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FIELD MANUAL

PREVENTION AND MEDICAL MANAGEMENT OF LASER INJURIES

HEADQUARTERS, DEPARTMENT OF THE ARMY

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PREFACE

Purpose and Scope

This field manual provides basic preventive, protective, and diagnostic information on laser injuries. The treatment procedures described herein are for use by combat medics, battalion aid station personnel, and other medical treatment facilities without an Ophthalmologist. Also, an evaluation matrix is provided for use by combat lifesavers and combat medics. Once an individual has been diagnosed as having a severe laser injury, causing loss of vision, he will be prepared for evacuation to a medical treatment facility where he can receive specialized care for his injury.

Neutral Language Statement

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

User Comments

Users of this manual are encouraged to submit recommended changes and comments to improve the publication. Comments should be keyed to the page, paragraph, and line of text in which the change is recommended. Reasons will be provided for each comment to ensure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to: **Commandant, Academy of Health Sciences, US Army, ATTN: HSHA-TLD, Fort Sam Houston, Texas 7823443100.**

1. Introduction

a. The word "laser" is an acronym for "light amplification by stimulated emission of radiation." In common usage, a laser is a device that produces an intense, narrow beam of light. Normally each laser can only produce a single frequency or color of radiation. However, there are many different types of lasers. Some produce light which is in the visible portion of the radiation spectrum and, therefore, can be seen. Others produce radiation which is outside of the visible spectrum (either infrared or ultraviolet) and is, therefore, invisible. Appendix A depicts the wavelength of common lasers. Some laser devices produce radiation with sufficient energy to severely injure or burn the eyes or skin of personnel who are down range. The use of laser devices, such as rangefinders and target designators may result in accidental injury to the eye. Appendix A also depicts some of the lasers commonly found in the United States Army. It is possible that similar devices may be used by opposing forces as antipersonnel weapons.

b. The beam of light emitted from a laser device is normally very narrow, usually less than an inch in diameter. However, over long distances, the beam progressively becomes wider. For a military laser, the beam is typically 1 meter in diameter at a distance of 1 kilometer and 2 meters in diameter at a distance of 2 kilometers. Thus, a laser can irradiate the whole body at these distances. If the energy of the laser is high enough, such exposures could burn clothing, skin, or any part of the body exposed to the beam. Most lasers, however, are not powerful enough to generate burns. Because the eye focuses and concentrates whatever light that enters the eye, it is extremely sensitive to injury from almost any type of laser device. The concentration of energy which is focused onto the back of the eye can be 100,000 times greater than the energy which enters at the front of the eye. Thus depending upon the type of laser, the energy output of the laser, and the distance from the laser, a spectrum of injuries can be expected. These may range from very tiny lesions in the back of the eye to severe burns affecting vast portions of the body. See Appendix A for principal wavelengths of common lasers.

c. Injuries to the eye result when the energy from the laser is absorbed by various anatomical structures. The frequency of the laser radiation determines which structure absorbs the energy (Figure 1).

(1) *Ultraviolet.* Lasers operating in the ultraviolet spectrum (below 400 nm UV-A,B,C) are absorbed in the anterior segments of the eye, primarily by the cornea, as well as by the lens.

(2) *Visible.* Laser radiations in the visible spectrum (400-700 nm) are absorbed primarily within the retina by the pigment epitheliums and the choroid.

(3) Infrared. Absorption of lasers in the infrared spectrum occurs in two areas of the eye. Lasers at the near-infrared spectrum (700-1400 nm IR-A) damage the retina and the choroid, whereas light in the far-infrared spectrum (above 1400 nm IR-B,C) damages the cornea.

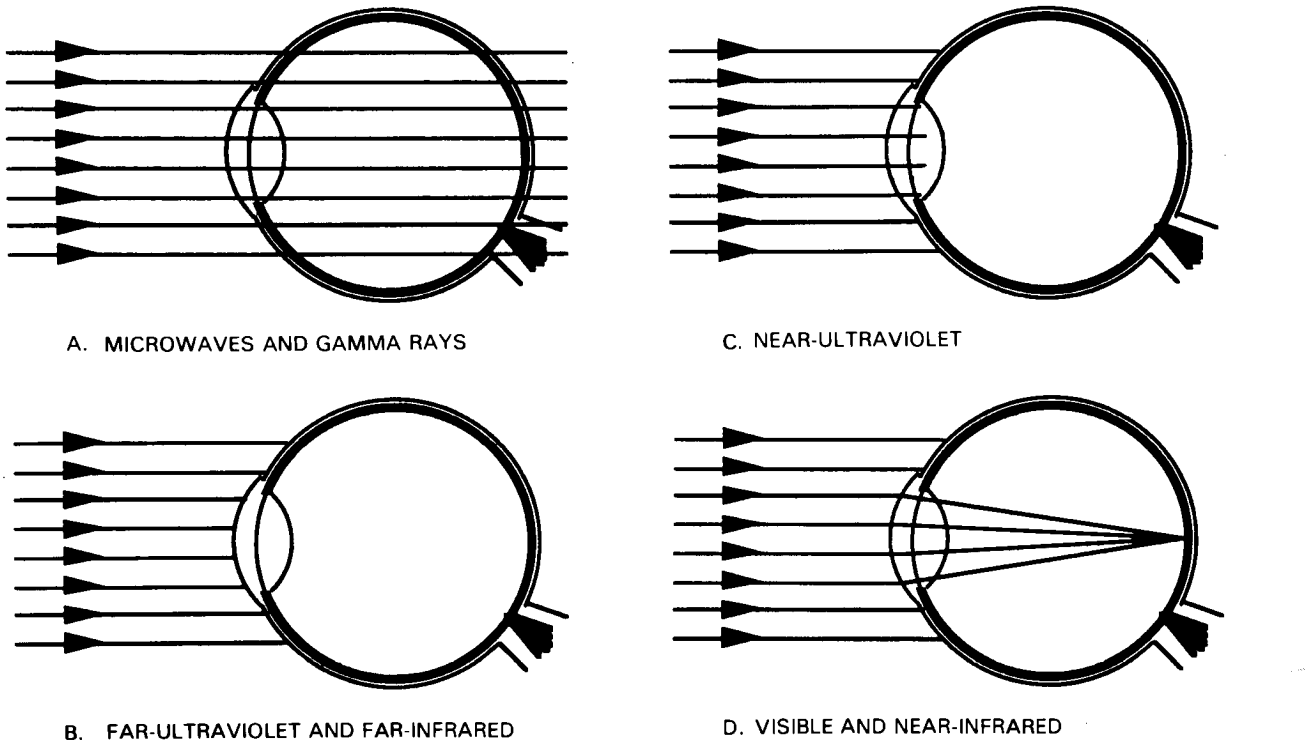

Figure 1. Schematic diagram of the absorption of electromagnetic radiation in the eye.

2. Threat

a. Potential Employment. The rapid growth of laser science has resulted in an increased use of laser instruments in the military. Currently lasers exist on the battlefields as rangefinders and target designators. They are also used to simulate live fire during force-on-force exercises. We have devices which can accidentally permanently blind us; therefore, it is likely that threat forces have similar equipment. This may increase the potential for laser eye injuries on the battlefield. In the future lasers may be used as antipersonnel devices/weapons to disrupt military performance by reducing the soldiers' ability to see.

b. Laser Effects on Visual Performance. Lasers may interfere with vision either temporarily or permanently in one or both eyes. At low energy levels, lasers may produce temporary reduction in visual performance in critical military tasks, such as aiming weapons or flying aircraft. At higher energy levels they may produce serious long-term visual loss, even permanent blindness. Critical military functions, such as reading a map or driving, may be impossible. Furthermore, soldiers who sustain minimal injuries or even no injury from low-energy laser exposures may develop serious psychological problems and become ineffective in the performance of their duties. Such psychological reactions may also develop among other soldiers assigned to units in which laser injuries have been reported. Such reactions could affect morale and discipline, as well as the overall ability of the unit to accomplish its assigned mission.