DoD and VA Vision Center Excellence

DHA Practice Recommendation:

Ocular Evaluation and Disposition after Suspected Laser Exposure

Edition: 1

Date: August 2022

DHA Practice Recommendation: Overview and Disclaimer

DHA Practice Recommendations (PRs) are developed by experts utilizing the best information available at the time of publication. In some instances, recommendations are expert opinion provided to users in the absence of definitive, well-designed and executed randomized control trials. DHA PRs provide the field with an authoritative source of carefully synthesized clinical information. They are intended to assist clinical care teams with real-time decision making based on best available evidence.

While the DHA sponsors this PR, its endorsement of the findings and recommendations are limited to validation of the expert opinion and compiled evidence of the sponsoring Subject Matter Expert (SME) body. This PR should be used to augment the practitioner's best clinical judgment. It may not account for local or structural conditions (i.e., resourcing, staffing, equipment, or Health Protection Conditions) impacting clinical decision making in the field by the practitioner.

DHA PRs are separate and distinct from jointly developed Department of Veterans Affairs (VA)/DoD Clinical Practice Guidelines (CPGs) that are the product of rigorous, systematic literature review and synthesis. In contrast, DHA PRs provide the MHS practitioner with a synopsis of relevant clinical evidence tailored to the military medicine setting and TRICARE beneficiary population.

DHA PRs provide standardized evidence-informed guidelines that MHS practitioners should refer to when addressing patients with specific clinical conditions. Clinical practitioners must be mindful of the emergence of supervening clinical evidence published in the academic press, not yet incorporated into the guideline.

This guideline is not intended to define a standard of care and should not be construed as such, nor should it be interpreted as prescribing an exclusive course of management for said condition or disease process. Variations in practice will inevitably and appropriately occur when clinicians consider the needs of individual patients, available resources, and limitations unique to an institution or type of practice. Every healthcare professional making use of this guideline is responsible for evaluating the appropriateness of applying it in the setting of any particular clinical situation.

This guideline is not intended to represent TRICARE policy. Further, inclusion of recommendations for specific testing and/or therapeutic interventions within this guide does not guarantee coverage in Private Sector Care. Additional information on current TRICARE benefits may be found at www.tricare.mil or by contacting the regional TRICARE Managed Care Support Contractor.

Ocular Evaluation and Disposition after Suspected Laser Exposure

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Purpose

This Practice Recommendation (PR) provides information and instructions for medical providers responsible for Service members following a suspected directed energy (DE) exposure involving the visual system. These suspected exposures, presumably caused by a laser or other intense bright light source, can compromise the ability to execute mission essential functions. For the purposes of this PR, the term laser will also include any light source, visible or invisible, capable of resulting in potential injury. The intent of this recommendation is to provide a better understanding of this type of injury and its effects and to establish a care algorithm for first-line providers and follow-on care by eye care providers. This PR is based on expert consensus because there is little available data on this type of injury. Specifically, it includes the key elements of a Service member's history, examination, disposition, and medical record coding following potential exposures. Service and unit-specific reporting procedures for exposures and possible injuries are also included. Early recognition and treatment of potential injuries is essential to maintain optimal visual performance. In addition, timely reporting is essential to assess the operational impact of these exposures/injuries.

CLINICAL SCENARIOS

1. An aircrew making a final approach is exposed to a laser source, leading to temporary flash blindness. Spatial awareness and situational awareness is affected, compromising actions during critical operations. The symptoms resolve without functional or anatomic evidence of damage.

2. A mounted Service member employs an escalation of force visible laser during operations. The beam is reflected off the turret mirror resulting in close proximity exposure. Central vision is immediately compromised. Evaluation shows decreased vision and retinal edema. This results in a central retinal scar and loss of vision.

Background

Lasers emit nonionizing radiation in the ultraviolet, visible, and infrared portions of the electromagnetic spectrum. When the eye is exposed to this energy, temporary disruption of visual function or permanent injury may occur.[1] Lasers available for wide scale commercial purchase that emit at visible wavelengths (including red, green, and blue) have been increasingly reported in laser strikes on commercial aircraft. These laser strikes on commercial aircraft have been reported most frequently during takeoff and landing.[2] A review of these civilian aircraft

incidents found that, while these laser strikes have not resulted in any documented permanent changes in visual functional or structural damage to the eyes, they have been documented to cause immediate visual effects, including flash blindness, glare, and startle that can interfere with critical functions on board the aircraft. Based on reports by civilian pilots who have been directly exposed, recovery of optimal visual function can take from seconds to minutes; however, alterations in visual function can last from several minutes to several hours.[3]

Potential exposures of the visual system to laser threats that are present across the spectrum of military operations are more varied. Laser technology is incorporated into multiple weapons systems from both friendly and hostile forces and presents a threat of temporary visual effects or permanent injury to the eye. Most laser systems designed for military use emit at infrared wavelengths that cannot be seen by the human eye. Visible laser systems also pose a threat to military operations. A review of data from the Defense and Veterans Eye Injury and Vision Registry (DVEIVR) from 2006-2018, found a small number of Service members (SMs) with documentation of exposure in the medical record. Of the cases reviewed, a few SMs were found to have permanent damage compromising visual function as a result of exposure.

This PR specifies a screening method for use in the eye care environment. Its use helps identify individuals who are affected by suspected laser exposure. Ocular exposure to DE in the form of lasers can acutely disrupt operational functioning. Permanent injury to the eyes and visual system is rare after these exposures. Awareness of this type of exposure is critical for all deployed providers, as well as emergency and Primary Care providers. Early engagement of eye care specialists is essential to maximize recovery. Service members with persistent symptoms or worsening vision complaints require priority evacuation. Exposed SMs require comprehensive evaluation by an eye care provider as soon as possible after exposure events. Consistent documentation of exposures and injuries will improve treatment recommendations.

Use of this PR assumes that a patient has had a known or suspected laser exposure, will undergo a comprehensive evaluation by an eye care provider as soon as possible after the exposure, and will have complete documentation of laser injury and severity.

Diagnosis

All SMs with a laser exposure require evaluation. The forms below include key points for documentation, as well as recommended testing and intervals. Generally, SMs should be evaluated at least daily until symptoms resolve, or evacuation or referral to an eye care provider is available. After evacuation out of theater, or primary diagnosis, frequency of follow-up is based on the clinical situation, but should occur at a minimum of 1, 3, and 6 months following exposure/ injury.

Laser Exposure Medical Documentation Sheet

Laser Exposure Medical Documentation
Attachment 1

Laser Incident Questionnaire

Laser Incident Questionnaire
Attachment 2

Clinical Management

Initial treatment guidance for suspected ocular injury from laser exposure is limited. Readily identifiable injuries, such as corneal abrasions, hyphema, or vitreous hemorrhage should be treated using current standards, in coordination with an eye care provider. These guidelines can be found in Eye Trauma: Initial Care, 28 Aug 2019[8] and Ocular Injuries and Vision-threatening Conditions in Prolonged Field Care, 01 Dec 2017.[9] In the context of visual dysfunction, available literature suggests benefit of early treatment with non-steroidal anti-inflammatory drugs (NSAIDs) and/or systemic corticosteroid therapy.[4, 5, 6] Treatment of SMs with suspected ocular injury should be considered as follows (if not otherwise contraindicated):

- **Vision 20/40 or better** but not at baseline, visual interference effects lasting more than 2-4 hours: start NSAID (indomethacin by mouth 25mg three times/day can be used if available, or ibuprofen 800mg by mouth three times/day).
- **Vision worse than 20/40** with any Amsler grid abnormalities: can consider use of steroids, in consultation with an ophthalmologist.
- Evaluation by an eye care provider in theater should be obtained, if operationally feasible. This decision is best made after discussion with the eye care provider. Teleconsultation for specific treatment decisions when no eye care providers are available.

Teleconsultation Services

- ADVISOR 833-238-7756; DSN 312-429-9089; select Emergency Department callers will be connected to Ophthalmology. ADVISOR covers all Combatant Commands.
- U.S. Air Force School of Aerospace Medicine Ophthalmology: 937-938-2675
- Naval Aerospace Medical Institute Ophthalmology: 850-452-2933 usn.pensacola.navmedotcnamefl.list.nami-ophthal@mail.mil

Asynchronous Consultation Services:

- INDOPACOM: Pacific Asynchronous TeleHealth (PATH): https://path.tamc.amedd.army.mil/
- EUCOM, CENTCOM, AFRICOM, SOUTHCOM: Health Experts onLine Portal (HELP): https://help.nmcp.med.navy.mil/

SMs reporting worsening visual acuity or visual symptoms or a change in exam findings should be considered for priority evacuation to allow for evaluation and care by an eye care provider. SMs with any visual symptoms that persist beyond 24 hours despite initial treatment should be considered for priority evacuation.

All SMs with symptomatic exposures, even those who return to baseline function, should have comprehensive evaluation by an eye care provider in theater or upon redeployment, if resources are not available in theater. This post-exposure evaluation should be documented in the electronic medical record.

SMs with repeated exposures (multiple exposures over several days) should be evaluated for symptoms after each incident and each evaluation documented and treated as an additional exposure.

DISPOSITION

Flight Surgeons
Follow Service-specific guidelines for aviation personnel; full references at end of PR.

- U.S. Air Force School of Aerospace Medicine Laser Injury Guidebook
- OPNAV Instruction 5100.27B Marine Corps Order 5104.1C, Navy Laser Hazards Control Program[7]
- Army personnel should follow above guidance.

***NOTE**: Aviation personnel are only to be returned to duty in accordance with Service-specific aviation guidelines from the above references and local SOPs.*

Other Forward Providers
SMs with exposures who return to baseline visual function (with no new or persistent defects on Amsler grid testing) within 2-4 hours may be returned to full duty without restrictions, as long as the SM meets current Service-specific standards. Full documentation and incident reporting is required for incidents with transient visual interference effects, as well as suspected ocular injuries. Non-aviation personnel may return to duty when visual function returns to baseline and allows for effective execution of MOS-specific duties and operational requirements.

Eye care providers
1. Whenever feasible and operationally viable, obtain ultrastructural image of the retina as near to time of exposure as possible in SMs with persistent visual complaints. This will serve to further define the severity of injuries, serve as a baseline for visual recovery, and inform ongoing understanding of the spectrum of DE injuries as an evolving operational concern.

2. SMs with suspected ocular injuries from laser exposure are eligible for enrollment in the Defense and Veterans Eye Injury and Vision Registry (DVEIVR) (Access DVEIVR). The registry is populated using medical encounter documentation, and no separate registration or entry into DVEIVR is required. Only unclassified details of the event should be entered into the medical record. Coding recommendations to facilitate tracking and analysis are listed below.

3. SMs with documented retinal involvement should be referred to a vitreoretinal specialist for further evaluation.

References

1. AFRL-SA-WP-SR-2012-0005 U.S. Air Force School of Aerospace Medicine Laser Injury Guidebook, April 2012. Air Force Research Laboratory, 711th Human Performance Wing, School of Aerospace Medicine, Aerospace Medicine Department, 2510 Fifth St.
2. Aerospace Medical Education Division, Federal Aviation Administration. Laser hazards in navigable airspace. https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/Laser_Hazards.pdf Accessed Feb 2020.
3. Palakkamanil MM, Michael P Fielden MP. Effects of malicious ocular laser exposure in commercial airline pilots. Can J Ophthalmol 2015;50:429–432.
4. Brown J, Hacker H, Schuschereba ST, Zwick H, Lund DJ, Stuck BE. Steroidal and Nonsteroidal Anti-inflammatory Medications Can Improve Photoreceptor Survival after Laser Retinal Photocoagulation. Ophthalmology 2007; 114: 1876–1883.
5. Mtanes K, Mimouni M, Zayit-Soudry S. Laser pointer-induced maculopathy: more than meetsthe eye. Journal of pediatric ophthalmology and strabismus, 2018; 55.
6. Chen Y, Lu N, Li J, Yu J, Wang L. Early treatment forlaser-induced maculopathy. Chinese Medical Journal. 2017;130(17): 2121-2122.
7. Department of the Navy. OPNAV Instruction 5100.27B Marine Corps Order 5104.1C. 2 May 2008.
8. Gensheimer, W. G., Mazzoli, R, Reynolds, M. E, et al. Eye Trauma: Initial Care https://jts.amedd.army.mil/assets/docs/cpgs/Eye_Trauma_Initial_Care_01_Jun_2021_ID03.pdf.
9. Reynolds, M.E, Hoover, C, Riesberg, J, et al. Ocular Injuries and Vision-Threatening Conditions in Prolonged Field Care https://jts.amedd.army.mil/assets/docs/cpgs/Ocular_Injuries_Vision-Threatening_Conditions_PFC_01_Dec_2017_ID66.pdf.

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Potential Conflicts of Interest

The authors declare no conflicts of interest.

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Attachment 1

Suspected Laser Exposure Evaluation and Documentation Sheet for Providers

Laser Exposure Medical Documentation: Initial Provider Evaluation		
Patient		
Identifier		
Date of Injury		
Date of Evaluation		
History		
Element	**Description**	**Result**
Exposure description	Color, brightness and duration of light/exposure	
	Other characteristics of light(pulse/flicker)	
	Eye(s) exposed	
	Direct or reflected exposure	
	Activity/tasks at time of exposure and ability to perform tasks	
	Optical devices in use at the time of suspected exposure (night vision devices, magnifying devices, specific laser protection devices)	
Presenting Symptoms	Reported symptoms may include: blurred vision, headache, blind spots, shadows, eye pain, eye irritation/burning, etc.	
Time since exposure	How long ago was the exposure?	
Duration of symptoms	Seconds, minutes, hours, ongoing	
Medical/Ocular History	Previous visual function (baseline vision as available (i.e. glasses use)	
	Previous ocular history	
	History of refractive surgery	
	Current medications	
Social History	Tobacco use	

MEDICAL CODING

The following ICD-10 coding guidance is recommended for laser exposures. Proper documentation and coding of these events allows for optimal tracking and analysis to inform and evaluate treatment recommendations. Uniform and consistent medical documentation and coding is essential to proper surveillance and research efforts. This guidance is designed to standardize coding across the MHS.

Table 1. ICD-10 coding guidance for laser exposures

Diagnostic Position	Code	Comments
Principal/First listed Diagnosis	Initial symptoms (headache, blurred vision, etc.)	Allows for tracking duration/resolution of symptoms longitudinally
Second Diagnosis	Anatomic findings (burn, scar, etc.)	Allows for documentation and tracking of injuries longitudinally
Third Diagnosis	W90.2* Exposure to laser radiation	ICD-10 codes in the range V00-Y99 describe the cause of the morbidity, not the condition itself; this code allows for accurate tracking of laser exposures.
	W90.2XXA Exposure to laser radiation initial encounter	
	W90.2XXD Exposure to laser radiation subsequent encounter	
	W90.2XXS Exposure to laser radiation sequela	

Attachment 2
Laser Incident Questionnaire

The following questions taken from the AFRL-SA-WP-SR-2012-0005 are designed to gather information to assist medical, operational, and intelligence personnel in analysis of laser beam exposure incidents. It should be anticipated that further questions and information will be sought as time allows. Finally, remember to call the Tri-Service Hotline at 1-800-473-3549 or DSN 798-3764, as soon as possible.

1. Describe the light you saw

What color(s) was the light(s)? How

bright was it?

How long was it on?

Was it uniform in appearance?

Did the intensity of the light change?

Was it constant or did it pulse or flicker? If so, how fast did it pulse or

flicker? How wide (perhaps using finger widths at arm's length) was the

beam at origin?

How wide on exposure was the light? Did the light fill your cockpit or

compartment? Was the light emanating directly from a source or was it reflected

off a surface?

Were there any other unusual light sources?

Have you seen this light(s) before?

2. Date, location, and circumstances

a. Date and time (local & Zulu using a 24-hour clock) that the exposure occurred. Local: DDMMYYYY hh:mm

Zulu: DDMMYYYY hh:mm

b. Location of exposure (if nonclassified). Describe location preferably using degrees decimal (DD), degrees-minutes-seconds (DMS), Universal Transverse Mercator (UTM), or Military Grid Reference System (MGRS).

c. How far and in what direction was the light source? Was it airborne or surface based?

d. What was between the light source and your eyes?

e. What were the atmospheric conditions: clear, overcast, rainy, foggy, hazy, and sunny?

f. Was any equipment such as windscreens, visors, NVGs, goggles or sensors affected by the light?

g. What evasive maneuvers did you attempt and did the beam follow you as you tried to move away?

3. Effects

a. How long did you look into the light beam?

b. Did you look straight into the light beam or off to the side?

c. What tasks were you doing when the exposure occurred? Did the light(s) hamper you from doing those tasks?

d. Were both eyes exposed? If not, describe the difference between the light exposure (for example, one eye was shielded or closed, or on the side away from the light beam). Describe any difference in the effect on either eye.

e. Was the light so bright that you had to blink or squint, close your eyes, or look away? Was the light painful? Describe the pain. For how long did the pain persist after the light exposure?

f. Was vision affected while the light was on? How much of your visual field was affected? What types of things could you see or not see? Did you notice the color of instruments or targets change? Did the changes to your vision remain constant or vary during the exposure? If the light source was mounted on a platform (e.g., aircraft, ground vehicle, or building), how much of the platform was obscured?

g. Did your vision remain affected after the light was extinguished? If so, for how long and how did you estimate the time? What types of things could you see or not see? Did you notice afterimages (“spots before your eyes”)? If so, describe them.

h. Were there any lingering (i.e., hours or days) visual effects? If so, were the

effects continuous or intermittent? Did you have problems reading or seeing in low-light conditions? How long until you were able to see normally again?

i. Did you notice any reddening, warming, or burns to your skin?

j. Describe the condition of your vision before the incident. Do you wear glasses?

k. Are you taking any medications?