S TIMULATED
E MISSION of
R ADIATION

## Laser & Energy Concepts

Wavelength Measurement

| Measurement | Scale | Example |
|---|---|---|
| Micrometers: | $10^{-6m}$ | .532 um |
| Nanometers: | $10^{-9m}$ | 532 nm |
| Angstroms: | $10^{-10m}$ | 5,320 A |

(most medical laser use described this way)

Also know visible color bands:

Approximate Range: 400 (purple) -700 nm (deep red)

## Laser & Energy Concepts

Wavelength Identification
7 Questions on CLO-A

| | | |
|---|---|---|
| $CO_2$ – 10600nm<br>Nd:Yag (harmonic) 1380nm<br>Diodes – 810 nm is common, but typically 530-1500nm<br>Alexandrite – 755nm<br>Helium Neon (HeNe) 632<br>KTP (& KDP) – 532nm<br>Argon – 488, 515nm | Er:Yag – 2940nm<br>Nd:Yag – 1064nm<br>Ruby – 694nm<br>Gold Vapor – 632nm<br>CW Dye (PDT) 630<br>ArFl Excimer 193nm<br>XeCl Excimer 308nm | Ho:Yag – 2100nm<br>Krypton – 647, 568, 531<br>Copper Bromide 577,510<br>Pulsed Dye, 578-600nm (Vascular)<br>Pulsed Dye, 504nm (Lithotripsy) |

Also know visible color bands to make it easier to remember:

Blue ~ 488nm, Green ~ 504-532nm, Yellow ~ 568-585nm, Orange ~ 585-595nm, Red ~ 632-694nm

## Laser & Energy Concepts

HISTORY

- Albert Einstein – theory of stimulated emission based on photovoltaic cells
- Schawlow / Townes – theoretical paper on "Optical Masers" (a laser)
- Ted Maiman – First Laser – Ruby, 1960
- Dr Leon Goldman – father of lasers in medicine & co-founder of the ASLMS

## Laser & Energy Concepts

Optics Principles - Focusing
(focusing lens – not collimated)

- Focal Length – distance from lens where the spot size is smallest
- Focal spot – point where the spot size is smallest
- Depth of Field – distance around focal spot where the spot size does not appreciably change (a "waist" in the focused beam)

## Laser & Energy Concepts

- Power Density (PD) effects on Tissue
- Power Density Parameters
  - Spot Size (Rapid Change in PD)
  - Power (Slower Change in PD)
- Techniques of changing Power Density with different delivery devices (i.e. focusing or collimated handpieces, bare fibers, waveguides)
- In aesthetics too High a PD can create burns & blistering. (also applies to excessive fluence)
- In aesthetics too Low a PD is generally safe, but ineffective for the treatment. (low fluence too)

## Laser & Energy Concepts

Physics:
<u>Radiant Exposure - </u>Joules/cm$^2$

This is a measurement of the "dose" of light in energy per surface area, or Joules/cm$^2$. This is the correct term, but in medicine / aesthetic laser use it is more commonly referred to as "Energy Density" or "Fluence" of the laser spot.

## Laser & Energy Concepts

Equipment Considerations:
Laser Settings for patient treatment

- Lasers for most aesthetic procedures are set to a targeted energy density expressed in Joules/$cm^2$
- This includes pulsed dye lasers for vascular; hair removal lasers such as alexandrite, diode or Nd:Yag; and others.

## Laser & Energy Concepts

Pulsed Laser Emission

- A compression of laser energy which emits power (watts) at a higher rate than is otherwise attainable in CW (Continuous Wave) mode
- This is different than a simple “timer” on a CW beam, which is sometimes called a “Gated Pulse”
- Is more thermally “precise” on tissues than CW mode

## Laser & Energy Concepts

FLUX

- Concept of delivering more energy in shorter time periods, in a pulse, to reduce thermal spread.
- 1W at .2s (.2J) is lower flux than 2W at .1s (.2J still).
- Look at the concept, and balance the power and time settings to see which is a higher flux.

## Tissue Interaction

Laser Pulsing

- Higher Fluxes from laser pulses result in less thermal spread (better thermal precision) from the intended target when used in thermal applications such as skin resurfacing, hair removal, removal of surface vascular marks, fine incisions, etc.

## Laser & Energy Concepts

Typical Power/Energy Display & Measurement:

General Rule

- CW Lasers – Watts or MilliWatts (rate of energy delivery)
- Pulsed Lasers – Joules or MilliJoules (how much energy actually delivered)

## Laser & Energy Concepts

- Typical Power/Energy Display & Measurement:
- Watts: $CO_2$, CW Nd:Yag, CW Dye, Argon, Many Surgical Diodes
- Milliwatts: Ophthalmic Diode Laser
- Joules: Ho:Yag, Alexandrite, Ruby, Pulsed Dye for vascular, Q-Switched Tattoo Nd:Yag
- Millijoules: Q-Switched Ophthalmic Nd:Yag, Pulsed Dye for lithotripsy

## Laser & Energy Concepts

Optical Principles

- Collimated – minimally divergent, like any point source of light.
  - The larger the diameter of the collimated beam (through a lens), the smaller the spot to which it may be focused
  - The larger the diameter of the collimated beam, the less the divergence of the beam.

## Laser & Energy Concepts

Optics Principles - Beam shapes

- Sinusoidal “TEM00” best for sharp incisions and ablations
- “Flat Top” or “Top Hat” type modes preferred for aesthetic procedures including laser hair removal

## Laser & Energy Concepts

Equipment Considerations – Delivery Systems

- Articulated Arms used on $CO_2$ and Er:Yag lasers because of the wavelength.
- Articulated Arms used on tattoo lasers such as Ruby or KTP/Nd:Yag because of the high energy pulses
- Most other lasers use fiber delivery which may terminate into a dermatological handpiece

## Laser & Energy Concepts

Equipment Considerations – Purge Gas on $CO_2$ Laser Handpieces

- Usually compressed air or Nitrogen from a tank
- Must be filtered with a suitable inline filter
- Primary purpose is to keep smoke out of the handpiece and off the laser lens
- Secondary purpose is to reduce charring on tissue during ablation

½ way there

## Tissue Interactions

### Chromophore

- Refers to the object that absorbs that particular wavelength of light. In dermatological laser procedures the two primary competing chromophores are melanin in skin and oxyhemoglobin in blood vessels

## Tissue Interactions

### Chromophore

- Objects reflect light of their own color, and absorb its opposite. Therefore red pigment in a tattoo would reflect the red light from a Ruby laser and be ineffective.

## Tissue Interactions

Laser Hair Removal

- Target is the hair bulb and "bulge" of the hair follicle, and the matrix of nerves and vessels surrounding the hair bulb. Melanin around the follicle is the target chromophore.
- Laser Hair Removal works by selectively heating these targets to lethal temperatures
- Steps must be taken to prevent overheating of the skin at the same time

## Laser & Energy Concepts

Equipment Considerations
Skin Cooling

Multiple methods may be used for skin cooling to prevent burns & include:

- Cooling Gels
- Cryogen sprays
- Chilled Crystal windows such as sapphire plates used for contact cooling of the skin
- Cold Air Chillers to blow refrigerated air on skin

## Laser Safety

Safety Practices
Skin Cooling

Overcooling of the skin could make treatments like laser hair removal less effective, but appropriate skin cooling is always provided in order to:

- Reduce the risk of blistering and burns
- Reduce swelling & inflammation
- Reduce patient discomfort

## Laser Safety

### Safety Practices

- Excessive Heating of Skin
  - Developing strategies to prevent or control excessive skin heating is critical to all dermatological laser procedures.
  - Blistering can potentially lead to infections.
  - Scarring, including Keloids, or hypo or hyperpigmentation can also result.

## Tissue Interactions

Laser Hair Removal

- Ideal patient has light skin, dark hair, and is not overly sun sensitive.
- Difficult or impossible to treat would be gray or white hair – especially on dark skin. This is a relative contra-indication.
- Other methods for treating light hair include Photodynamic Therapy or Radio Frequency Electrical methods (aside from electrolysis)

## Aesthetic Procedures

Laser Hair Removal, Tissue Effects

Ensuring first that no blistering or burning is created on skin, good indications of the clinical end point for laser hair removal can include ejection of the hair shaft stub from inside the follicle, or redness & swelling around the hair shaft (perifollicular edema).

## Laser Safety

Safety Practices:
Skin prep for Laser Hair Removal

- Cleanse & Shave only
- If area is not shaved the energy will be wasted on exposed hair shaft, plus the vaporizing hair shaft can contribute to skin burns, or burn the delivery device such as contact windows or IPL filters.

## Laser Safety

Safety Practices:
Skin prep for Laser Hair Removal

- If area is tweezed or waxed then you've removed the primary target for the laser to generate heat at the follicle, and the laser treatments will be ineffective. If performing electrolysis first, the same applies, but there is no reason for laser treatments after electrolysis.

## Laser Safety

### Safety Practices - Laser Hair Removal

The medical treatment protocol developed for any facility for Laser Hair Removal will define relative contra-indications, and these may include:

- Sun Sensitivity (not extreme) – Red heads can sometimes be placed in this category. This can be balanced with the energy settings and does not preclude treatment.

## Laser Safety

### Safety Practices - Laser Hair Removal

Stronger relative contra-indications may include:

- Photosensitizing medications – (i.e. accutane)
- Active Infections such as herpes, cold sores, etc.
- Dark Tan in a Caucasian (send them away until the tan fades, or sometimes can use bleaching creams to speed the process)
- History of Keloid scarring in family

## Tissue Interactions

### Thermal Relaxation Time (TRT)

- Amount of time required for a target to dissipate heat (time to return to ½ of peak temperature)
- Smaller objects have shorter TRT's – will get hotter, faster than larger objects, and then lose their heat more quickly

## Tissue Interactions

### Thermal Relaxation Time (TRT)

- To "kill" an object with heat (i.e. hair follicle), the clinically effective dose of light must be delivered in a time shorter than its TRT – otherwise it will shed the heat and survive.

## Tissue Interactions

### Thermal Relaxation Time (TRT)

- To spare adjacent structures that also might absorb the light (epidermis), the time period should be longer than its TRT – so that it can dissipate the heat and survive.

## Tissue Interactions

### Typical Thermal Relaxation Times

- Hair Follicle – 40-100 milliseconds
  *larger follicles have longer times*
- Epidermis – 3-10 milliseconds

Therefore a theoretically ideal laser pulse (at clinically effective doses) for hair removal would be from 10-40 milliseconds

## Tissue Interaction

### Laser Pulsing

- Repetition Rates (frequency) of the laser pulse (usually in pulses per second) relate mostly to convenience for the user, and comfort for the patient. Slower repetition rates take longer, but allow for better heat dissipation so that it usually is less painful for the patient and better tolerated.

## Aesthetic Procedures

### Non-ablative Skin Rejuvenation

- A variety of lasers, other light sources (IPL) or RF electricity may be used.
- Works by causing non-destructive deep dermal heating, which in turn creates a slight inflammatory reaction.
- The natural healing process induced by the inflammation creates the rejuvenation through enhanced collage production and tightening of skin.
- Multiple treatments are required

## Aesthetic Procedures

### Non-ablative Skin Rejuvenation

- A variety of lasers, other light sources (IPL), or RF electricity may be used including:

Yellow light pulsed dye or CuBr lasers (578-595nm)
Diode lasers from ~ 810-1500nm
Nd:Yag lasers at 1064nm, Er:Glass at 1540nm
others --

## Aesthetic Procedures

### Full Surface Ablative Skin Resurfacing

- Er:Yag much more superficial than $CO_2$ laser ablations (only 20-50$_u$ depth with Er:Yag)
- Er:Yag less painful than $CO_2$ because it avoids the depth of most of the nerves
- Significantly less down time with Er:Yag for healing than $CO_2$ laser ablations
- Er:Yag much safer on dark skin than $CO_2$ because it is very superficial and avoids "de-melanizing" the skin, which otherwise could cause severe, long term hypo-pigmentary changes in the dark skin.

## Aesthetic Procedures

### Full Surface Ablative Skin Resurfacing

- $CO_2$ full thickness laser ablation is much more aggressive and can produce more dramatic results, at the price of significantly increased recovery time and discomfort.
- Fractional laser resurfacing is a method that avoids complete ablation of the surface, so results in less disfigurement and quicker healing.

## Aesthetic Procedures

### Pigmented Lesions

- Removal of lesions such as freckles, age spots, lentigenes, etc
- Green light lasers such as CuBr or KTP are primarily used, including green light diodes.

¾ way there

## Aesthetic Procedures

### Vascular Lesions

- Removal of lesions such as port wine stains, telangiectasia, rosacea, cherry angiomas, etc
- Yellow light lasers such as Pulsed Dye or CuBr are primarily used, but can also use green light KTP or green diodes for smaller areas
- Initial target is the oxygenated hemoglobin within the red blood cells in the capillaries. They then pass their heat into the capillary wall through conduction and the vessel immediately or gradually atrophies and absorbs.

## Laser Safety

### Applicability of ANSI Z136.3 Standards

Applies to ALL Health Care Settings Including

- Hospitals & Surgery Centers
- Small medical clinics & offices
- Mobile laser vans & services
- Medical Spas & Cosmetic Centers
- Anywhere a laser is used on a person

## Laser Safety

### ANSI LASER HAZARD CLASSIFICATIONS I-IV

- Based on the ability of the energy to injure personnel or the patient
- All Surgical Lasers are Class IV
- Class IV – all precautions required all the time in the NHZ (wear safety glasses)
- Anything over 0.5w average power or anything that burns eye or skin is Class IV

## Laser Safety

### Medical Laser Safety Officer

- Appointed by the facility administration
- Administers the Laser Safety Program
- May or may not run actual equipment
- No particular background nor education required
- Utilizes many different resources in order to manage the Laser Safety Program
- Required by ANSI in all health care facilities that utilize lasers. (Including medical spas & offices)

## Laser Safety

Medical vs. Industrial/Scientific LSO's

- Both are required by ANSI to be appointed by their respective facilities
- Industrial/Scientific based upon ANSI 136.1
- Medical based upon ANSI 136.3
- Need for measurements for Medical LSO's is minimized because of Laser Classification scheme required of medical laser manufacturers

## Laser Safety

### Administrative Controls

LSO responsibilities:

It is for overall management of the safety program to include education of staff, protective measures implemented (safety glasses), program monitoring, etc.

It is NOT to establish or enforce clinical treatment parameters or protocols – they implement those established by their medical director.

## Laser Safety

### Administrative Controls

LSO responsibilities:

- Standard Operating Procedures
- Documentation of Laser Training
- Documentation of Laser Service
- Annual Laser Safety Audits conducted
- Establishment of Credentialing standards

## Laser Safety

Nominal Hazard Zone (NHZ)

- Area where eye or skin burn really occurs (Where the MPE is exceeded)
- Can be designated the entire room, but is not required to be
- The NHZ is determined solely by the Medical Laser Safety Officer using manufacturer recommendations, their own informed judgment, or measurement or equivalent means.

## Laser Safety

Laser Treatment Controlled Area (LTCA)

- The entire laser room, or a designated area in a very large room
- Signs required on all entryways
- Safety glasses provided, but are not required to be worn until within the NHZ
- Occupied only by authorized personnel trained in Laser Safety

## Laser Safety

Laser Operator Functions

- Ensure policies/procedures followed
- Signs on doors & windows covered when applicable.
- Glasses available, and worn in NHZ
- Aiming beam checked for alignment with surgical beam on *every case*. (when they are different lasers)
- Must be personnel that are authorized by the facility & trained both in Laser Safety & Operation of the Laser.

## Laser Safety

Safety Practices

Laser Nurse / Technician Operator

- Post Laser Signs on room entrances & ensure glasses are available & worn in the NHZ
- Monitor room for compliance with laser safety policies
- It is NOT their responsibility to ensure that physicians use the correct laser parameters.
- If they are a sole aesthetic operator they use parameters within guidelines as previously determined by their physician director/supervisor.

## Laser Safety

Eye – Skin Hazards

- Hazard levels for eyes are determined by a value known as the MPE – Maximum Permissible Exposure (MPE) level for the cornea or retina.
- Safety Glasses Optical Density value is designed to keep the MPE below the hazard level.
- Laser Safety Glasses are NOT designed to protect from direct impacts of the laser into the eyes through the glasses (reflections only).

## Laser Safety

Retinal Hazards – Depends on Wavelength

- All wavelengths which pass through fluid
- Incorporates all visible light lasers
- Between approximately 400-1400nm
- Practical difference between hazards of visible vs. infrared. (Because of aversion response)
- Lens of eye increases power density on Retina by 100,000 times.

## Laser Safety

Aversion Response

- The body's reaction to "jerk" away from bright light sources (aversion to bright light)
- Considered to be 0.25s
- Those visible lasers that cannot exceed the MPE (Maximum Permissible Exposure level) within this time are considered eye-safe
- The aversion response time is not fast enough to guarantee protection from Class IV lasers, but it would reduce one's exposure

## Laser Safety

Corneal Hazards – Depends on Wavelength

- All wavelengths which do NOT pass through fluid
- From 1400nm on up, and 400nm on down
- Includes CO2, Er:Yag, YSCC, Ho:Yag, Er:Glass, Xe:Cl and Ar:Fl excimers.

## Laser Safety

Laser Protective Eyewear

- Should always be worn within the NHZ
- Does NOT guarantee protection from direct impacts from the laser beam for retinal hazards (It is MOST IMPORTANT to not allow the beam to be directed toward one's face)
- Must be labeled according to the Wavelengths & Optical Density (O.D. or degree of protection).
- O.D. is a logarithm. I.E $10^4$ = OD 4, so a change from 4-7 is a 1000 fold increase in attenuation. (tenfold for each unit of O.D.) Higher numbers offer more protection.

# Laser Safety

Safety Practices
Glass Transmission

- Lasers that don't transmit through glass include $CO_2$, Er:Yag, Ar:Fl, and present superficial corneal burn hazards.
- Glass in optics of scopes & instruments afford protection to the viewer
- Window glass affords protection to outside viewers so that no coverings are required (for those lasers from 300-2800nm)

# Laser Safety

Window Coverings

- Must be flame retardant when used
- Applies only to wavelengths that transmit through glass
- Required only when the window is located within the NHZ of the room.
- Any material opaque to the wavelength is sufficient
- Consideration given to use of barriers at doorways in special circumstances

# Laser Safety

Safety Practices – Instrument Reflections

- Not a major practical problem, but a consideration around sensitive areas (esp. the eye).
- Ebonizing instruments just creates a black color and doesn't affect the reflection much – especially from IR lasers.
- Anodizing an instrument creates a "roughened" micro-surface on the instrument that helps to disperse the reflection.
- The major problem is reflection from a flat metal surface in close proximity to a sensitive area (i.e. eye, teeth, etc.)

# Laser Safety

Fire Hazards

- Water available for quenching flames (irrigation solutions on backstand are OK)
- Fire Extinguisher immediately available (does not have to be in the room)

(From ANSI recommendations)

## Laser Safety

Laser “Radiation”

- Non-ionizing type of radiation (not like X-Ray (lasers emit light – a radiant body)
- Used on warning signs and labels
- Wavelength of the “radiation” must be listed on the warning signs
- No hazard during pregnancy

## Laser Safety

Indirect Laser Hazards
(Non-Beam Hazards)

- Laser Plume
- Electrical – this is probably the most significant hazard to Repair Technicians, including direct laser beam hazards, but for other personnel is not much different than other surgical equipment
- Dyes & Solvents
- Laser Gases

Next to Last!

## Laser Safety

Safety Practices

Aesthetic Procedures performed by non-medical personnel

Even though a well trained non-medical technician can very effectively perform aesthetic laser procedures, the most significant risk is that they may misdiagnose or miss entirely a skin condition that is detrimental to the patient. This is why many state’s have varying requirements of “physician supervision” for these procedures.

FINISHED !