Occupational Eye Disorders

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Vision & work

- **The effect of vision on work**
  - Influence on safety (for example, in transport) and quality control (for example, in manufacturing).

- **The effect of work on vision**
  - This may be transient (Visual fatigue) or permanent (ocular injury)
  - Most workplace injuries are preventable

Introduction

- The reported incidence of occupational injuries that lead to visual disability approaches 70,000 workers in the united states each year.

  Many of these injuries are preventable.

- Knowledge about the work environment and potential work related risks, is important.
- Assessment of visual function is an important part of pre-employment medical screening and monitoring of the workforce.

History

Ask about :

1.vision before and after the injury and sudden or gradual.

2.nature of injury ;small rapidly moving object (penetration)or large slowly moving object (contusion or rupture of globe)

3. type of material (If the presence of a foreign body is suspected) **magnetic metal** such as iron or steel, **nonmagnetic metal** such as aluminum or copper, **organic material** such as wood),

✓**Metallic salts** from iron or copper can cause irreversible toxic .damage to the retina, best prevented by their prompt removal .

✓ **Less-soluble** materials, such as aluminum, plastic, or glass, are associated with a better prognosis.

✓ **Organic** foreign bodies, such as pieces of wood or splinters of plant material, may introduce an intraocular infection that is frequently difficult to treat and has a very poor prognosis.

✓If a chemical burn is present or suspected, the type of chemical (alkali or acid) will influence how quickly and deeply it penetrates the eye .

Eye examination

- Even if an injury is thought to have affected only one eye, **both eyes should be examined.**
- ***Observation :*** swelling, redness, symmetry
- ***visual acuity***
- ***Color vision***
- ***Visual field testing***
- ***Ocular motility and pupils***
- ***Other tests***

استانداردهای بینایی در مشاغل

- استاندارد های بینایی باید بصورت دستورالعمل باشند
- اندازه جزئیات بصری، فواصل کاری، نیاز به سرعت و دقت و عواقب اشتباه باید قبل از تدوین استاندارد بینایی سنجیده شوند
- نیاز متفاوت وظایف شغلی به تیزبینی

فواصل کاری:

۱- دور(بیش از ۲ متر) مانند خلبان و راننده

۲- متوسط تا نزدیک(۳۰ سانت تا ۲ متر): منشی گری، کار با کامپیوتر، تراشکاری

۳- بسیار نزدیک: خیاطی، مونتاژ، تعمیر ساعت

- توانایی دید دور نرمال: خلبان، راننده
- نیاز به دید نزدیک نرمال: خیاط، مونتاژکار
- دید در نور کم: راننده، کار در اتاق تاریک عکاسی
- لزوم دید دو چشمی: راننده، جراح، دندانپزشک، خیاط، راننده لیفتراک، خلبان، نگهبان و دیده بان
- ارزیابی خطرات احتمالی ناشی از عدم افتراق رنگ ها در بررسی عملی

U.S Army Job Standard: civilian &military jobs classification

Vision standards:

1. Clerical and administrative occupations requiring a considerable amount of desk work
2. Occupations involving operation of moving vehicles
3. Jobs involving inspection for surface defects and fine tolerance
4. Jobs involving machines in which the operating parts are within arm's reach
5. Skilled trades requiring good near and distant vision
6. Jobs of relatively unskilled

U.S Army Job Standard: civilian &military jobs

Job title	Vision standard
Forklift Operator	2
Nondestructive Tester	3
Police Officer	5
Plumber	5
Firefighter	2
Crane Operator	2
Cardiologist	5
Mason	5
Painter	4

Test of Visual Acuity(VA)

- Nearly always equal to examination of eyes
- Far vision:4-6meters
- Near vision:25-40-50 centimeters
- VA is tested first binocularly, then each eye separately
- First without correction and then with correction

Test of Visual Acuity(VA)

- VA can be record as :

1. Last line correctly
2. Last line correctly + number of letters read correct
3. Patient correctly reads more than half of the characters in each line (AMA)

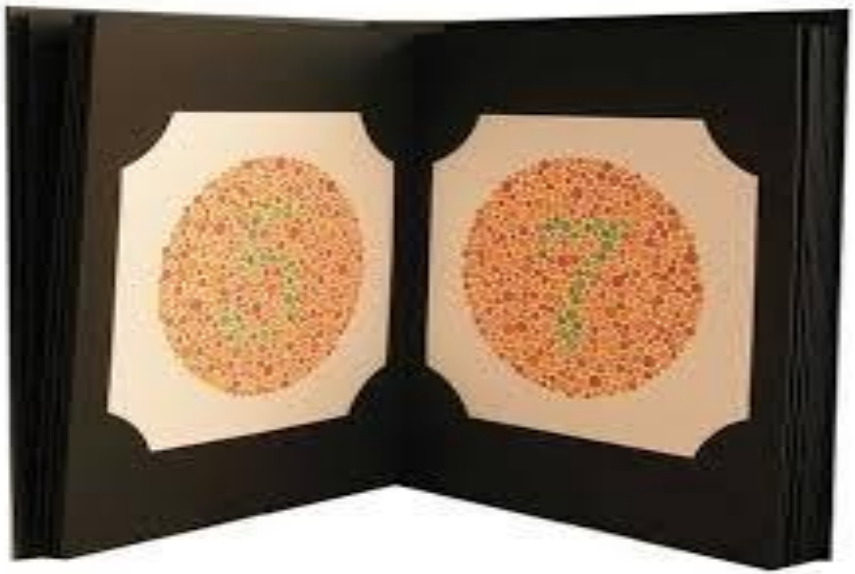
color vision

- Color vision appears to be particularly sensitive to toxic exposures, include solvents:
- **(styrene, toluene & CS_2) and mercury.**
- ***Screen tests :***

  - ***Ishihara*** plates detect only red-green defect.
- - ***Waggoner H-R-R*** plates detect blue-yellow defect
- In occupational fields where some degree of colour deficiency may be tolerated without significantly affecting visual performance
- A recent review

  no increase with colour deficiency in unintentional injuries in driving or in the workplace

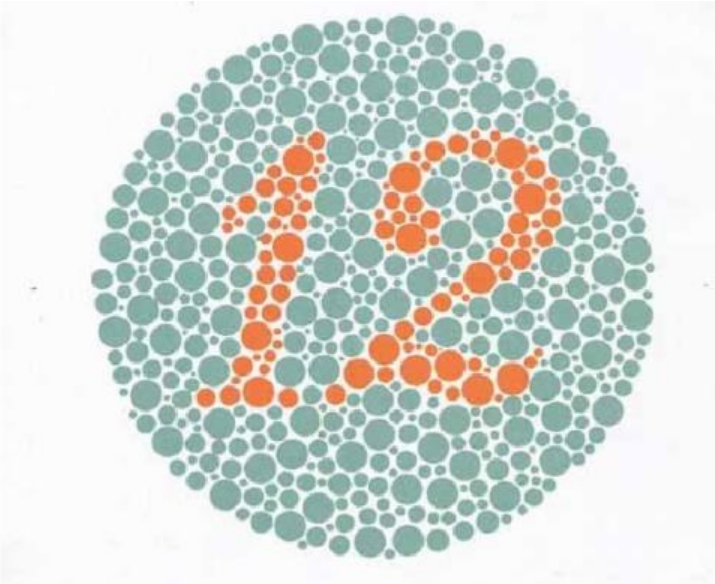
Ishihara Test



آزمون ایشی هارا

- ۲۴ و ۳۸ لوحه ای
- ۴۵ سانتیمتری چشم با زاویه ۴۵ درجه
- با عینک
- هر چشم جداگانه
- هر عدد ۳ ثانیه
- مسیر: ۱۰ ثانیه
- ۱ و ۲۴ یا ۱ و ۳۸، نمایشی اند برای تست تمارض
- ۸ درصد مثبت کاذب

- Both the normal and those with all sort of color deficiencies read it as12.



آزمون ایشی هارا

- لوحه ای ۲ تا ۹: افراد با اختلال دید رنگ، اعداد متفاوتی را می بینند
- ۱۰ تا ۱۷: فقط افراد نرمال اعداد را می بینند
- ۱۸ تا ۲۱: فقط افراد با اختلال دید رنگ اعداد را می بینند
- ۲۲ تا ۲۵: افتراق پروتان از دیوتان و افتراق خفیف از شدید

- ✓ بیش از ۳ غلط در آزمون: انجام آزمون فارنسورث D-15
- ✓ اختلاف دو چشم: ارجاع به چشم پزشک

دانشگاه علوم پزشکی و خدمات بهداشتی ، درمانی تهران

بیمارستان بهارلو – درمانگاه طب کار

برگه گزارش تست دید رنگ Ishihara

نام و نام خانوادگی : ..... تاریخ : .....

Number of plate	Normal person	Person with red- green deficiency				Person with total Color blindness and weakness
1	12	12				12
2	8	3				X
3	6	5				X
4	29	70				X
5	57	35				X
6	5	2				X
7	3	5				X
8	15	17				X
9	74	21				X
10	2	x				X
11	6	x				X
12	97	x				X
13	45	x				X
14	5	x				X
15	7	x				X
16	16	x				X
17	73	x				X
18	x	5				X
19	x	2				X
20	x	45				X
21	x	73				X
		Protan		Deutan		
		strong	mild	strong	mild	
22	26	6	(2) 6	2	2(6)	
23	42	2	(4) 2	4	4(2)	
24	35	5	(3) 5	3	3(5)	
25	96	6	(9) 6	9	9(6)	

مهر و امضاء :

visual field

- Even though we function binocularly; visual field is clinically tested monocularly.
- The absolute limits of the monocular visual field are:

  superior: 55-60 degrees

  inferior: 70 degrees

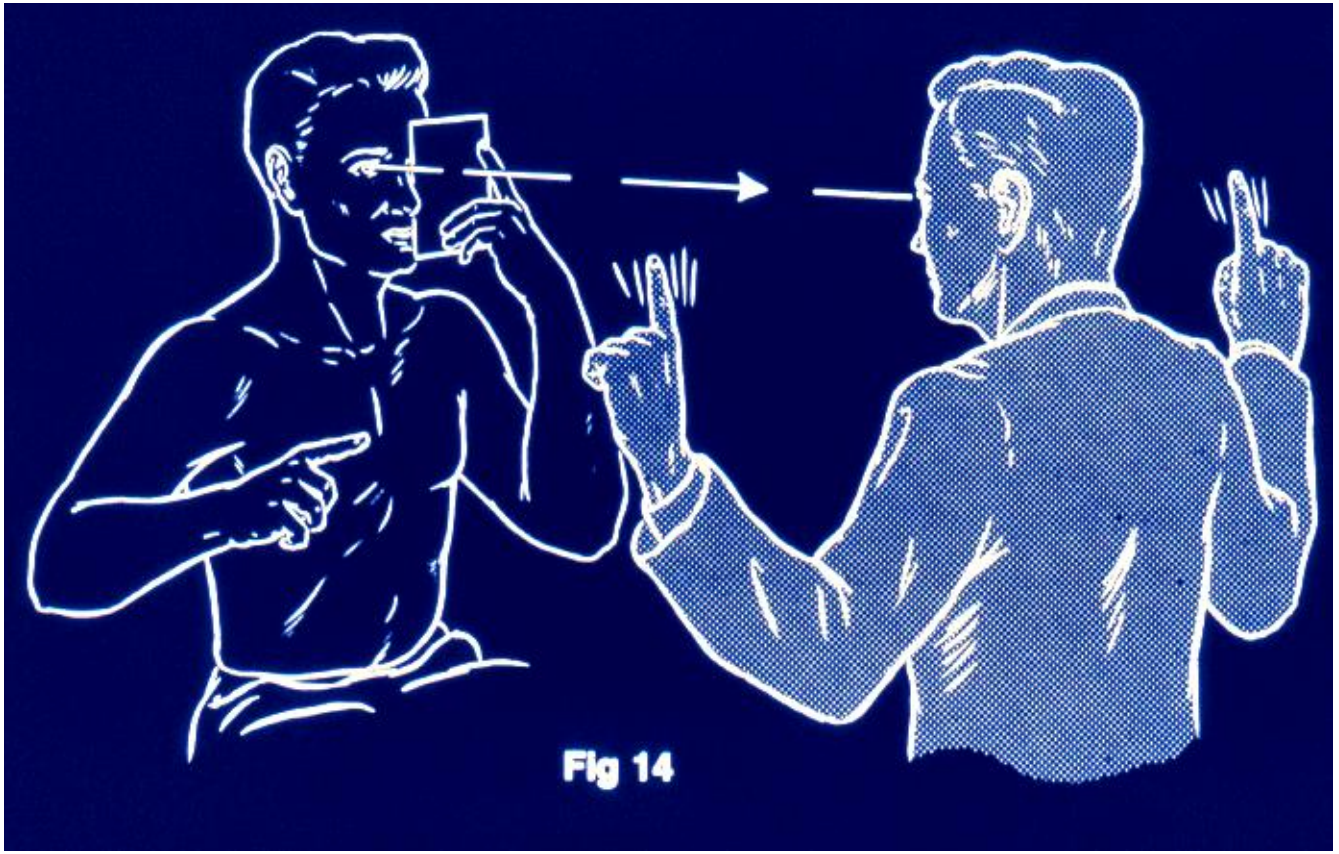
  temporal: 90-100 degrees

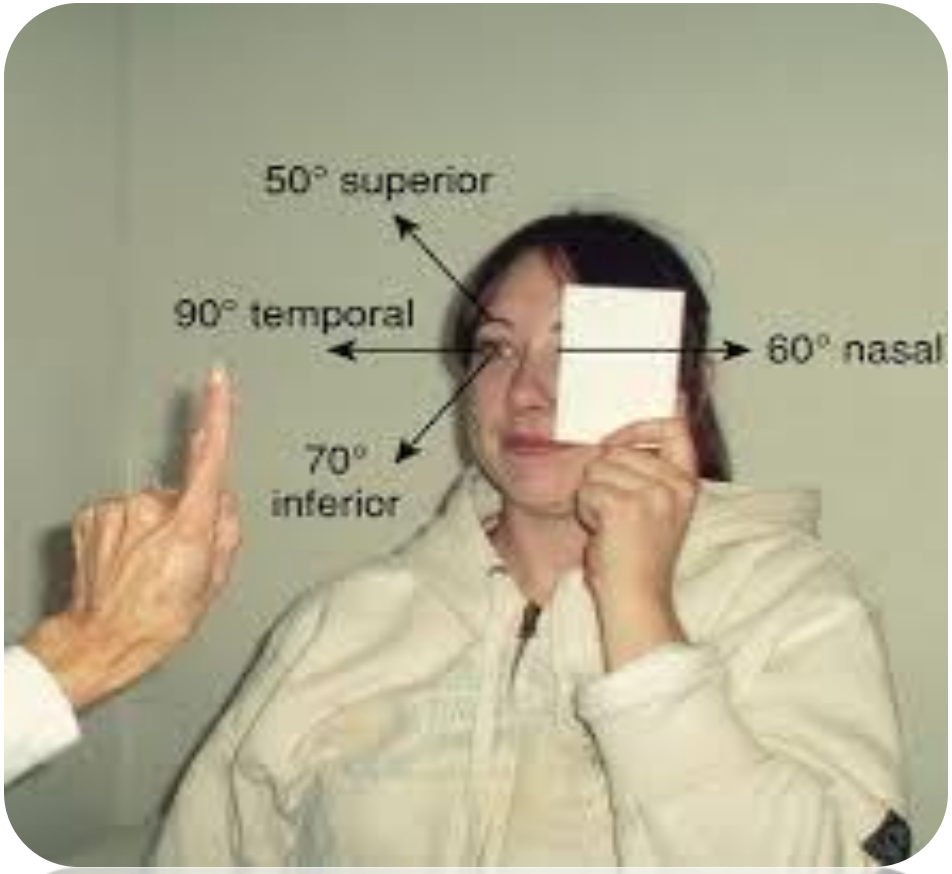
  nasal: 60 degrees

- Those test peripheral and central field.
- Those should be tested in who with suspected **head injury or decrease in visual acuity.**

- ***Confrontation field :*** most frequently use
  - Each eye is tested separately and binocular.
  - Test for four quadrants of **peripheral vision.**
  - The examiner brings his fingers slowly into view from the periphery.

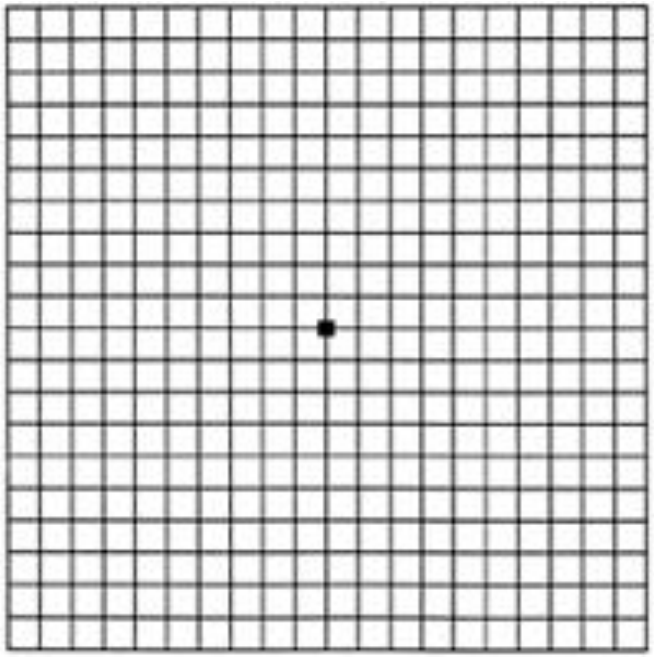
Visual Field

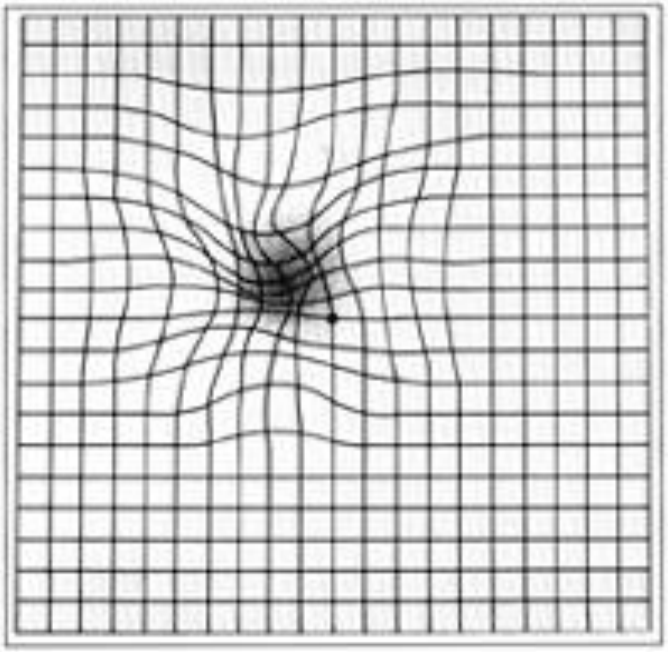



50° superior
90° temporal
60° nasal
70°
inferior

Test of Visual Field: Amsler grid

Evaluate **central visual field**





- Severe visual field defects are therefore associated with disequilibrium; workers so affected should not be permitted to work at height

Stereopsis: Titmus Fly Test

- House fly test for gross stereopsis, graded circle test (800 to 40 seconds of arc), animal testing for young children (400 to 100 seconds of arc)
- The large image of the fly is useful for testing children, as they respond to large objects

Titmus stereotest

STEREOTEST — CIRCLES		Reference distance constant 15 minutes of arc
Test	Correct Answers	Angle of Steropsis at 16 Inches
1	Bottom	800 seconds
2	Left	400 seconds
3	Bottom	200 seconds
4	Top	140 seconds
5	Top	100 seconds
6	Left	80 seconds
7	Right	60 seconds
8	Left	50 seconds
9	Right	40 seconds

One minute of arc is equal to 1/60 degree of a circle

Disturbances in binocularity

- Beyond approximately 0.5 km, the use of monocular (psychological) cues assumes greater importance in judging depth. These monocular cues are: relative size, perspective, overlapping, position in field

- **Stereopsis is only important for visual tasks relatively close to the subject and in certain specific workers such as forklift drivers.**

- Childhood disturbances in vision may prevent stereopsis from developing and increasing age reduces stereopsis; by age 65 it is absent in 33 per cent, and reduced in a further 33 per cent of the population.

Squint

- the visual axes of the eyes are not aligned.
- There is considerable evidence in the literature that people with squints are subject to discrimination in the recruitment process and in the workplace.
- This is particularly inappropriate as there is now some direct evidence that people with squints do as well as orthophoric (straight-eyed) people in complex tasks such as flying.
- Double vision cause serious danger :
  in transport or in working at a height.
- Diplopia in upgaze (due to weakness of an elevator muscle):
  disabling to a forklift driver but not to an office worker

External eye diseases

- **Dry eye**
- Reduction amount or degradation in the quality of tears :

  Discomfort and predisposes to infection. Autoimmune attack, poor nutrition and recent emotional upset.
- Some working environments exacerbate the symptoms of dry eye.
- Measure the relative humidity in the workplace.
- *workplaces cannot be humidified, and the worker will need to be placed elsewhere if simple lubricant eye drops do not solve the problem*.

Infection

Epidemic viral conjunctivitis:

- affected subjects be sent home promptly until the conjunctivitis has recovered.

- Soft contact lens wear is a risk factor for keratitis.

- Fungal keratitis:
  - agricultural workers(red eye with blurred vision)
  - sight threatening
  - must be referred urgently
  - predisposing factor is trauma with implantation of spores into a corneal abrasion (by vegetation, for example, or an animal's tail).

Chemical burns

- ***Acid burns :*** battery acids and clean metal

  - That tend to be fixed by protein in tissues
- ***Alkali burns:*** cleaning agents (NaOH & KOH), ammonia

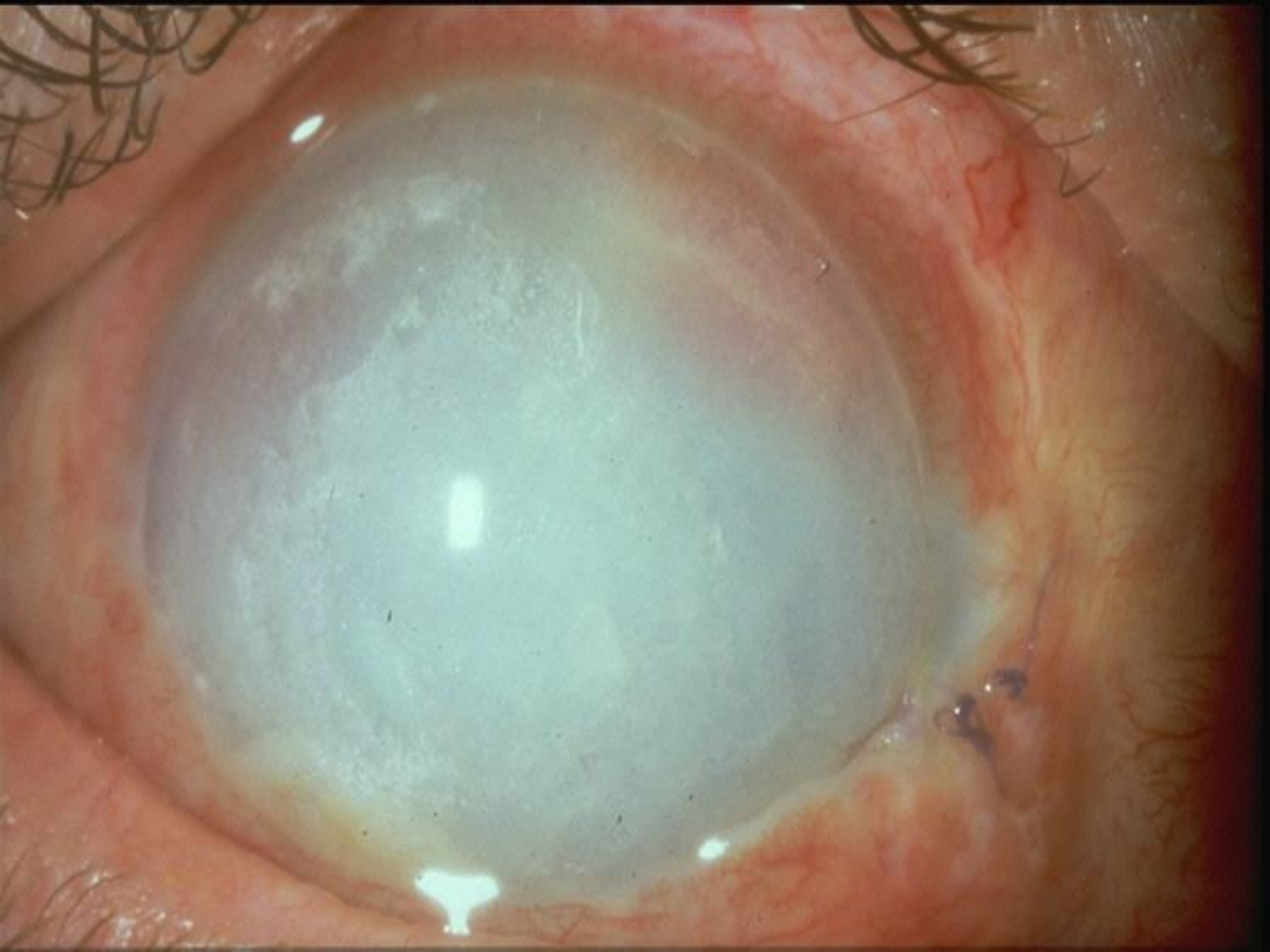
  - Alkalis are not quickly neutralized by tissue, their **destructive action can continue for hours.**
- **Clinical findings :** skin and eyelid show edema and erythema. VA acuity is decreased.
- **Complications :** bluring of cornea, glaucoma, obliteration of the blood vessels

Classifications of chemical burns of the eye.

Table 8–1. Classifications of chemical burns of the eye.

Classification	Clinical findings
Mild	Erosion of the corneal epithelium Faint haziness of the cornea No ischemic necrosis of the conjunctiva or sclera
Moderate	Corneal opacity blurring details of the iris Minimal ischemic necrosis of the conjunctiva and sclera
Severe	Corneal opacity blurring the pupillary outline Severe ischemic necrosis and blanching of the conjunctiva and sclera

DJO
Digital Journal of Ophthalmology
www.djo.harvard.edu



Chemical burns (treatment)

- Emergency treatment with use immediately to **wash the eyes with copious amounts of water** until the patient can be taken to an emergency facility. The lids must held open.
- Topical anesthetic
- PH test
- Remove damaged epithelium
- Antibiotic and corticosteroid

Prevention

keeping chemicals in **unbreakable containers** and providing Splash **protection shields** and **eye glasses**

Thermal burns

- Reflex lid closure usually protects eye surface
- Direct contact with molten metal or glass can cause severe injury to lids. Irrigation may be necessary to remove particulate matter.
- Extensive loss of lid skin can lead to exposure and drying of the cornea.

Mechanical injury (abrasions cornea)

- ***Welder's flash :*** exposure to UV radiation

  - After a latent period (6-8 h), this cause and acute onset of severe pain, Photophobia ,blepharo spasm and tearing

  - Treatment include an **antibiotic ointment and patching the eye** to prevent lid movement or blinking for usually 24-48 hours.

  caution: The patient should not be given topical anesthetic to use at home.

Mechanical injury (abrasions cornea)

- ***Superficial foreign bodies :*** those are most commonly occuring work related eye injuries.

  - Fluorescein stains helps to locate the foreign body treatment by applying a **topical antibiotic and covering** the affected eye with a path dressing for 24-48 hours.

  - scarring usually dose not occur

  caution: The patient should not be given topical anesthetic to use at home.

Mechanical injury

- ***Intraocular foreign bodies :*** history of irritating sensation and no superficial foreign body is found. Vision may be nearly normal if wound is small. Type of material is important :

  - **Soluble metallic salts** (**iron and copper**): can cause irreversible toxic damage to the retina. They must be removed.

  - **Inert material** (**aluminum, plastic & glass**) : it may be unnecessary to remove.

  - **Organic material** (**wood & plant**) : it may cause infection. Remove is recommended.

Eye irritant

- Exposure to aerosol, dust, smoke and vapor.
- **Acute:** burning, tearing, belepharospasm.
- **Chronic:** fatigue, dryness, burning and redness. irrigation with saline solution, adequate ventilation and avoidance of irritants are best preventive measures.

Ionizing radiation eye injuries

- X-rays, beta rays, and other radiation sources in adequate doses can cause ocular injury.
- **Eye lid** vulnerable to x-ray damage (loss of lashes and scarring).
- Damage to conjunctiva lead to **dryness of eyes**.
- X-ray radiation in a dose of 500-800 rad directed toward the lens surface can cause **cataract.**

UV radiation eye injuries

- Wavelengths < 300 nm can damage the **corneal** epithelium (arc welding, high altitudes and reflection of snow, water or sand).

- Wavelengths of 300-400 nm are transmitted through the cornea, and approximately 80% are absorbed by the **lens**, where they may cause **cataractous** changes.

- workers exposed to bright sunlight in occupations such as **farming, truck driving, and construction works** appear to have a higher incidence of cataracts than do those who work primarily indoors.

Injuries Caused by Visible Radiation

- Visible light has a spectrum of 400–750 nm. If the wavelengths of this spectrum penetrate fully to the retina, they can cause thermal, mechanical, or photic injuries.
- Thermal injuries are produced by light intense enough to increase the temperature in the retina by 10–20°C (18–36°F).
- Lasers used in therapy can cause this type of injury.

- Photic injuries are caused by prolonged exposure to intense light which produces varying degrees of cellular damage in the retinal macula without a significant increase in the temperature of the tissue (usually no more than l–2°C)
- Sun gazing is the most common cause of this type of injury, but prolonged unprotected exposure to a welding arc also can damage the retinal macula.

- Wavelengths of 500–750 nm are most useful for vision and appear not to cause photic damage to the retina at exposures most commonly encountered.
- However, repeated exposure to bright sunlight by working outdoors for 3–4 hours each day can cause prolongation of the dark adaptation response, thereby reducing night vision

IR radiation eye injuries

- Infrared has a spectrum > 750 nm.
- Wavelengths spectrum of 750-2000 nm are biologically active for damage tissue.
- This can produce lens changes **(cataract).**
- Occupational exposure include processes in which thermal energy is used such as heating and dehydrating processes.
- glassblowers and furnace workers particularly are at risk.

Eye strains

- Occupations include computer operator, librarians, nurses and students.
- Symptoms include sore eyes, fatigue and headache.
- Environmental and ergonomic factor are important contributors.
- Workers with eye strains must be referred for assessment of refractive error.

Prevention

- About 60% of workers who suffer eye injuries did not wear eye protection at the time of the injury.
- Appropriate eye protection is the most important single intervention.
- Assessment risk of operations and exposures.
- Visual checking in routine health exams.
- Planning for eye emergencies.
- Engineering modification.

Eye protection

- The following criteria should be used in selection:

- Type of hazard:

  (a) Mechanical (flying debris, dust, or molten metal).

  (b) Chemical (fumes, gas, or liquid splash).

  (c) Radiation (heat, UV, or glare).

  (d) Laser (over a wide spectrum of wavelengths).

- Type of protector:

  (a) A safety face shield protects face and eyes but does not keep out dust or gas. It can be comfortably worn for long period.

  (b) Safety goggles provide protection for all hazards and may be worn over spectacles.

  (c) Safety spectacles are comfortable but will not keep out dust, gas or molten metal.


gettyimages

- Type and shade of lens:

  (a) Toughened and laminated glass is less impact resistant but more resistant to abrasion.

  (b) Polymethylmethacrylate and polycarbonate offer high impact resistance but are easily scratched.