LASER SAFETY EDUCATION FOR PHYSICIANS: CHILDREN'S HOSPITAL & MEDICAL CENTER

Lasers Available at Children's Hospital & Medical Center

1. **Ceralis Ceramoptic Diode Laser – Class IV Laser**

   55cm Wavelength = 980nm near infrared light – Laser beam absorbed in water and hemoglobin. Laser energy can be directed in a precise manner to achieve desired cutting, coagulation or vaporization effects by selection of specific probe.

   Eyewear = OD of 5 should protect from Gallium Aluminum Arsenide (Ga Al As) laser radiation in the range of 950-1010nm

2. **Iris Oculight SLX Diode Laser = Class IV Laser**

   520cm Wavelength = 810nm invisible laser beam – Laser beam absorbed in water and hemoglobin

   Eyewear = OD of 2.0 or >@800-840nm
   *All personnel in the room shall wear safety glasses even when laser indirect ophthalmoscope or slit lamp adapter is used.

3. **CO2 Laser (Sharplan 30c) = Class IV Laser**

   10.6 micron Wavelength = 10,600nm far infrared beam – Laser beam highly absorbed by water content of tissue.

   Eyewear = OD of 5.5 or >@ 10,600nm (i.e. most quality safety glass spectacles with side guard for lateral exposure)
   No safety eyewear is required when viewing through a microscope, colposcope or endoscope as the glass lenses of these instruments provide sufficient protection.

4. **Candela V beam = Class IV laser**

Wavelength = 595nm Visible light spectrum
Laser Type: pulsed, flash lamp excited dye medical laser absorbed by hemoglobin
Max delivered energy= 6joules
Pulse Duration: 0.45-40ms duration of energy density pulse delivered to pt.
Beam Spot Sizes- 5mm, 7mm, 10mm & 3x10eliptical
Fluence= amount of energy density delivered to selected spo
DCD spray= cryogen spray applied to pt. Set @ 0, or 20-100 ms
DCD delay= duration of time between cryogen spray and laser pulse
Eyewear = OD of $\geq$ 4.9 @ 591-597 nm Damage to RETINA in unprotected eye
Fiber: **Limit bends to radius of 6"** to prevent damage to fiber and potential injury

5. VersaPulse P20 Holmium Laser

Wavelength= 2.1 um strongly absorbed by water in tissue, near infrared (Most damaging to the retina)
Applications: urology, arthroscopy, ENT, gastroenterology, gynecology, & general
Energy in joules, pulse repetition rate in Hertz, system sets power delivered

Eyewear: minimal optical density of $\geq$ 4.0

Non-target tissue protection methods: saline soaked gauze, saline in abdomen to absorb stray laser energy, laser beam backstops on specialized laparoscopes, lips and teeth protected with moist gauze

6. Ellex Nd: YAG Super Q Laser

Laser Source	Q-switched Nd: YAG
Wavelength	1064 nm
Energy	0.3 to 10 mJ, single pulse, continuously variable
Pulse Duration	4 ns

Applications: Ophthalmology photodisruption
Procedures: Capsulotomy and Iridotomy

LASER TERMINOLOGY

NHZ= Nominal Hazard Zone or space within which the level of direct, reflected, or scattered radiation may exceed the applicable MPE. Laser appropriate eyewear will be worn in all OR rooms for all laser procedures to prevent exposure to laser hazards.

MPE= maximum permissible exposure is the level or laser radiation to which an unprotected person may be exposed without adverse biological changes in the eye or skin

NOHD= Nominal Ocular Hazard Distance= distance along the axis of the unobstructed beam from the laser to the human eye beyond which the irradiance or radiant exposure during normal operation in not expected to exceed the appropriate MPE.

OD= Optical Density

PLUME OR LGAC (LASER GENERATED AIRBORNE CONTAMINANTS) – Gases, vapors and aerosol created by vaporization of tissue or other materials. Plume May contain viable bacteria, virus, cellular debris or toxic fumes.

SMOKE EVACUATOR: First line of defense against LGAC and should be used for all procedures generating plume or LGAC

POLICIES AVAILABLE FOR REVIEW: CHILDREN'S HOSPITAL & MEDICAL CENTER HOME PAGE- INTRANET -POLICIES
Documentation, eye protection, & laser safety precautions for all laser procedures: PTCR15r

Proper operation & safety awareness of Ceram optic Ceralis D25 Diode laser: EQUIP2r

Proper use & safety awareness for Sharplan 1020 CO2 laser: EQUIP22r

Operation and Safety of Oculight SL, SLX, Diode Laser: EQUIP4r

SAFETY

I UNDERSTAND CLASS IV LASERS ARE USED IN THE OR AT CHILDREN'S HOSPITAL & MEDICAL CENTER AND KNOW NOT TO ENTER AN OR ROOM WHERE LASER SIGNS AND GOGGLES ARE PRESENT WITHOUT FIRST WEARING LASER APPROPRIATE GOGGLES

LASER FOOT PEDAL SHALL BE OPERATED BY OPERATING PHYSICIAN OR PHYSICIAN SUPERVISED RESIDENT

All LASERS WILL BE IN STANDBY WHEN NOT IN USE

LASER SHALL NOT BE ACTIVATED WITHOUT AN AIMING DEVICE, OR IF AIMING BEAM APPEARS COMPROMISED. (THIS IS TESTED BY OR STAFF PRIOR TO PATIENT COMING TO ROOM)

ALL WINDOWS WILL BE COVERED WITH OPAQUE BARRIER DURING LASER PROCEDURES AT CHILDREN'S HOSPITAL & MEDICAL CENTER

EYE PROTECTION

LASERS ARE NOT TO BE ACTIVATED UNTIL CONFIRMED ALL IN CONTROL AREA ARE WEARING LASER APPROPRIATE EYE WEAR TO INCLUDE PATIENT

EYEWEAR SHALL BE INSPECTED BEFORE PROCEDURES TO ENSURE NO CRACKS PRESENT, FIT IS ADEQUATE TO COVER EYES, AND WAVELENGTH/ OD (OPTICAL DENSITY) PRESENT AND IDENTIFIED AS APPROPRIATE FOR LASER

EYEWEAR IS SPECIFIC TO LASER AND IS NOT INTERCHANGEABLE FOR ALL LASERS USED AT CHILDREN'S HOSPITAL & MEDICAL CENTER

I AM AWARE THAT PETROLEUM BASED EYE LUBRICATION IS NOT TO BE USED DURING LASER PROCEDURES AT CHILDREN'S HOSPITAL & MEDICAL CENTER
(Children's Hospital & Medical Center only stocks non-petroleum based eye lubrication on anesthesia carts as of Dec 2012)

LASER APPROPRIATE EYEWEAR WILL BE WORN BY EVERYONE IN NHZ WHILE LASER IS IN OPERATION. NHZ AT CHILDREN'S HOSPITAL & MEDICAL CENTER IS THE ENTIRE OR SUITE. (EXCEPTION TO THIS IS THE LASER OPERATOR LOOKING THROUGH AN ATTACHED MICROSCOPE WITH A LENS THAT HAS THE APPROPRIATE OPTICAL DENSITY FOR THE LASER IN USE)

PATIENTS' EYES WILL BE PROTECTED WITH LASER APPROPRIATE EYEWEAR, LASER APPROPRIATE CORNEAL PROTECTORS, OR TAPED CLOSED WITH MOIST EYE PAD IN PLACE DURING LASER PROCEDURES
THE LASER CORNEAL PROTECTORS ARE **METAL** AND ARE THE **APPROPRIATE** CORNEAL PROTECTORS TO USE FOR LASER PROCEDURES AROUND THE EYES. (PLASTIC CORNEAL PROTECTORS ARE **NOT** ACCEPTABLE)

LASER CORNEAL PROTECTORS SHALL BE PLACED IN AND REMOVED FROM PATIENT EYES BY OPERATING PHYSICIAN OR RESIDENT

PROTECTION AGAINST PLUME OR LGAC:

SMOKE EVACUATORS SHOULD BE USED FOR ALL PROCEDURES WHERE PLUME OR LGAC ARE PRESENT. THERE IS **NO SUITABLE MASK** DESIGNED TO FILTER ALL LGAC. SURGICAL MASKS ARE **NOT** DESIGNED TO PROVIDE PROTECTION FROM LGAC OR PLUME CONTENTS. (SURGICAL MASKS ARE INTENDED TO PROTECT THE PATIENT FROM THE CONTAMINATED NASAL OR ORAL DROPLETS OF ANYONE WITH ACCESS TO SURGICAL FIELD).

FIRE RISK/PREVENTION

LASER FIRE RISK IS TO BE ASSESSED BY THE SURGICAL TEAM DURING TIME OUT

NEW ANSI Z136.3 RECOMMENDED STANDARDS STATE O2 CONCENTRATIONS OF **21%** ARE RECOMMENDED FOR 60 SECONDS PRIOR TO LASER IGNITION DURING AIRWAY LASER CASES (ASA RECOMMENDS CONCENTRATIONS AT THE MINIMUM REQUIRED TO AVOID HYPOXIA) THE LASER OPERATOR IS TO BE VALIDATING O2 LEVELS WITH ANESTHESIOLOGIST PRIOR TO PLACING LASER IN READY MODE

COMBUSTIBLE MATERIAL (HAIR, DRAPES, GAUZE, PETROLEUM BASED EYE LUBRICANT, MASTISOL, 02 ENRICHED ENVIORNMENT CAN CAUSE A FLASH FIRE) BE ALERT AND HAVE WATER OPEN AND AVAILABLE

SPONGES, GAUZE PADS, AND SWABS NEAR OPERATING FIELD SHOULD BE MOISTENED WITH SALINE TO REDUCE FIRE RISK FROM LASER IGNITION

TO REDUCE THE DANGER OF BURNS OR DRAPE FIRES DUE TO BROKEN FIBERS, CARE SHOULD BE TAKEN TO AVOID LEANING ON OR CLAMPING A FIBER, OR SUBJECTING A FIBER TO A SHARP BEND

TO REDUCE THE RISK OF FIRE DURING LASER PROCEDURES IN PERIANAL AREA, MOIST GAUZE SHOULD BE PLACED IN THE RECTUM TO DECREASE METHANE GAS PRESENCE IN LASER FIELD

LASER BEAMS ARE REFLECTED BY SHINY SURFACES. INSTRUMENTS IN THE LASER BEAM PATH SHALL BE DULL, DIFUSE, AND OR NON-REFLECTIVE TO PREVENT REFLECTION OF LASER BEAM TO NON TARGETED TISSUES.

I UNDERSTAND THAT STANDARD ENDOTRACHEAL TUBES ARE COMBUSTIBLE AND SHOULD NOT BE USED DURING AIRWAY LASER IGNITION AND THAT PLASTIC, PLASTIC TAPE, OINTMENT, PETROLEUM BASED LUBRICANT AND SURGICAL PREP SOLUTIONS CONTAINING ALCOHOL MAY ALSO BE FLAMMABLE.

REFERENCES:

ANSI Z136.1 – 2007. Am. National Standards for Safe Use of Lasers.

ANSI Z136.3 – 2011. Safe Use of Lasers in Healthcare Facilities.

Ceram Optec user manual
Candela user manual
Sharplan CO2 laser user manual
Occulight Diode laser user manual
VersaPulse P20 Holmium Laser user manual