Policy Applies to: All those Mercy Hospital employees, credentialed specialists, contractors and visitors who work with or near a laser.

Related Standard:
Australia/New Zealand Standard *Safe use of lasers and intense light sources in healthcare AS/NZS4173:2018*

Rationale:
The purpose of this policy is to provide patients, Mercy Hospital employees, credentialed specialists, contractors, and visitors with a safe working environment during the use of laser equipment.

Cultural Considerations:
No cultural consideration identified.

Definitions:
Laser - Light **A**mplification **S**timulated **E**mission of **R**adiation. The principle components of a laser are a laser medium, a source of energy and laser mirrors

Laser medium - the laser type is typically known by the particular medium used. For example CO2 (gas) dye, (liquid).

Source of energy - electrical discharge, a light source or even another laser. The choice is dictated by the laser medium.

Laser mirrors - the laser medium has to be contained in such a way that the light will travel in one axis only and be nearly parallel. One mirror is partially reflective, allowing a small portion of the beam to leave the laser cavity to become the useful laser beam.

Laser classes
Class 1 lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Class 1 M Lasers emitting in the wavelength range from 302.5 nm to 4000 nm, safe under reasonably foreseeable conditions of operation, but may be hazardous if the user employs optics with the beam.

Class 2 lasers that emit visible radiation where eye protection is normally afforded by aversion responses such as blinking.

Class 2 M Lasers emitting in the wavelength range from 400nm nm to 700 nm that emit visible radiation where eye protection is normally afforded by aversion responses such as blinking. However viewing the output may be more hazardous if the user employs optics within the beam.

Class 3 R Lasers that emit in the wavelength range from 302.5nm to 10 million nm where direct intrabeam viewing is potentially hazardous but lower risk than 3B lasers.

Class 3B Lasers that are normally hazardous when direct intrabeam exposure occurs. Viewing diffuse reflections is normally safe.

Class 4 Lasers that are also capable of producing hazardous diffuse reflections within the nominal ocular hazard area (NOHA). May cause skin injuries and could also constitute a fire hazard. Their use requires extreme caution. At Mercy Hospital the Alcon Constellation vitreo retinal machine for ophthalmology surgery,the ENT Revolix jr. and the urology Sphinx jr. are all classified as Class 4 laser technology. The CSSD NuTrace laser is also a Class 4 laser when the side door is open.

Objectives:

- To ensure staff are appropriately trained in the safe use of lasers
- To minimise the health risks from lasers to patients and personnel
- To ensure efficient and effective use of laser equipment.

Implementation:

1. Provision of training to staff commensurate with the degree of potential laser hazards
2. Appointment of a Laser Safety Officer whose primary function is to implement and monitor Mercy Hospital's laser safety policy. Reports via theatre manager to the Quality & Risk Committee
3. Appointment of Deputy Laser Safety Officers (DLSO's) who will carry out the day to day aspects of laser safety. There will be a DLSO assigned to each case where a laser is in use
4. Appropriate signage at entrance to theatre alerting to the use of a laser
5. All departments using laser equipment must maintain documentation relating to the provision of safety and control measures
6. Completion of a Laser checklist
7. Completion of a log book
8. Completion of education programme (all accessible on SharePoint) every two years inclusive of;
    - Laser Education package
    - Laser Safety Questionnaire
    - Skills validation checklist
9. Preventive maintenance of the laser and accessories including;
    a. Appropriate checking prior to being put into service
    b. Calibration of the output power, energy and temporal characteristics
    c. Copies of all instruction manuals stored for easy access
    d. A schedule for recommended testing, maintenance, safety checks and calibration.

Evaluation:

Incident reports

- For non-injury incidents related to equipment malfunction a report needs to be forwarded to the Therapeutic section, MOH
- For incidents involving injury an additional report must be sent to the National Radiation laboratory.

Staff feedback
Record of compliance with educational requirements
Audit of compliance with policy
Record of laser safety education for Credentialed Specialists.

Associated Documents

External

- Australia/New Zealand Standard S*afe use of lasers and intense light sources in health care AS/NZS4173:2018*

Internal

- Laser Education Folder
- Laser Safety Questionnaire 1
- Laser Safety Questionnaire 2
- Electrosurgical Smoke Evacuation Policy
- Personal Protective Equipment Apparel
- Incident Policy

Acknowledgements

Canterbury District Health Board for access to their *Laser Safety Policy (2011), Laser safety questionnaire, Laser educational folder*

Process

Recommended Practices

Each class 4, class 3R and 3B laser where radiation is greater than the accessible emission level(AEL) for a class 2 laser (400 to 700nm) needs to bear a label close to each aperture stating the following ; 'Laser aperture' or avoid exposure – 'laser radiation is emitted from this aperture'

Health care laser safety requirements

Laser classification	Potential hazard	Installation	Personnel	training
Class 1 1M	safe	nil	For class 1 nil For class 1M do not view with optical instruments	Operation only
Class 2, 2M	low	Area warning signs	Class 2 do not stare into beam Class 2M do not view with optical instruments	Operation only
Class 3R	low	Area warning signs	Do not view beam directly	Operation only
Class 3 B	Medium	Area warning signs Controlled access	Exposure to beam is hazardous; Eye protection essential	Laser safety operator and user training
Class 4	High	Are warning signs Controlled access	Eye or skin exposure to direct or scattered radiation is dangerous Eye protection essential	Laser safety operator and user training

Warning Signs and Controlled Access

Since the beams of surgical lasers are hazardous to eyes and/or skin, all health care workers should be aware of areas of laser use, and controlled access to these areas must be maintained.

Warning signs must be displayed conspicuously at all entrances to the areas where lasers are used.

Rationale:
Laser warning signs alert personnel of the need to implement laser safety requirements. Warning signs and labels serve as control measures to reduce the possibility of exposure of the eyes and skin to hazardous levels of laser radiation and other hazards associated with the operation of laser devices during testing, normal operation, and maintenance.

Designs, symbols, and wording on the warning signs must be specific and consistent for the type of laser in use.

Rationale:
Recognisable warning signs, specific to the type of laser being used, should be designed according to national safety standards.

The laser key must never be left in the laser during storage. Only authorised personnel will have access to the key.

Rationale:
As a laser safety measure, controlled access to the laser key must be maintained.

Eye Protection

Visible and near infrared laser beams are focussed by the eye to a very small spot on the retina where they can cause irreparable damage. In view of this the eyes of both patients and health care workers should be protected from laser beams.

Laser-safe eye protection with appropriate wavelength and optical density must be worn by all health workers and all patients. Labelling to protect against improper use is also essential.

Rationale:
Each type of laser light has a specific wavelength that requires a different type of eye protection.

During laser use, the patient's eyes and eye-lids should be protected from the laser beam. If the patient is awake, he or she should wear appropriately labelled eye wear. The anaesthetised patient's eyelids should be closed, covered with the appropriate ophthalmic drape.

Rationale:
Eyes are vulnerable to laser injury.

Laser protective eye wear should be available near the posted warning sign(s).

Rationale:
Readily available eye wear helps ensure compliance with eye protection procedures.

All viewing windows in the laser room should provide adequate protection specific to the laser wavelength.

Rationale:
The use of "beam stop" material prevents laser beam transmission.

Skin Protection

All Class 4 surgical lasers can cause burns. The skin and other tissues of patients and health care workers should be protected from aberrant and reflected laser beams.

The laser should be in standby mode when not in use.

Rationale:
When the laser is set up and not being fired, the controls should be set to "standby", to prevent inadvertent activation.

Exposed tissues around the operative site should be protected with saline or water saturated materials (e.g. towels, sponges, non-flammable material) when thermally intensive lasers are being used. These materials should be remoistened periodically to ensure proper protection.

Rationale:
The solution (i.e. saline, water) absorbs or disperses the energy of the beam in areas not intended for laser application.

Only dull, ebonized, or non-reflective anodised instruments should be used near the laser site.

Rationale:
Dull, ebonized, or non-reflective anodised instruments decrease the amount of direct laser beam reflection and beam scatter.

Backstops or guards should be used during laser surgery where applicable.

Rationale:
Appropriate backstops prevent the beam from affecting non-targeted tissue.

Laser Plumes

High powered lasers, particularly CO_2 lasers, often create plumes which contain viable viral material. Patients and health workers should be protected from inhaling the plume associated with laser use.

Plume and noxious fumes should be evacuated through a filter device.

Rationale:
Plume and noxious fumes are irritating to the respiratory tract. Some particles in the laser plume are classified as hazardous to breathe. Use of a mechanical smoke evacuator system with a high efficiency filter during plume generating laser vaporisation procedures decreases the risk of plume inhalation.

Smoke evacuation systems should be used according to the manufacturers written instructions.

Rationale:
Ultimately, the final determination of how well a smoke evacuator works relies on the smoke evacuation techniques of the laser personnel.

High-filtration surgical masks designed for laser use should be worn during procedures that produce plumes.

Rationale:
High-filtration surgical masks for laser use are intended to minimise inhalation of the larger carbonaceous particles in plume and should be used according to manufacturer's written instructions.

Fire Safety

High powered lasers, particularly CO_2 lasers, can ignite patient drapes and any other flammable agents such as anaesthetic gases, gases in the bowel, prep, solutions and plastics. Patients and health care workers should be protected from fire hazards associated with laser use.

Flammable or combustible anaesthetics prep, solutions, drying agents, ointments, plastic resins, or plastic should not be used near the laser site.

Rationale:
Fire is one of the most significant hazards with laser use. The intense heat of the laser beam can ignite combustible/flammable solids, liquids, and gases. Pooled prep solution can retain laser heat and burn tissue.

Flame resistant drapes or moistened, reusable fabrics should be used to drape the operative site.

Rationale:
Wet sponges or towels and fire resistant drapes around the laser tissue impact site decreases the potential for fire.

A basin of water or saline and an appropriate fire extinguisher (for electrical fires) should be readily available.

Rationale:
Water or saline is needed in case of accidental fire within the sterile field. The fire extinguisher should be used for fires in the laser itself to prevent harm to the optics or delicate circuits of the laser.

The endotracheal (ET) tube used during laser surgery in the aero digestive tract (combined organs of the digestive tract including lips, mouth, tongue, nose throat, vocal cords and part of the oesophagus and trachea) should be laser safe. The cuff should be inflated with saline.

Rationale:
ET tubes can ignite and support combustion if they are not laser safe.

Electrical Safety

Lasers frequently contain electrical components which operate at lethal Voltages. Patients and health care workers should be protected from the electrical hazards associated with laser use.

Electrical circuitry in the area of laser use should have adequate amperage to meet the power requirements of the specific laser.

Rationale:
Some lasers have sizeable power requirements. Failure to provide sufficient power can trip circuit breakers that serve other outlets.

Liquids should not be placed on the laser unit. The laser foot pedal should not be placed on or near liquids.

Rationale:
Spilled liquid may act as a conductor and cause internal short-circuiting.

Laser Safety Team

A Deputy Laser Safety Officer should be available whenever a surgical laser is used.

A Deputy Laser Safety Officer must be in the operating room during all surgical procedures.

Rationale:
A Deputy Laser Safety Officer must be available for all laser procedures. They have the responsibility and authority to ensure that safety parameters are followed and that they are in compliance with policies, standards, and regulations.

The Deputy Laser Safety Officer operating the laser should have no responsibilities other than operating the laser.

Rationale:
A Deputy Laser Safety Officer is recommended because the laser must be put in the standby mode when it is not being used. The circulating nurse should not be expected to assume the responsibility for laser operation and assistance in addition to performing other responsibilities in caring for the patients during surgery.

Training

Personnel working in a laser treatment are required to have safety training and basic orientation to the technology.
Personnel will be educated in laser safety and be familiar with the unique features, specific operation & safety measures for the type of laser used in that team members practice setting.

Associated Documents

- AS/NZS 4173: 2018 Guide to the Safe Use of Lasers in Health Care
- AS/NZS 2211.1: 2004 Safety of Laser Products
- AS/NZS 3200.2.22: 1997 Approval and Test Specification - Medical Electrical Equipment - Particular Requirements for Safety – Diagnostic and Therapeutic Laser Equipment
- AS/NZS 1715: 2009 Respiratory Protective Devices
- AS/NZS 4187: 2014 - Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities
- Health and Safety at Work Act 2015.