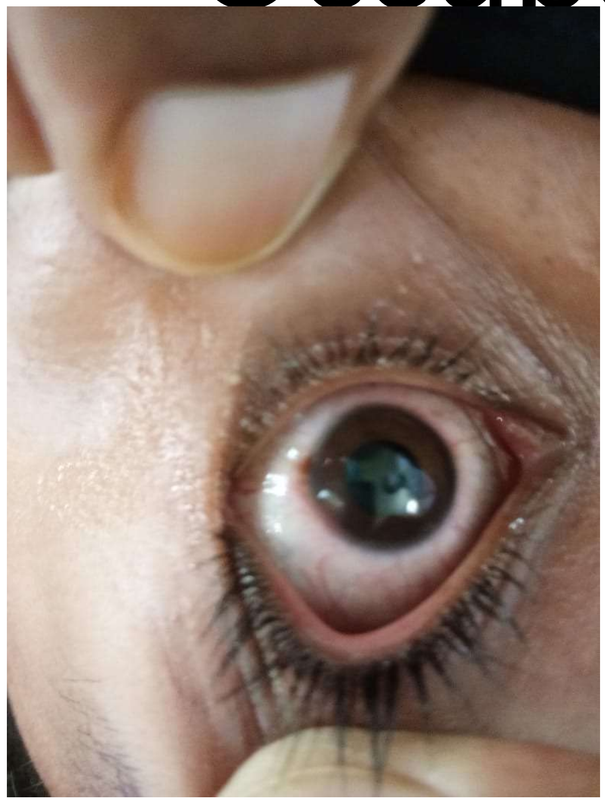
Occupational eye diseases and injuries



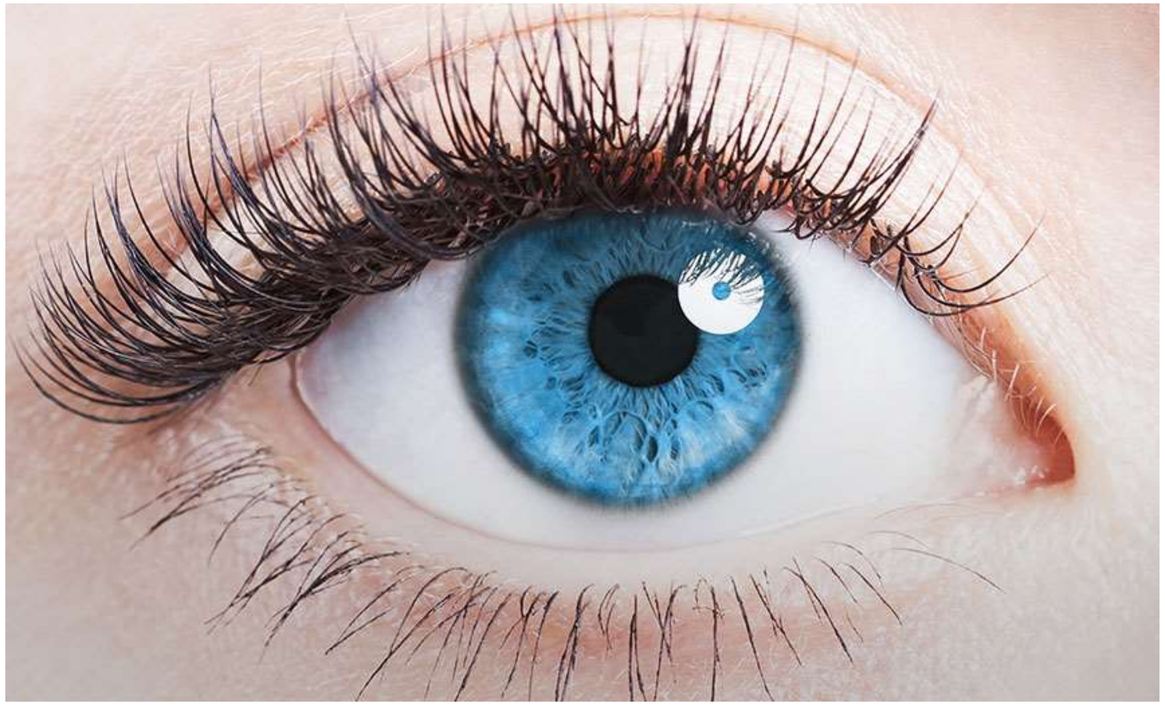
Othalmology section

VSTPS

Dr. A K Mishra, Sr. Consultant(Opthal), K Vijaya, FMO

‘Sarvendriyanam Nayanam Pradhanam’

An occupational disease or accident prevented, is a benefit but that which is compensated is an APOLOGY



Eye injuries have been known since ancient times. Although nature has provided a protective bony wall and lids to cover the eye to protect it from injury, it is still exposed to all types of trauma. Trauma is the leading cause of patient presentation to the eye clinic, accounting for 52% of the patient load. Occupational eye injuries are more common in younger men and comprise 70% of all the ocular injuries.

INDEX

Occupations

Anatomy and physiology - a quick glimpse

Classification

Hazards

Treatment

Prevention

Vision Conservation Program

Classification

1 Injuries

2 Diseases

Cause of concern: Occupational eye trauma is more common in young men and comprise 70 % of all ocular trauma.



History

Examination

A thorough history has to be obtained, with
particular emphasis on
*the type of industry,
*the nature of work,
*the hours of work daily,
*the exact nature of the event which led to the injury and
* the object which caused the injury.
* The patient’s symptoms following the injury are to be enquired about in detail.
*A relevant past ocular and general medical history has to be obtained
for risk assessment in the present ocular injury.
*The history of prior treatment for the injury has to be recorded.
All the patients are to be subjected to a complete ophthalmic examination. Their visual outcomes are to be considered.

Injuries

5% of all injuries due to industrial injuries(source: DGFASLI AFIH course manual)

- Flying objects(foreign bodies)-80%
- Tools and parts of machinery(8%)
- Splashes of liquids(acids and alkalies)(7%)
- Explosives (2.5%)
- Falls. (2%)
- Infections (0.5%) (occupational in origin)

Injuries

Introduction

- These injuries may vary in severity from slight irritation to complete destruction of the eye.
- Eye injuries rarely endanger the life but very often lead to impairment of vision.
- Eye injury may seem to be trivial, but it may have disastrous after results.
- One can only decide whether an injury is trivial or major after the individual has completely recovered without any sequelae.
- Extreme caution and utmost care, expertise and gentleness make the essential principles of management of eye injuries.

Hazards

Eye injuries

- Mechanical
- Physical
- Biological
- Chemical
- Foreign bodies are very common.
- Occupations like foundry work, engineering works, construction works, and chemical industries
- Injuries can be lacerations, perforations, ruptures and burns

Hazardous

Material

- Solder specs
- Grinding dust
- Insulation fibre
- Bits of wire
- Glass pieces
- Electrical sparks
- Solvent splashes
- Liquids or gases under pressure
- Nails
- Welding Fumes
- Nails



Source:Dr. Mortan Grant text book

Eye diseases can occur due to trauma:

A Survey conducted by Central Labour Institute, Mumbai in the post traumatic period,

Revealed that the incidence of pterygium, chronic conjunctivitis, and cataracts frequently

Of traumatic origin, was higher in dock workers.

Chemical exposure or splashes cause occupational eye diseases.

Eye irritation due to hydrogen sulphide gas and UV rays

Corneal edema and epithelial vacuoles eg. xylene

Cataract due to dinitrophenol

Optic atrophy due to Lead

Anatomical position wise description

A) Corneal and conjunctival
B) Lens, iris and anterior chamber
C) Posterior segment and optic nerve
D) Central nervous system disturbances
E) Occular pressure disturbances
F) Eye and Lid
G) Pupil

Corneal and conjunctival Disturbances

Chemical burns

- Caustic, alkaline, and acids
- Solvent splashes-organic solvents
- Surfactant and detergent injuries: Liquid splashes or dusts
- Delayed or latent action injuries :Dimethyl sulfate, formaldehyde, methyl bromide, methyl dichloroproprionate, cosmic acid, sulfurdioxide.
- Delayed corneal epithelial edema Producing haloes around light from vapour exposure: allyl alcohol, amine diethydiglycolate, di-isopropyl amine, dimethylaminopropylamine, ehylenediamine, tetra methyl butane diamine, triethylene diamines, corneal epithelial vacuoles after chronic vapour exposure: n-butanol, xylene
- Delayed corneal epithelial injury-keratitis epithelial with blurring and pain several hours after exposure to gases, vapours, or dusts—allyl alcohol, diazomethane, di chlorobutenes, dimethyl sulphate, ethylene oxide, ethylenimine, hydrogen sulphide, methyl bromide, osmic acid.
- Corneal and conjunctival discolouration with late corneal scarring and distortion-benzoquinone
- Conjunctival discolouration from internal substances - Aniline, arsine, nitro benzene, silver.

COMMON ACID SUBSTANCE

Acid	Strength	Use
Sulfuric (H_2SO_4)	Strong	Car batteries, fertilizer, making other acids, explosives, dyes, refining petroleum
Nitric (HNO_3)	Strong	Fertilizers, explosives, rocket propellant, production of nylon
Chromic (H_2CrO_4)	Strong	An intermediate in electroplating, ceramic glazes, wood preservation
Hydrofluoric (HF)	Weak, but most reactive anion	Etching glass, semiconductor production, rust remover







COMMON ALKALI SUBSTANCE

Compound	Common sources	Comments
Ammonia [NH_3]	Fertilizers	NH_4OH fumes
	Refrigerants	Very rapid penetration
	Cleaning agents (7% solution)	
Lye [NaOH]	Drain cleaners	Penetrates almost as rapidly as ammonia
Potassium hydroxide [KOH]	Caustic potash	Severity similar to that of lye
Magnesium hydroxide [$Mg(OH)_2$]	Sparklers	Produces combined thermal and alkali injury
Lime [$Ca(OH)_2$]	Plaster	Most common cause in workplace
	Mortar	Poor penetration
	Cement	Toxicity increased by retained particulate matter
	Whitewash	







Acid Injury:

Acids dissociate into hydrogen ions and anions

The hydrogen molecule damages the ocular surface by altering the pH while the anion

Causes protein denaturation, precipitation and coagulation

Protein coagulation prevents the deeper penetration of the acids.

Alkali Injury:

Alkalis dissociate into hydroxyl ion and a cation on the ocular surface

The hydroxyl ion saponifies the cell membrane fatty acids, while the cation interacts with

Stromal collagen and glycosaminoglycans

This interaction facilitates deeper penetration into and through cornea and into the anterior

Classification of chemical Injuries

1. Hughes classification
2. Modified Hughes/Roper Hall classification
3. Duas Classification

What are we afraid of……

Complications that could happen because of injuries…..

Cornea a transparent structure becomes opaque

There is Ocular pressure(just like blood pressure) which might increase

Damage to all the visual pathway

Ultimately landing in Blindness

Blindness due to occupation and unsafe working conditions are unpardonable

Unsafe act such as not taking proper precautions, not wearing PPEs, being alcoholic

Having co morbidities which are not being taken care of properly.

Lens, Iris and Anterior Chamber

- Cataracts from systemic chemicals dinotrophenol, dinitro cresol
- Lens deposits and discolouration: Copper, Iron, Mercury, phenyl mercuric salts, silver
- Myopia with miosis - Anticholinesterase agents.

Posterior segment and Optic Nerve

- Retinal function dark adaptation altered - Carbon dioxide, carbon disulphide, carbon monoxide.
- Retinal hemorrhages- Acetyl phenyl hydrazine, benzene, lead methyl bromide, triethyl tin, warfarin
- Papilledema: Ethylene glycol, lead, methanol, thallium
- Optic Neuritis - dinitro benzoin, dinitro toluene, lead, methanol, thallium
- Peripheral visual field constriction: Carbon dioxide, carbon monoxide, methyl mercury, methanol, naphthalene

Central nervous system -Vision

- Cortical blindness or hemianopia: CO, Lead

Intraocular pressure disturbances

- Pressure elevation from chemical burns: ammonia, calcium, hydroxide, formaldehyde

Eye and Lid

- Nystagmus: Carbon disulphide, dieldrin, ethyl alcohol, ethylene-glycol, methyl bromide, methyl chloride, methyl iodide.
- Diplopia: Carbon disulphide, carbon monoxide, ethyl alcohol, ethylene glycol, lead, methyl bromide, methyl chloride, methyl iodide, triethyl tin
- Paralysis of extra ocular muscles: Ethyl alcohol, lead, thallium, triethyl tin
- Ptosis of eye lids-Thallium
- Lid edema from systemic substances- arsine, hydralazine

Pupillary status

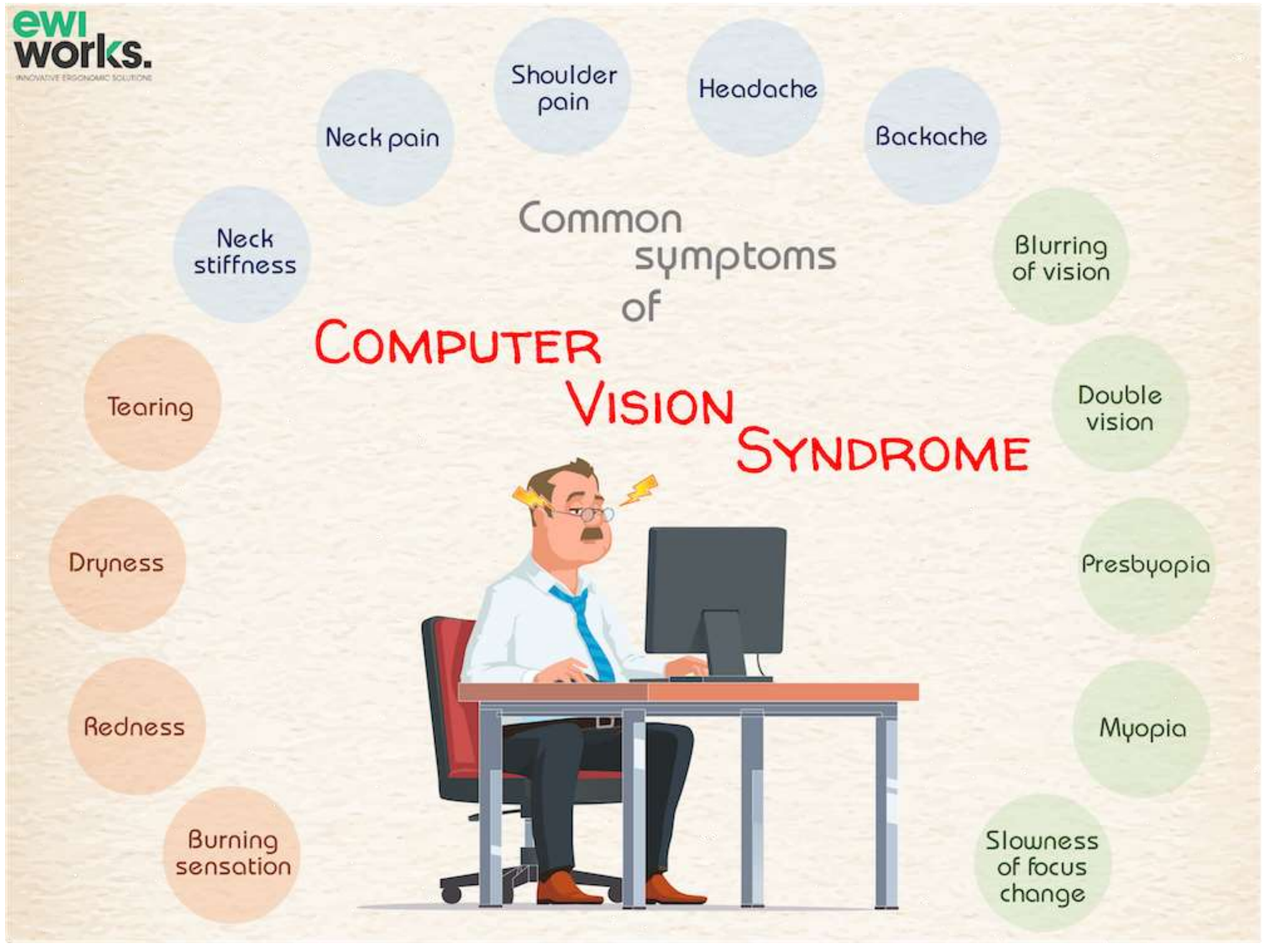
- Dilated pupils - Atropine, datura poisoning, anticholinergics
- Constriction of pupils : organophosphates

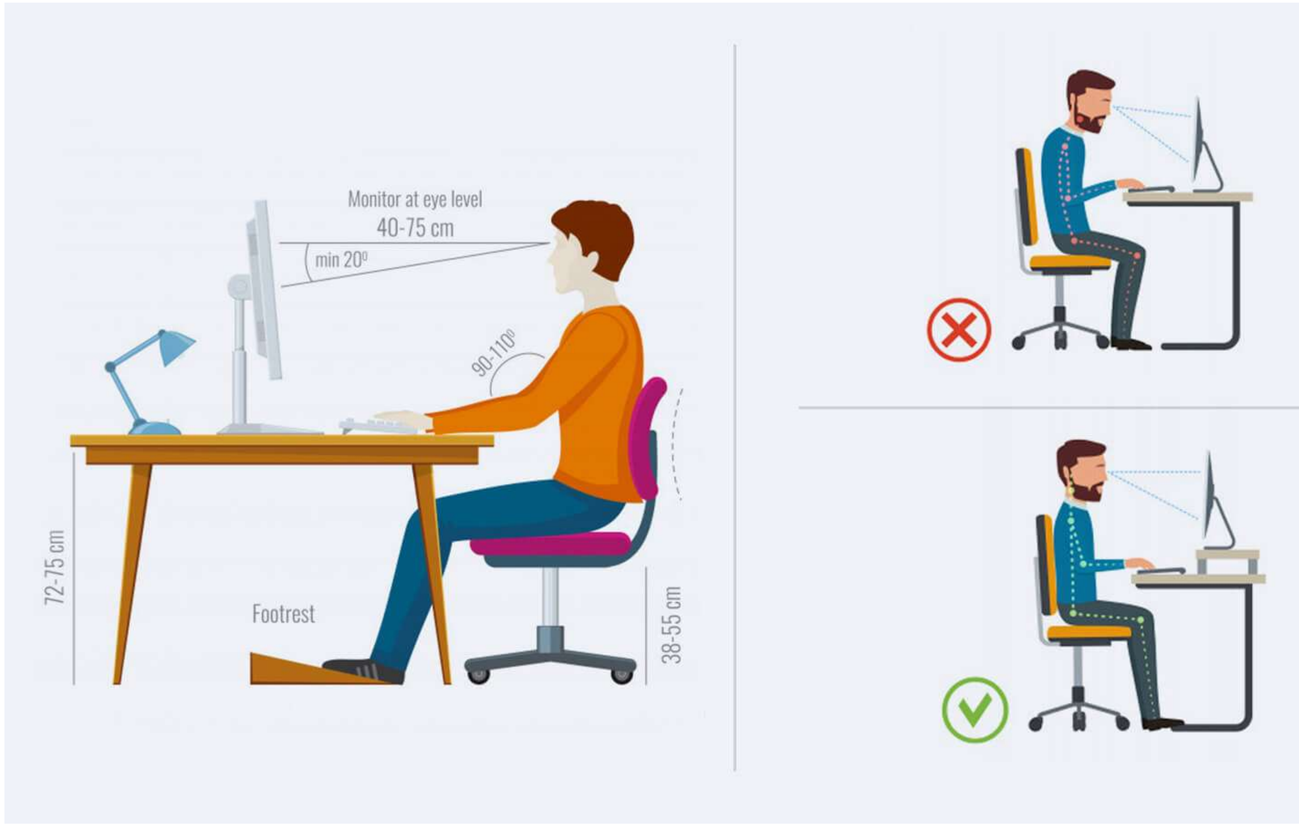
Eye diseases

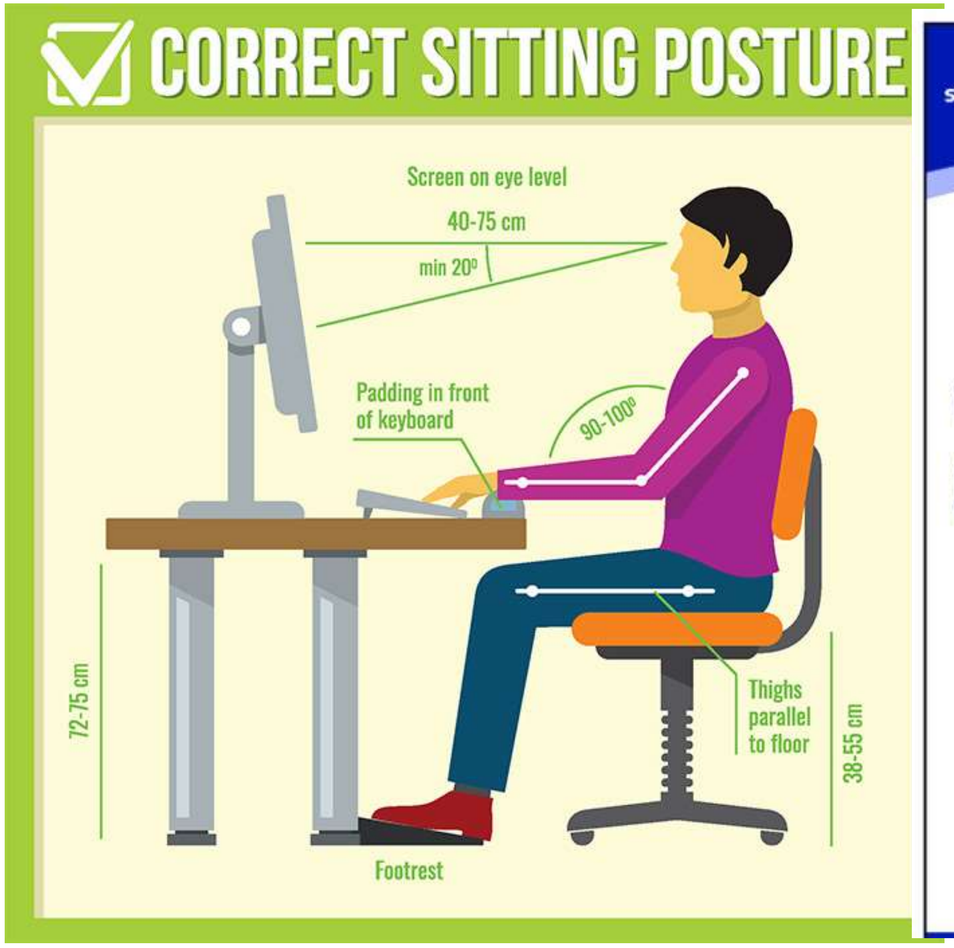
Due to Occupational hazards

- Cataracts in workers working near furnaces, glass blowers, near heat
- Welding Arc Injury
- Cataracts in farmers working in hot sun.

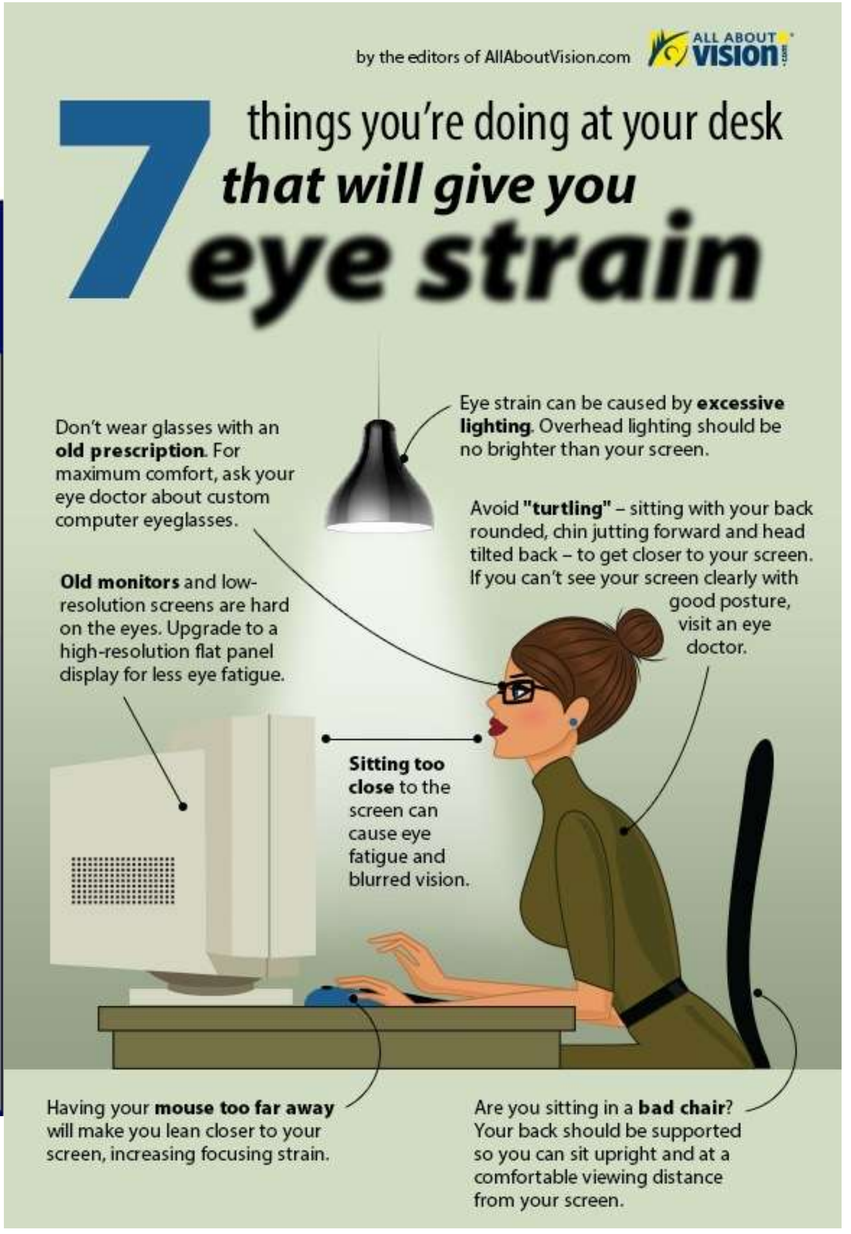
Computer vision syndrome






CORRECT SITTING POSTURE
Screen on eye level
40-75 cm
min 20º
Padding in front of keyboard
90-100º
72-75 cm
Thighs parallel to floor
38-55 cm
Footrest


During computer or smart phone usage, reduce stress on your visual system by following these tips.
1 If possible, use Ott-Lite Full Spectrum lighting.
2 Every 15 minutes, focus on an object 20 feet away for 20 seconds.
3 Maintain Harmon distance from screen center. Harmon distance = from middle knuckle to center of elbow.
4 Use good posture. Feet flat on floor. No slouching, legs at 90 degree angle.
5 Don't view at an angle, turn or tilt your head.
6 Avoid any glare on screen.
7 Adjust brightness of screen and size of text for comfort. You shouldn't be squinting, straining or leaning toward the screen.


by the editors of AllAboutVision.com
ALL ABOUT VISION
7 things you're doing at your desk that will give you eye strain
Don't wear glasses with an old prescription. For maximum comfort, ask your eye doctor about custom computer eyeglasses.
Eye strain can be caused by excessive lighting. Overhead lighting should be no brighter than your screen.
Avoid "turtling" – sitting with your back rounded, chin jutting forward and head tilted back – to get closer to your screen. If you can't see your screen clearly with good posture, visit an eye doctor.
Old monitors and low-resolution screens are hard on the eyes. Upgrade to a high-resolution flat panel display for less eye fatigue.
Sitting too close to the screen can cause eye fatigue and blurred vision.
Having your mouse too far away will make you lean closer to your screen, increasing focusing strain.
Are you sitting in a bad chair? Your back should be supported so you can sit upright and at a comfortable viewing distance from your screen.

NON IONIZING RADIATION AND THE EYE

Ultraviolet 100–400 nm (wavelength)
Visible 380–760nm
Infrared 760 nm–1mm
Microwave 1mm–1m

Table 54.1 The pathophysiology of optical radiation and the eye.

Spectral domain		Wavelength (nm)	Sources		Absorbtion site		Nature of damage	
Physical	Biological		Lasers	Others	Tissue	Location		
Far ultraviolet	Ultraviolet C	200–280	Excimer	Sunlight Arc lamps Germicidal lamps Mercury lamps	Cornea	Epithelium	Photochemical	Photokeratitis Corneal opacity –
Far ultraviolet	Ultraviolet B	280–315	Excimer	Sunlight Sun lamps Welding arcs	Cornea	Epithelium	Photochemical	Photokeratitis Corneal opacity
		295–315			Lens Nucleus	Epithelium	Photochemical	Cataract
Near ultraviolet	Ultraviolet A	315–400	Excimer	Sunlight UV-A sun lamps Sunbeds	Lens	Epithelium Nucleus	Photochemical	Cataract –
Visible	Visible	380–780	Argon Dyes Helium-neon Krypton	Sunlight Incandescent lamps Fluorescent lamps Arc lamps	Retina	Pigment Epithelium Haemoglobin Macular pigment Visual cells	Thermomechanical Thermal Photochemical Thermal Thermal Photochemical	 Visual loss Visual loss Visual loss Insidious visual loss Colour vision problems Accelerated ageing
Near infrared	Infrared A	780–1400	Gallium arsenide Neodymium YAG	Sunlight Arc lamps Electric fires Furnaces	Retina	Pigment epithelium	Thermal	Visual loss
					Iris Lens	Pigment epithelium Nucleus	Thermal	Cataract
Far infrared	Infrared B	1400–3000	Erbium	Sunlight Furnaces	Cornea	Epithelium	Thermal	Corneal opacity Aqueous flare
					Lens	Epithelium	Thermal	Cataract
Far infrared	Infrared C	3000–10 000	Carbon dioxide	Furnaces	Cornea	Epithelium	Thermal	Cataract

Modified from Ref. 2. REF. HUNTER

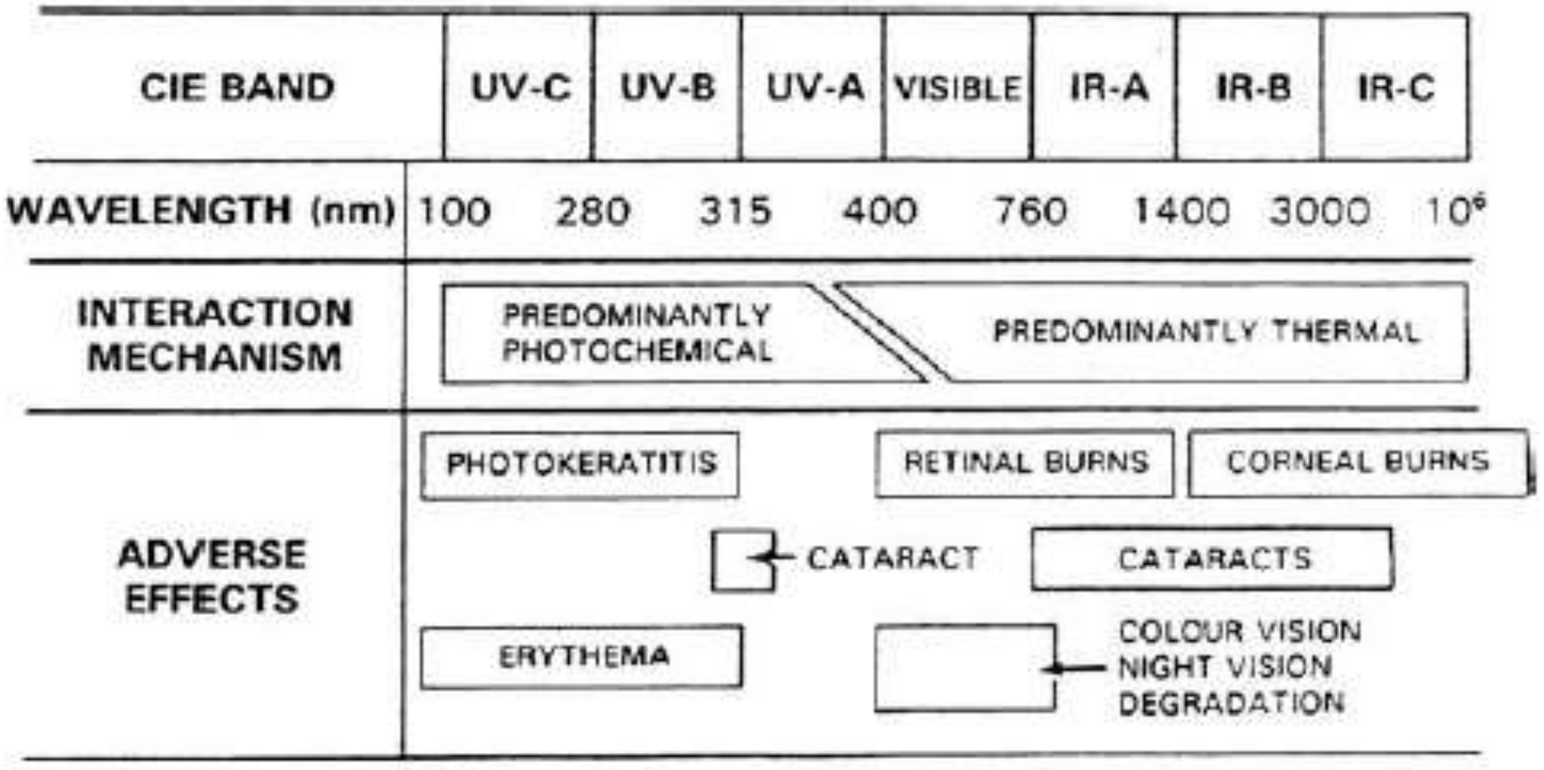


Figure 54.4 International Commission on Illumination (CIE) spectral bands with their corresponding effects. The direct biological effects of optical radiations are frequency dependent. In the visible and infrared (IR) regions, the interaction mechanism is primarily thermal. In the ultraviolet (UV) region, the interaction mechanism is predominantly photochemical, although thermal injury is also present. The biological effects for IR radiation are corneal burns and cataracts. The biological effects for visible radiation are retinal burns, cataracts and degradation of colour or night vision. The biological effects for UV radiation are photokeratitis, cataracts and erythema. UV-A and UV-B also cause skin cancer. Reproduced from Ref. 1.

Table 54.2 Selected occupational exposure limits for some common lasers.

Type of laser	Wavelength	Exposure limit
Argon-fluoride	193 nm	3.0 mJ/cm^2 over 8 h
Xenon-chloride	308 nm	40 mJ/cm^2 over 8 h
Argon ion	488, 514.5 nm	3.2 mW/cm^2 for 0.1 s
		2.5 mW/cm^2 for 0.25 s
Helium-neon	632.8 nm	1.8 mW/cm^2 for 1.0 s
		1.0 mW/cm^2 for 10 s
Helium-neon	632.8 nm	100 μW/cm^2 for 8 h
Neodymium-YAG	1064 nm	5.0 μJ/cm^2 for 1 ns to 100 μs
		5 mW/cm^2 for 10 s
Erbium glass	1540 nm	1.0 J/cm^2 for 1 ns–10 s
Erbium: YAG	2940 nm	10 mJ/cm^2 for 1–100 ns
Hydrogen-fluoride	2.7–3.1 μm	10 mJ/cm^2 for 1–100 ns
Carbon dioxide	10.6 μm	100 mW/cm^2 for 10 s to 8 h, limited area
		10 mW/cm^2 for >10 s

Source: ACGIH EL

Note: To convert exposure limits in mW/cm^2, multiply by exposure time in seconds, e.g. the He-Ne or Argon EL at 0.1 s is 0.32 mJ/cm^2.

Table 54.3 Selecting eye protection for intense optical radiation.

Type	Assessment	Protector type	Shade No.	Limitations	Not recommended
Welding electric arc	Shade based on visual comfort	Welding helmet	10–14	Protection from optical radiation directly related to filter lens density; select the darkest shade that permits adequate task performance	Protectors that do not provide protection from optical radiation
Welding gas	Shade based on visual comfort	Welding goggle or welding face shield	4–8	Face shield can be worn over the primary protector	
Cutting			3–6		
Torch brazing			3–4		
Torch soldering	Shade based on visual comfort	Spectacles or welding face shield	1, 3–5	Face shield can be worn over the primary protector	
Glare	Shade based on visual comfort	Spectacle frontal protection	1–4	Shaded or special purpose lenses, as suitable	
Laser specified	Optical density as maximum laser exposure divided by exposure limit	Laser protective goggle or spectacle	Optical density units used	Choose filter lens based on comfort, optimal visual performance	Uncomfortable goggles, users fail to wear
RF/microwave	Psychological	Goggles made but not recommended	NA	NA	Not effective

Adapted from Ref. 68. This table was published in *Opthalmology Clinics of North America*, **8**, Vinger P, Sliney D, Issues in ocular trauma. The prevention of sports and work related injury, 709–21, copyright Elsevier (1995).
NA, not applicable.

Key points

- Excessive non-ionizing radiation can damage the eye.
- Damage is usually to the cornea or retina and can result in visual deterioration.
- Users exposed to acute or chronic non-ionizing radiation should be aware of exposure limits, safety standards and the appropriate eye protection.

Miner’s Nystagmus

History: Bradford, an ophthalmic specialist contributed to the identification of Miner’s nystagmus:

This occurs chiefly in those who have worked for a long time at the coal face.

The patient complains of defective vision, which is worse at night, headache, giddiness, photophobia, the dancing of lights and

The nystagmus is essentially rotatory and very rapid; in latent cases it is elicited by fixing the head and making the patient loo

The frequency of the disease varies inversely with the illumination in the mine,

suggesting that fixation difficulties in the dim illumination may be an aetiological factor;

it will be remembered that visioning a dull light is carried out almost entirely by the rods.

In these circumstances visual acuity is greatest 10-15% outside the fovea, and there is a physiological central scotoma making

Improvement in miners’ lamps and in the lighting of mines eliminated the disease.

Role of Medical Officers in Industry regarding eye diseases

* Detailed History
* First Aid
* Thorough examination by an Experienced Ophthalmologist
* Hospitalization
* Treatment
* Prevention by Check up of the worker, work site
* Site for dangerous processes and Showers

5.4 Vision Conservation Programme

A well organized vision conservation program for an industry has five components.

i. Screening the vision of the individual workers.

ii. Determining the vision requirements of different jobs among the workers.

iii. Detailed assessment of the hazards of jobs with special reference to the eye and of the general work environment.

iv. Encouraging the wearing of basic eye protective equipment at all times by everyone who enters the area potentially hazardous to the eye.

v. Providing properly fitting approved type of safety eye – against special hazardous operations.

Individual workers should be examined and vision status recorded – both at the time of initial recruitment and during periodical examinations. A "vision tester" or an "orthorator" is a very useful and compact instrument to screen acuity of vision (distant & near), field of vision muscle balance (in both the places), binocular vision and colour vision. The visual standards of each worker should be carefully matched with the vision requirements of jobs performed by them eg. crane operators, drivers etc.

Proper first aid training and health education should be imparted to the workers to ensure that, in cases of ophthalmic emergencies like chemical splashed immediate eye wash etc. are carried out which are essential to minimize the damage to the eye. Incorrect first aid or unnecessary intervention may lead to further damage and thereby loss of vision.

Rehabilitation of those who have suffered eye injuries should also be given due importance. One eyed persons need special consideration and placement depending upon their job demands.

"In all cases of eye injuries of any nature, guarded prognosis should be given, as no matter how trivial an eye injury may seem, there is always the risk of disastrous after-result".

Chemical Injuries - Treatment

- Alkalies cause severe damage; Ammonia and sodium hydroxide are particularly harmful.
- Irrigation with copious amounts of normal saline, if not available then with plain water till the pH returns to normal or for 30 minutes.
- All fornices to be irrigated thoroughly
- Refer to Ophthalmologist for further treatment which is anaesthetics, antibiotics, cycloplegics, steroids, anti inflammatory medicines and drops/ointments
- Acetazolamide tablets in first ten days to lower intra ocular pressure
- Ascorbic acid and tetracycline locally and systemically
- 10% sodium citrate, 5% N-acetylcysteine or 1% medroxyprogesterone eye drops are useful adjuncts.

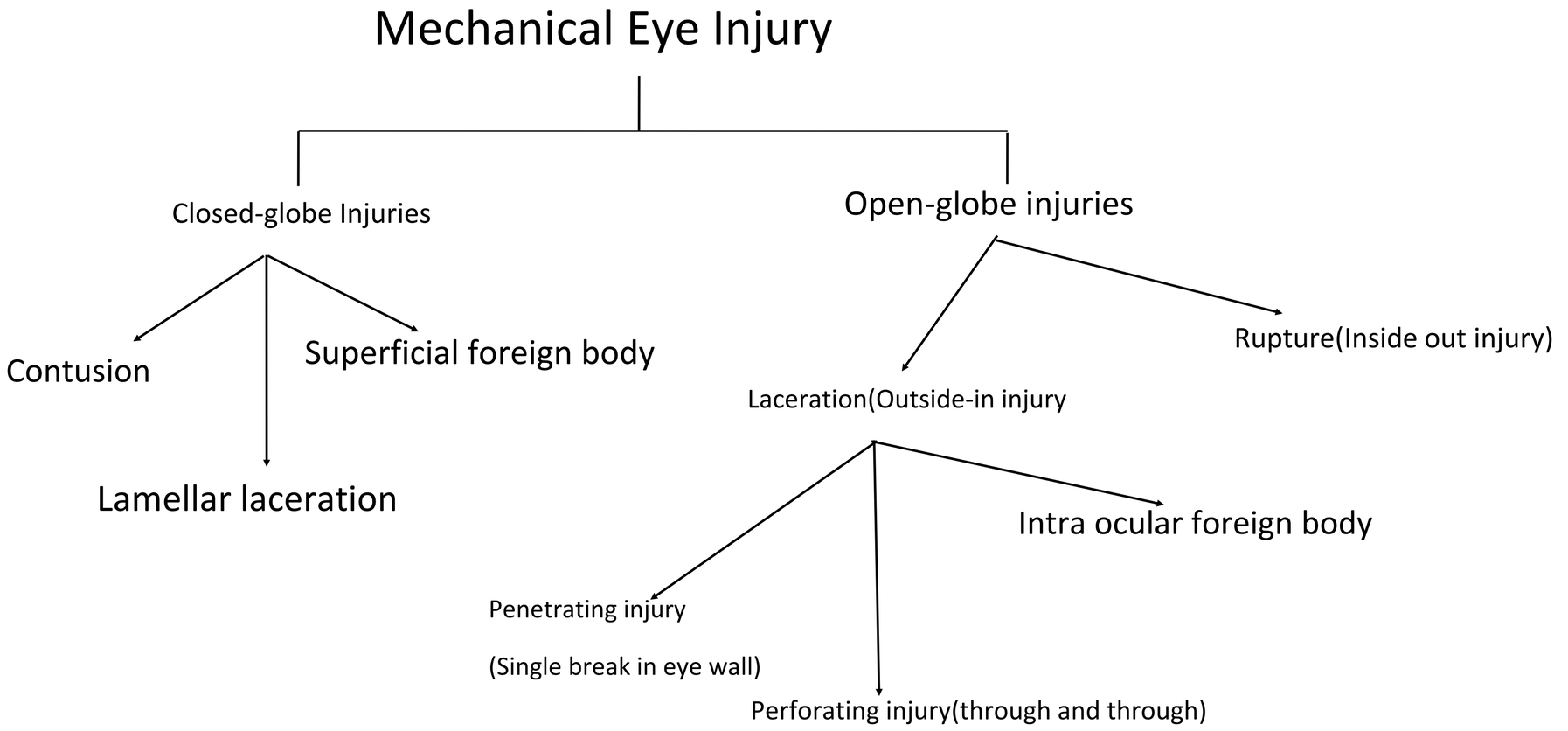
Grading of Ocular Chemical Injuries

Grade I	(Mild)No limbal ischaemia
Grade II	(Moderate) 180^0 limbal ischaemia with epithelial defect and clear cornea
Grade III	(severe) 180^0 limbal ischaemia with epithelial defect and hazy cornea
Grade IV	(severe) 2700 limbal ischaemia with epithelial defect and hazy cornea

Acids: HCL, H2SO4 coagulate the surface layers and do not penetrate the eye. They should also be treated by copious irrigation. Acids can also produce limbal ischaemia. Symbhleron and shortening of the fornices occur as the raw surfaces heal, and this needs to be taken care of.

Mechanical Injuries

Classification of ocular trauma



Treatment: Removal

Prevention by PPE

Sympathetic Opthalmitis

Eye Protection Wear in Industries







Eye showers

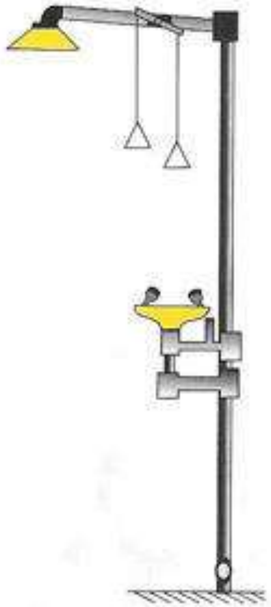
In industry



Hand Operated Safety Shower



Paddle Operated Safety Shower



Hand/ Pull Operated Safety Shower



Spares for Eye Wash Fountain (Bowl, Nozzel & Shower)



Paddle/Pull Operated Safety Shower



Wall Mounted Eye Wash Shower





KEY MESSAGE

* Potential eye hazards are found in nearly every industry and 90% of them are preventable.
* Mechanical injuries were the most common type of injury.
* Activities should be undertaken to create awareness about the risks of injuries that may be sustained and also plans should be drawn up to avoid them.

Harvard Health Publishing
HARVARD MEDICAL SCHOOL
Trusted advice for a healthier life

5 truths about protecting your eyes



Of your five senses, which one are you most afraid of losing? If you're like most people, your answer is your ability to see. Because our eyesight is so precious, it's no wonder that myths abound about your eye health, what can damage our eyes, and what can protect them. Here, we debunk five common myths — and tell you how to truly keep your eyes healthy.

Myth: Doing eye exercises will delay the need for glasses.
Fact: Eye exercises will not improve or preserve vision, help your eye health, or reduce the need for glasses. Your vision depends on many factors, including the shape of your eyeball and the health of the eye tissues, neither of which can be significantly altered with eye exercises.

Myth: Reading in dim light will worsen your vision.
Fact: Dim lighting will not damage your eyesight or eye health. However, it will tire your eyes out more quickly. The best way to position a reading light is to have it shine directly onto the page, not over your shoulder. A desk lamp with an opaque shade pointing directly at the reading material is ideal.

Myth: Carrots are the best food for the eyes.
Fact: Carrots, which contain vitamin A, are indeed good for the eyes. But fresh fruits and dark green leafy vegetables, which contain more antioxidant vitamins such as C and E, are even better for eye health. Antioxidants may even help protect the eyes against cataracts and age-related macular degeneration. Just don't expect them to prevent or correct basic vision problems such as nearsightedness or farsightedness.

Myth: It's best not to wear glasses or contact lenses all the time. Taking a break from them allows your eyes to rest.
Fact: If you need glasses or contacts for distance or reading, use them. Not wearing your glasses will strain your eyes and tire them out instead of resting them. However, it will not worsen your vision or lead to eye disease.

Myth: Staring at a computer screen all day is bad for the eyes.
Fact: Using a computer does not damage your eye healths. However, staring at a computer screen all day can contribute to eyestrain or tired eyes. People who stare at a computer screen for long periods tend not to blink as often as usual, which can cause the eyes to feel dry and uncomfortable. To help prevent eyestrain, adjust the lighting so it doesn't create a glare or harsh reflection on the screen, rest your eyes briefly every 20 minutes, and make a conscious effort to blink regularly so that your eyes stay well lubricated.



Before

Oxygen Cold Burn

Clinically appears as a hot burn

Surgeon opinion is thermal burn

Patient felt heat

After



Points to ponder

Keeping the contract worker in view

1. Cornea can be replaced(Are we donating sufficiently)
2. Lens can be removed(At what loss)
3. AOL can be kept(Different varieties)
4. Age factor(Why young age?)
5. Economic factor(Affordability)
6. PREVENTABLE-Significant factor

What is desired a benefit or an apology?

Industrial Health and safety cannot be achieved by legislation alone

Acceptance of this social measure by the management and realisation by all stake holders is required

to create a favourable work environment and to contribute towards safe operation for yielding optimum production

—-Dr. Barun Kumar Sikdar, Certifying surgeon, West Bengal

- References:
- DGFASLI manual of AFIH course
- Hunter’s text book of Occupational diseases
- A treatise on Occupational Health(Dr. B K Sikdar)
- Internet
- Parson’s Diseases of the eye