Occupational Eye Diseases and Injuries - A cause for concern

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ABSTRACT

Our eyes are the most essential component of our sensory system. Their continuous exposure to the environment makes them susceptible to diseases and injuries. Leading ophthalmologists are well aware about the risks associated with negligence in case of occupational eye injuries or diseases. The defects may range from low risk to high risk where loss of sight might become inevitable. Thus addressing this topic carries relevance both for the medical community as well as the public at large. We will be looking at the various aspects of the diseases and injuries whereby recommending strategies for prevention, timely diagnosis & treatment.

Keywords: Ophthalmologists, Occupational eye diseases and injuries, prevention & treatment

FACTORS BEHIND OCCUPATIONAL EYE DISEASES & INJURIES

We find a range of various causes that may lead to occupational eye diseases or injuries. The most important factor is the environment in which we are working or carrying out our occupational task. While it is mostly known that high risk areas are particularly those which are in vicinity to dangerous equipment or heavy machinery and in proximity to hazardous chemicals or toxicants, these days, prolonged screen exposure is also becoming a high risk factor.

Moreover, poor management and low priority to safety of workers or employees has stood out as a crucial reason behind most cases. Individuals may have varying susceptibilities to workplace injury, and this variability is related to occupational and individual characteristics. Many reports have found a consistently elevated risk

for injury among younger workers and workers with lower educational attainment. The increased risk for injury among novice workers compared to their longer-tenured counterparts remain despite adjustment including age, sex, and job.

The reasons include a combination of unfamiliarity with job tasks or work environment, failure to recognize workplace hazards, ineffective or inadequate safety training, and differential exposure to more hazardous tasks at the beginning of a job. Workers with lower levels of education appear to be particularly vulnerable, possibly because of their greater exposure to physical demands or other hazards. Additional evidence suggests that experienced workers plan ahead in order to limit fatigue and avoid stressful emergency situations much more than their less experienced co-workers.

Work in the chemical, construction and mining industries is among the most hazardous, and comparatively with weaker health and safety regulations, in combination with growing numbers of immigrant workers and a paucity of surveillance data, it has resulted in widespread under recognition of worker injury risk. And although occupational health and safety research is limited overall for these sector, research for other sectors is particularly sparse. Recognizing the dual needs for more accurate surveillance data and development and implementation of effective OSH interventions, a formal research and public health practice agenda for this sector was undertaken. (NIOSH 2008). Construction is one of the most physically demanding and dangerous sectors. Workers are regularly exposed to ergonomic and safety hazards from manual handling, power tools and equipment, confined spaces and electricity, work performed from heights, excavation, irregular work hours, and exposure to weather extremes. A construction worksite is also complex and dynamic. Often it comprises multiple employers with potentially divergent safety cultures and a high proportion of self-employed workers, adding to the challenge of effectively disseminating safety information and interventions for effective uptake. This sector also employs a disproportionate number of immigrants, independent contractors, on-call or day laborers, contract workers, temporary workers, and young workers—all subgroups with higher injury risk, which presents major challenges for OSH in this sector (CPWR 2013). In HICs, construction workers have higher-than-average risk for injury and MSD, and the leading causes of injury involve contact with objects and overexertion. More than half of injuries sustained by self-employed workers require five or more days away from work compared to only a quarter of the injuries sustained by workers employed by firms (HSE 2014). In HICs, construction workers have a three- to fourfold risk for a fatal accident at work compared to workers in other sectors,

while in LMICs the risk is as much as six fold (ILO 2014B). Even among HICs, however, fatality rates differ, although the reasons for this disparity are poorly understood. [1]

CATEGORIZATION

While the general public may not see much difference between occupational eye diseases and injuries, both carry their differences due to the cause of their nature.

1. EYE INJURIES

Injuries may be caused by accidents or due to violence that may have taken place at work, home or any other surrounding. The most commonly seen injuries are subconjunctival hemorrhage, traumatic iritis and corneal abrasion wherein most cases the patient had either met a workplace accident or had hurt himself due to irresponsible handling of equipment.

Every year, 800,000 eye injuries occur on the job, including 36,000 that require time off from work. But according to eye health and safety organization Prevent Blindness America, wearing proper eye protection can prevent 90 percent of all eye injuries. [2]

While some injuries result in corneal abrasion in the eye which usually require proper care & diagnosis to ensure smooth recovery and to avoid any further complication. Some injuries may take a drastic form which may occur due to deep laceration or internal bleeding. These cases require immediate surgery and attention to prevent permanent damage to the eye that may end up causing vision loss. In some cases, one may be unable to judge the severity of the injury costing him proper vision and only after complete diagnosis and consultation should one move ahead with any decision.

HAZARDS

- Materials that come under the category include grinding dust, bits of glass, electrical sparks, liquids or gases under high pressure, welding fumes etc.

- Struck by a heavy equipment or tool may lead to internal bleeding

- Corneal edema may be caused by xylene (used as solvent in printing, rubber and leather industries) and exposure to dinitrophenol (used in pesticides) may cause cataracts. Lead is known to cause Optic Atrophy.

- Chemical burns occur when the eye comes in contact with alkaline solutions found in laboratory chemicals or the chemical industry.

- Prolonged exposure to UV radiation is also a leading cause of allergic conjunctivitis. Other sources can be laser, welding machinery and germicidal lamps.

The following are the occupational eye injuries that are commonly seen:

- **Ocular Trauma**
- **Photokeratitis, or Ultraviolet Keratitis**
- **Chemical injury**
- **Corneal abrasion**

OCULAR TRAUMA – FINDINGS & OBSERVATION

It is observed as a global cause for visual loss and many people get affected by it at their workplace. The causes for it include foreign bodies like flying objects, machine equipment and tools, chemicals & liquids around, explosives, falls and infections. [3] Some important points to be noted are:

- Various observations have concluded that lack of proper eyewear protection gear, deficit training and carelessness result in OEI. Thus it is obvious that fulfilling these conditions in prior may aid reducing the cases and minimizing economical costs.
- Ocular trauma is one of the most under-recognized causes of vision loss in the developed world. Blunt or penetrating ocular trauma can lead to vision loss through cataract or glaucoma
- Cataract and glaucoma resulting from ocular trauma can occur in the setting of both penetrating and blunt injuries, thus both open and closed globe injuries.
- Time course: Cataract may occur acutely after trauma, but more often a slowly progressive cataract develops. Evolution of the cataract can be monitored.

- Glaucoma, or damage to the optic nerve, can occur as soon as 2-3 weeks following the trauma event, depending upon the intraocular pressure and other factors, such as hyphema, and cyclodialysis, iridodialysis and other distortions to intraocular structures.

Treatment

- Management of post-traumatic cataract and glaucoma will depend upon time interval between injury and presentation of patient as well as clarity of ocular media, presence and morphology of cataract, and degree of IOP elevation if glaucoma is present.
- Indications for prompt surgical intervention include the following: Presence of cortical material in the anterior chamber is a sign of lens proteins being released, which can lead to glaucoma. Obscured visualization: if posterior segment injuries cannot be identified and treated due to cataract [4]

PHOTOKERATITIS OR ULTRAVIOLET KERATITIS

- Photo keratitis, or Ultraviolet Keratitis, is a painful eye condition which can develop after unprotected exposure to Ultraviolet (UV) rays. Ultraviolet rays, from a variety of sources including welding arcs (arc eye, welder's eye), reflections of snow (snow blindness), and germicidal UV lamps can damage the corneal epithelial cells and cause them to slough off after several hours. This is similar to having "sunburn" of the eye.
- This leaves underlying corneal nerves exposed and damaged, causing symptoms of intense pain, photophobia, and foreign body sensation.

Treatment

- Treatment of Photo keratitis is supportive, and similar to that of treatment of a corneal abrasion. The corneal epithelium should heal within 24-72 hours, and supportive measurements such as ointment, artificial tears, and oral analgesics can be used to treat symptoms until the cornea is re-epithelialized.

- Topical antibiotic ointments such as erythromycin ointment can provide improved comfort and also may also prevent a bacterial super-infection. We recommend dosing erythromycin ointment 4 times a day for 2-3 days under medical supervision. [5]

CHEMICAL INJURY

- Chemical (alkali and acid) injury of the conjunctiva and cornea is a true ocular emergency and requires immediate intervention. Chemical injuries to the eye can produce extensive damage to the ocular surface and anterior segment leading to visual impairment and disfigurement.
- Early recognition and treatment ensures the best possible outcome for this potentially blinding condition.

Treatment (After consultation with an Ophthalmologist)

- Antibiotics- A topical antibiotic ointment like erythromycin ointment four times daily can be used to provide ocular lubrication and prevent super infection. Stronger antibiotics (e.g. a topical fluoroquinolone) are employed for more severe injuries (e.g. Grade II and above).
- Cycloplegic agents such as atropine or cyclopentolate can help with comfort.
- Artificial tears- and other lubricating eye drops, preferably preservative free, should be used generously for comfort.
- Steroid drops- In the first week following injury, topical steroids can help calm inflammation and prevent further corneal breakdown. In mild injuries, topical prednisolone (Predforte) can be employed four times daily. In more severe injuries, prednisolone can be used every hour.
- After about one week of intensive steroid use, the steroids should be tapered because the balance of collagen synthesis vs. collagen breakdown may tip unfavorably toward collagen breakdown. [6]

CORNEAL ABRASION

A corneal abrasion is a scratch on the surface of your cornea. Fingernails, makeup brushes and tree branches are common culprits of corneal abrasions. Some other causes of corneal abrasion are rubbing your eye and having very dry eyes [7] due to long hours of work without adequate breaks.

Treatment

- Corneal abrasions heal with time. Prophylactic topical antibiotics are given in patients with abrasions from contact lenses.

- Traditionally, topical antibiotics were used for prophylaxis even in non-infected corneal abrasions not related to contact lenses, but this practice has been called into question.
- Patching the eye has been used to help relieve the pain associated with corneal abrasion, but research has not shown benefit from patching.
- Patching should not be performed in patients at high risk of infection, such as those who wear contact lenses and those with trauma caused by vegetable matter, because of potential incubation of infecting organisms and promoting subsequent infectious keratitis [8]

3 YEARS STATISTICS OF CASES REPORTING IN 3 PROJECTS

PROJECT	**FOREIGN BODY**	**PHOTOPHTHALMIA/ PHOTOKERATITIS**	**CHEMICAL INJURY**	**CORNEAL ABRASION**
VSTPS	30	15	5	25
SSTPS	23	12	6	22

PS- THESE ARE CASES REPORTING TO OUR HOSPITALS FROM ADJOINING INDUSTRIES.

2. OCCUPATIONAL EYE DISEASES

The findings from the World Sight Day (October 10) Report appear to be very revealing. It finds that populations with a low demographic dividend, rapid changes in lifestyles, poor access to eye care are among the main reasons behind the increasing numbers of people living with ocular defects or diseases.

Dr.Tedros Adhanom Ghebreyesus (WHO Director-General) says that "Eye conditions and vision impairment are widespread, and far too often they still go untreated,"

People who need eye care must be able to receive quality interventions without suffering financial hardship. Includes eye care in national health plans and essential packages of care is an important part of every country's journey towards universal health coverage." This must aim at the healthy wellbeing of the people worldwide.

"It is unacceptable that 65 million people are blind or have impaired sight when their vision could have been corrected overnight with a cataract operation, or that over 800 million struggle in everyday activities because they lack access to a pair of glasses," adds Dr. Tedros.

All over the world, at least 2.2 billion people have a vision impairment or blindness, of whom at least 1 billion are suffering from a vision impairment that could have been prevented or has yet need to be addressed.

Occupational eye diseases can be cured and prevented from undergoing any severe complications. Some of the occupational eye diseases are mentioned namely:

- **Chronic Conjunctivitis**
- **Computer Vision Syndrome**
- **Asthenopia caused by VDT**
- **Optic neuritis**

CHRONIC CONJUNCTIVITIS

Conjunctivitis is an inflammation of the conjunctiva. Conjunctivitis that persists for four or more weeks is considered chronic. Chronic bacterial conjunctivitis is most commonly caused by Staphylococcus species (a distinct type of bacteria), but other bacteria can also be involved. This type of conjunctivitis is often associated with blepharitis.
Symptoms can include redness of the conjunctiva, burning, frequent, foreign body sensation and morning eyelash crusting or eyelash loss.

Treatment

Treatment might include antibiotics, artificial tears and other topical medications. Sometimes oral antibiotics may be needed. [9]

COMPUTER VISION SYNDROME

The modern 24-hour society has greatly affected the timing of work hours. The development of new technologies and global economic competition require that goods and services be made available at all hours of the day and night (Costa 2010). The traditional schedule of regular, mainly daytime working hours has given way to a variety of work patterns for many workers in HICs. Results from the 2000 European Working Conditions Survey indicate that only 25 percent of employed workers and less than 10 percent of self-employed workers have traditional work schedules. The vast majority work irregular hours, including some combination of compressed work hours, variable work hours, shift work or night

work, weekend work, part-time work, and on-call work (Costa and others 2004). A large body of evidence suggests that shift work and night work interfere with circadian rhythms, decrease efficiency, and strain social and family relationships (Costa and Di Milia 2010).

This syndrome encompasses a range of problems such as Headaches, Backache, Blurring of vision, Double vision, Myopia, Tearing & Dryness. Due to prolonged and continuous exposure to screen adversely affects the vision and working of the eye.

Blehm et al have divided the symptoms of CVS broadly into four categories-

1) Asthenopic – eye strain, tired eyes and sore eyes

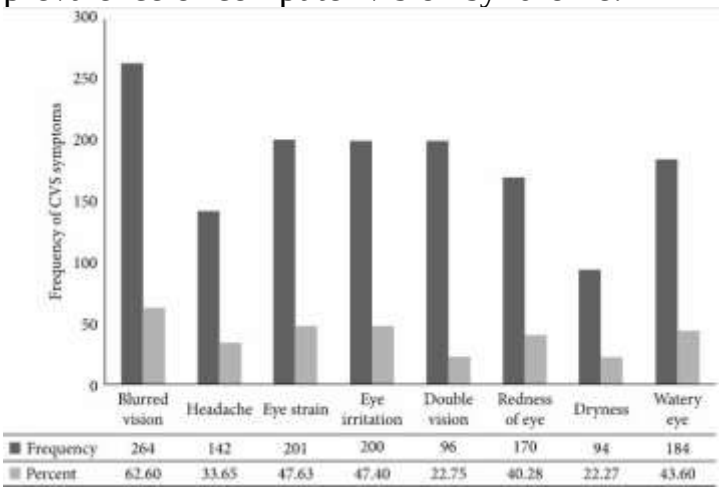
2) Ocular surface related- watering, irritation and dry eye (Burning and red eyes)

3) Visual- blurred vision, slowness of focus change, double vision and changes in color perception

4) Extra ocular-neck pain, backache and shoulder pain. [10]

The most frequently reported health-related problems, occurring in over 70% of computer workers are related to eyes. It is estimated that nearly 60 million people suffer globally, and that a million new cases occur each year since personal computers are one of the commonest office tools used extensively, this will continue to cause significant and growing contribution to diminished productivity at work while also reducing the quality of life of a computer worker. Many studies have been conducted in an attempt to address questions concerning safety and health for visual display terminal (VDT) users.

The given table represents the frequency of CVS symptoms. The self-reported prevalence of computer vision syndrome.



	Blurred vision	Headache	Eye strain	Eye irritation	Double vision	Redness of eye	Dryness	Watery eye
Frequency	264	142	201	200	96	170	94	184
Percent	62.60	33.65	47.63	47.40	22.75	40.28	22.27	43.60

Reference: Awrajaw Dessie, Fentahun Adane, Ansha Nega, Sintayehu Daba Wami, Daniel Haile Chercos, "Computer Vision Syndrome and Associated Factors among Computer Users in Debre Tabor Town, Northwest Ethiopia", Journal of Environmental and Public Health, vol. 2018, Article ID 4107590, 8 pages, 2018. https://doi.org/10.1155/2018/4107590

Among computer users was 69.5 % (95% CI; 65.60, 73.0). Blurred vision, eyestrain, and eye irritation were the most common reported symptoms of CVS with prevalence of 62.60%, 47.63%, and 47.40%, respectively. [11]

ASTHENOPIA

It is commonly known as Eyestrain. Subjective symptoms of ocular fatigue, discomfort, lacrimation, and headaches arise from the overuse of eyes. Weakness or tiring of eyes accompanied by pain, headache, blurry vision and sensitivity to light or inability to keep the eyes open may occur.

Treatment

- Treatment of the underlying cause is first line; therefore an eye exam is warranted with glasses prescription as necessary, correction of strabismus and artificial tears, lid hygiene and warm compresses for dry eyes.
- The correct prescription cannot be overemphasized in the management of this condition especially in hyperopic patients. Cycloplegia is indicated in patients under the age of 30 years to diagnose the entire amount of hyperopia as well as to prevent over prescription in myopic patients.
- Avoiding prolonged use of computer devices (more than 2 hours) and short brakes for eye rest helps relieve the symptoms. Analgesic drugs may also be prescribed for this condition. [12]

OPTIC NEURITIS

Optic neuritis is an inflammation that affects the myelin lining of the optic nerve, which transmits visual stimuli to the brain. The optic nerve is actually a nerve tract of axons that originate in the ganglion cells of the retina in the back of the eye. Nerve tracts are the information pathways in the brain.
The "optic nerves" are the only nerve tracts not located entirely within the brain. The optic nerves carry visual information from the retina to the area of the brain that recognizes vision (the occipital cortex). [13]

Treatment

- The physician should treat by either observation or administration of intravenous (IV) corticosteroids (1 gm. methylprednisolone/day x 3 days) followed by an oral corticosteroid taper (1 mg/kg/day x 11 days).
- Treatment with corticosteroids has been shown to: (1) relieve pain; (2) increase the rate of visual recovery (not the final visual recovery); and (3) decrease the risk of developing MS(Multiple Sclerosis) over the following 2 years, if the initial MRI shows 2 or more plaques.
- Intravenous corticosteroids can be given as outpatient therapy at an infusion center or at home through a home health care agency.[14]

PREVENTIONS & MEDICAL ADVICE

1. It may surprise many that almost 70% of blindness due to injury or disease is treatable. All one needs to do is consult an ophthalmologist on time & proceed with a recommended treatment only.
2. On time visit to a clinic can drastically reduce the chances of serious vision loss and later difficulties.
3. Self-treatments via eye drops or any other method should be avoided before taking professional advice or medical consultation.
4. Because HICs have banned certain harmful materials, such as asbestos or polychlorinated biphenyl, stockpiles have made their way into countries without such regulations, a cycle affectionately referred to as chemical "dumping". Such activities must be checked.
5. Few professionals are trained in occupational exposure or disease control, and those with training often take advantage of the better employment prospects at

multinational companies and in HICs. Hence it is essential to make sure that well trained professionals are present at all worksites

6. A proper routine training must be imparted before initiating any work with chemicals and machinery.

7. Personal protective equipment must be provided to workers with no compromise on eye protection gear quality.

8. The present regulations must be well understood by workers and employers.

9. On site presence of health staff may drastically reduce the time that is lost during moving the patient to the hospital

10. Local cases should be studied to find out data about various parameters related to eye surgeries and treatments

Combined with the dearth of research, the sparseness of strategies for controlling exposure or preventing acute and chronic diseases is not surprising. For this reason, the discussion combines control of these conditions with injury control, for which the need is more immediate, the risks are well documented and recognized, and the available information is at least slightly more traceable. More experts should commit themselves in updating the knowledge base further and also in creating awareness among the people especially in developing countries where economical and financial constraints limit individual initiative thus paving a way for collective efforts.

CONCLUSION

The research and effort that were undertaken have been able to provide the needed insight into occupational eye diseases and injuries where we can conclude that all the stakeholders' must work together at their regional level to aid and support research and initiatives. We also need to make sure that we are able to impart a scientific temper and understanding among the people while also keeping in mind that the technicalities do not become a cause for the people to distance themselves. Ophthalmologists & Research scholars can invite others from various backgrounds to share their experience and knowledge so that we can collectively make a difference. I will also recommend that the courses on ophthalmology must be designed in a way that they shed enough light on the occupational hazards so that students can be made well aware on the various factors. It will be of immense benefit to the medical community if the government is able to support and sustain

the researches that are been carried so that the field can be renewed with the latest findings and reports.

ABBREVIATIONS USED

OSH – Occupational Safety and Health
NIOSH – National Institute for Occupational Safety and Health
CPWR – Centre to protect workers' rights
HIC – Hospital Incidence Command System
MSD – Moderate and severe disabilities
CVS – Computer Vision Syndrome
HSE – Health Safety and Environment
ILO – International Labor Organization
LMIC – Low and Middle Income countries
VDT – Video Display Terminal

REFERENCE

01. Patel, V., D. Chisholm., T. Dua, R. Laxminarayan, and M. E. Medina-Mora, editors. 2015. *Mental, Neurological, and Substance Use Disorders*. Disease Control Priorities, third edition, volume 4. Washington, DC: World Bank.
doi: 10.1596/978-1-4648-0426-7

02. Laura Walter. 800,000 Eye Injuries Occur Annually, 90% are Preventable.
https://www.ehstoday.com/ppe/eye-face-head/article/21908478/800000-eye-injuries-occur-annually-90-are-preventable

03. DGFASLI manual of AFIH course

04. Aakriti Garg, MD, Alpa S. Patel, M.D., Anna Murchison, MD, MPH, Daniel B. Moore, MD, Grant A. Justin, MD, Kourtney Houser, MD, et al. Ocular Trauma: Acute Evaluation, Cataract, Glaucoma.
https://eyewiki.aao.org/Ocular_Trauma:_Acute_Evaluation,_Cataract,_Glaucoma

05. Austin Rohl, M.D., Christina Moon, M.D. and Vatinee Bunya, MD. Photokeratitis https://eyewiki.aao.org/Photokeratitis#:~:text=Ultraviolet%20rays%2C%20from%20a%20variety,%22sunburn%22%20of%20the%20eye.

06. Anna Murchison, MD, MPH, Danielle Trief, MD MSc, James Drake Auran, MD, Maria A. Woodward, MD and Zeba A. Syed, MD. Chemical (Alkali and Acid) Injury of the Conjunctiva and Cornea. https://eyewiki.aao.org/Chemical_(Alkali_and_Acid)_Injury_of_the_Conjunctiva_and_Cornea

07. Kierstan Boyd. Corneal Abrasion and Erosion. https://www.aao.org/eye-health/diseases/what-is-corneal-abrasion

08. Arun Verma, MD, Feras H Khan, MD. Corneal Abrasion Treatment & Management https://emedicine.medscape.com/article/1195402-treatment

09. Chronic Conjunctivitis. https://www.hopkinsmedicine.org/wilmer/conditions/chronic_conjunctivitis.html#:~:text=Conjunctivitis%20that%20persists%20for%20four,is%20often%20associated%20with%20blepharitis.

10. Soumya Harapanahalli Venkatesh, Anita T Girish, Shashikala, Praveen Kulkarni, Snigdha Mannava, Rajendra Rajarathnam. A Study of Computer Vision Syndrome at the Workplace - Prevalence and Causative Factors

11. Awrajaw Dessie, Fentahun Adane, Ansha Nega, Sintayehu Daba Wami, Daniel Haile Chercos, "Computer Vision Syndrome and Associated Factors among Computer Users in Debre Tabor Town, Northwest Ethiopia", *Journal of Environmental and Public Health*, vol. 2018, Article ID 4107590, 8 pages, 2018. https://doi.org/10.1155/2018/4107590

12. A. Paula Grigorian, MD, Chrysavgi Adamopoulou, MD, K. David Epley, M.D. and Robert F. Melendez, MD, MBA. Asthenopia. https://eyewiki.aao.org/Asthenopia

13. Optic Neuritis. https://www.medicinenet.com/optic_neuritis/article.htm

14. Karl C. Goldnik Nick, MD. Current management of optic neuritis https://www.aao.org/current-insight/current-management-of-optic-neuritis