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Work and vision

Management of eye injuries in the workplace

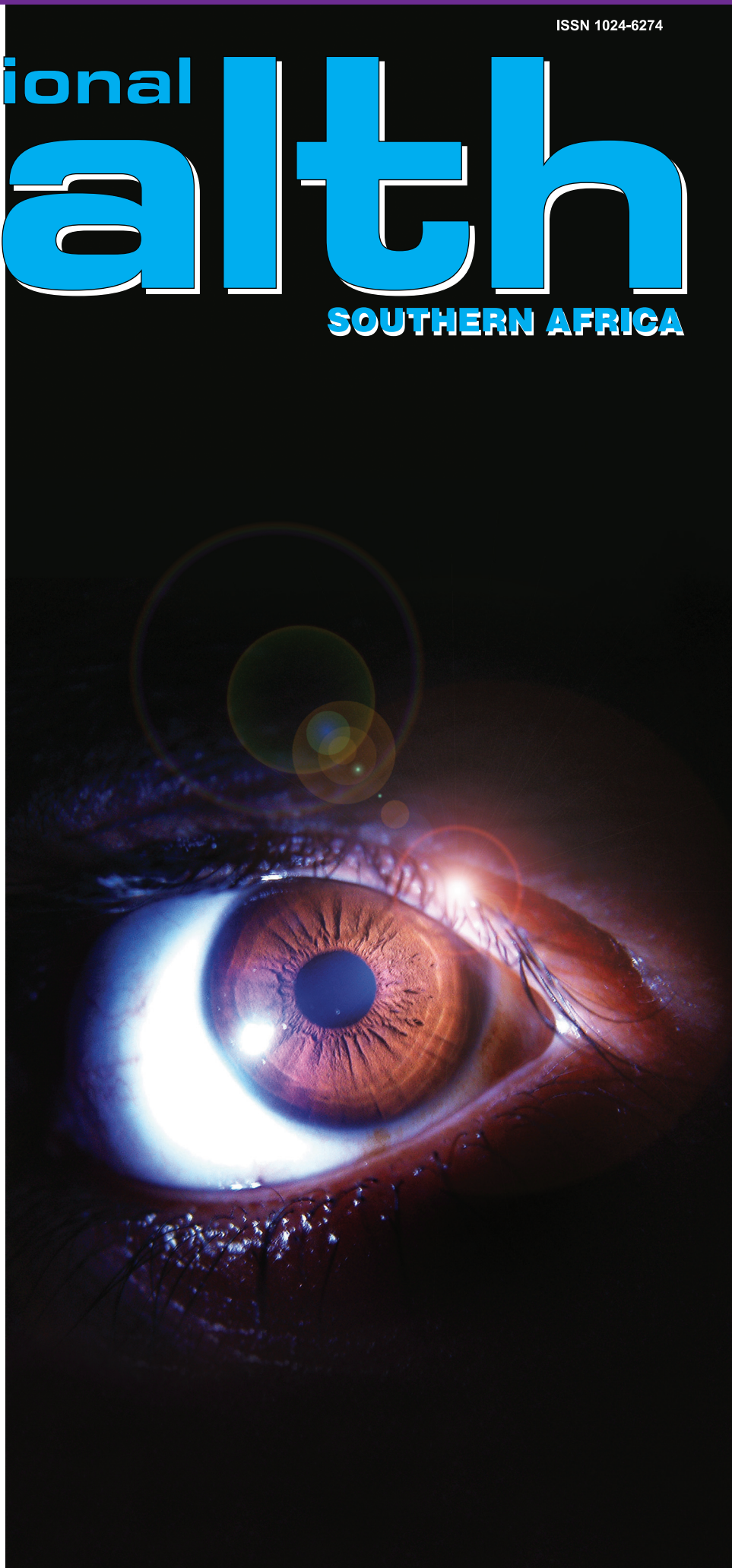
The initial management of ocular chemical burns

Eye safety in the work environment and the role of the optometrist

EN Safety specifications for eye protection

Driver fitness evaluation with respect to vision

Analysis of attendance records for the Occupational Dermatology Clinic, Groote Schuur Hospital



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Regulars

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From the Editor . . .

Linda Grainger, Editor

With the main theme being *Work and vision*, this issue contains a comprehensive set of papers relevant to the topic and of practical use to our readers. The first one, by Carmichael, Mbambisa and Welsh, deals with eye injuries in the workplace. Unfortunately a common occurrence in South Africa, it is essential that practitioners know how to manage them in order to reduce the adverse consequences of such injuries to eyesight. Therefore, the paper explains how to correctly assess damage to the eye and interpret the findings to make a diagnosis and appropriate decisions for primary care. The immediate care of a range of injuries and the need for referral is included in the discussion.

The second paper, a case study by Mbambisa and Carmichael, highlights aspects of the preceding one. It reports the clinical findings of a case of ocular chemical burns following cement alkali burns to both eyes to illustrate the importance of using protective eye wear and the need for immediate treatment following chemical injury to the eyes. The type of damage incurred is shown in Figure 5 of the Carmichael *et al.* paper. The absence of an effective occupational health and safety programme and appropriate immediate treatment in this particular workplace is patently obvious and resulted in easily avoidable, yet serious, damage to the eyes of the patient concerned.

In the third paper, Naidoo, Jaggernath and Maharaj discuss eye safety in the work environment. They examine the role of the optometrist within the work environment, explain vision assessment and visual requirements at the workplace, describe hazards within a work environment and the necessary safety precautions required for eye safety. Their paper highlights the important contribution of optometrists as members of the multidisciplinary occupational health team, as they can conduct visual examinations and eye screening, and participate in the development of appropriate eye safety policies and procedures.

Continuing on the topic of eye safety, Burrow describes the European Standards relating to protective eyewear, specifically EN 166, and outlines factors driving future developments to enhance worker compliance in wearing eye protection. As he points out, personal protective eyewear should fit the individual or be adjustable to provide appropriate coverage, be comfortable and allow for sufficient peripheral vision.

The final paper in the set addresses the issue of driver fitness evaluation with respect to vision. Adams, its author, was involved in the development of the earlier version of the SASOM Guideline No.6, Medical requirements for fitness to drive. She describes visual disorders indicated in driver fitness standards and discusses driver fitness evaluation with respect to vision, drawing on the 2009 version of the guideline. Readers are advised to obtain the full guideline for more detail on this subject.

The last paper in this issue concerns occupational skin diseases. As noted in Volume 16, Issue 5 devoted to the topic, practitioners have long been aware that these diseases are common in South Africa but the prevalence is largely unknown. Burdzik and Todd report on their analysis of attendance records for the Occupational Dermatology Clinic, Groote Schuur Hospital, Cape Town during 2008 and 2009. The results complement those of the study by Fourie and Carman on the National Institute of Occupational Health skin clinic, and together they make a useful contribution to the gap in our knowledge.

On the news front, we recently received an interesting press release announcing a new Council of Europe Committee Resolution that calls for a dramatic reduction in human exposure to EMFs and microwave radiation from mobile phones, mobile masts and other wireless devices. The application of the precautionary principle approach to EMFs both from electric power and from wireless communications technologies is strongly advocated. It calls on Member Governments to impose a ban on mobile phones, DECT cordless phones, WiFi or wLAN systems in classrooms and schools, and that all reasonable measures be taken to reduce exposure to electromagnetic fields. Read the full report at http://www.emrrfsa.org/european-other-government-recommendations/.

Lastly, please read the call for papers shown below and consider contributing to our upcoming issues with specific themes.

Linda Grainger

Call for papers during 2011

Two more specific themes will be addressed in issues during this year. We therefore invite you to submit original research, review, case study, or back to basics papers for consideration for publication in this issue. The authors' guidelines are available on the website, www.occhealth.co.za. All papers are peer-reviewed before publication.

Should you be interested in submitting a paper, please indicate this by e-mailing the Editor at grainger@telkomsa.net. Please provide some basic details about what you envisage would be included in the paper. I would appreciate receiving this information as soon as possible. The actual final submission dates for papers are shown below.

Issue	Theme	Submission date
September/October 2011	Respiratory health	11 July 2011
November/December 2011	Infections of relevance to OH	7 September 2011

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Management of eye injuries in the workplace

TR Carmichael, BN Mbambisa, ND Welsh, Ophthalmology Division, University of the Witwatersrand

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Abstract

Eye injuries which occur in the workplace are more common in developing countries like South Africa where appropriate eye protection might be lacking. The purpose of this paper is to assist the occupational health care provider to correctly assess damage to the eye and interpret the findings to make a diagnosis and appropriate decisions for primary care. Examination of the eyes by health-care doctors and nurses should be systematic, assessing all the structures in order to determine appropriate treatment and referral. The most urgent condition is a chemical burn in which minutes matter and immediate irrigation can prevent long-term vision loss. Lid lacerations are usually easy to identify but penetrating globe injuries or intraocular foreign bodies may be missed and result in permanent loss of vision and disability. Many injuries can be adequately managed by primary care health workers, either medical doctors or nurses, and do not require referral.

Key words: eye injury, workplace, arc eye, corneal foreign body, conjunctivitis, chemical burn, penetrating eye injury, intraocular foreign body

Introduction

It has been estimated that eye injuries severe enough to restrict activities number about 55 million annually worldwide.[1] About 200 000 of these were estimated to be open globe injuries although epidemiologic data are scarce. In South Africa we have concurrent epidemics of trauma from interpersonal violence and motor-vehicle accidents as well as infectious diseases such as AIDS (Acquired Immune Deficiency Syndrome) and tuberculosis. Against this background, workers may present with a range of eye injury and pathology. In addition, South Africans approach sport with a zeal that borders on religious fervour. Squash is especially dangerous but other modern sports have been associated with eye injury where appropriate eye protection is not worn.[2]

In the workplace, doctors and nurses must deal with the injuries resulting from occupations which might place them at higher risk than the average population. Males are known to be at particular risk but those in less developed countries are also at higher risk.[3] It is assumed that about 90% of work-related eye injuries are preventable.[4] The main products involved in 94 500 eye injuries in the United States of America in 2003 were: tools, both power and manual (21%), welding, including arc eye (16%) and chemicals, including glues, paints and acids (13%).[5] Corneal foreign bodies (FBs) were included either under tools or welding.

In approaching the optimal management of these injuries an evidence-based approach is required but many issues remain unresolved.[4] An audit of 274 eye consultations at a Hong Kong hospital showed 43% were managed using evidence from systematic reviews, meta-analyses or randomised controlled trials and evidence for observational studies (prospective or retrospective) supported the intervention in another 34%.[6] With time, even more of our management decisions will likely be based upon some form of hard evidence. Attempts at classifying and scoring eye injuries may facilitate assessment and allow better prognostication as well as better initial assessment[7] but are not routinely done in the workplace.

The purpose of this paper is to assist the occupational health care provider to correctly assess damage to the eye and interpret the findings to make a diagnosis and appropriate decisions for primary care.

Equipment required for basic eye examination and treatment

- Vision chart – 4 or 6 m;
- Direct ophthalmoscope;
- Fluorescein dye strips;
- Cotton buds to evert lids and remove FBs, 18 gauge needles to remove FBs;
- Loupe – or plus 3 glasses;
- Drip set, two litres of Ringers lactate or saline, basin to collect water, pH strips for chemical burn irrigation;
- Eye pads, micropore, chloramphenical ointment, cyclomydril; and
- Topical anaesthetic – Novescine, tetracaine.

Important points when examining an eye trauma patient

Consider whether the injury requires tetanus toxoid and enquire if the patient has had any recently. If not, it might be necessary.

Examine the eye systematically from the front (eyelids) to the back (fundus). Penlight torch examination of the cornea and anterior segment of the eye may show a cloudy (hazy) cornea or obvious signs of damage. The upper lid may need eversion and fluorescein dye may be used to check for staining indicating corneal abrasion. Do not forget to palpate the orbital rim for fractures and X-ray if indicated,

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i.e. if there is crepitus around the orbit, signs of a blow-out or other fractures, or suspected intra-ocular foreign body. Ocular movements should be tested. Pupil reactions can be noted.

Look at the red reflex with the direct ophthalmoscope. If absent, it might indicate blood in the eye or lens damage (cataract). Carefully and systematically examine the retina looking for haemorrhages and retinal detachment.

Test the visual acuity with the best available correction (glasses, contact lenses) or use a pinhole occluder – this estimates the patient's best-corrected acuity.

Intraocular pressure measurement: If a penetrating globe injury is suspected, compression of the globe should be very gentle, using a cotton bud or digital (two fingers) technique on the eyelid. In a case with a known penetrating injury, this should not be done.

Indications for referral to an ophthalmologist

In general, many of the common eye conditions that need definitive management can wait for one day (patient seen by an ophthalmologist within about 24 hours) or even 2–3 days. Sometimes it is desirable that the patient is seen as soon as possible (ASAP) regardless of the time of day.

Conditions which need immediate referral (ASAP) are: severe pain in the eye; sudden visual loss or where the visual loss is severe and the duration cannot be assessed; corneal and corneo-scleral lacerations; possible penetrating injuries including intra-ocular foreign bodies; chemical burns; hyphaema (blood in the anterior chamber, see Figure 1); and eyelid lacerations involving the lid margin (see Figure 2). Of these, the only dire emergencies where minutes matter are in instituting irrigation with water in chemical burns of the eye.

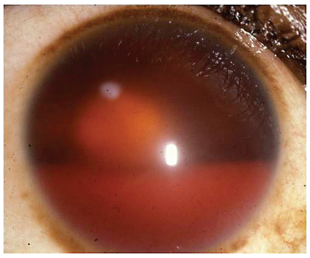

Figure 1. Hyphaema with blood filling a third of the anterior chamber

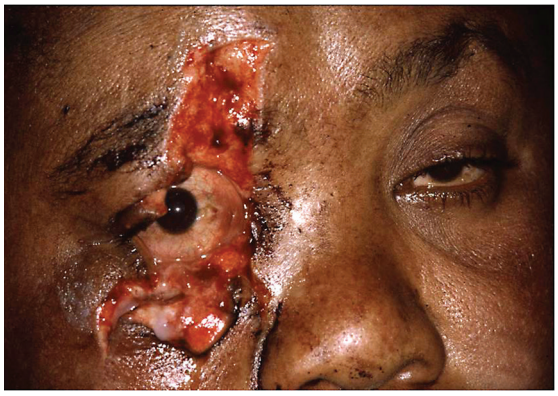

Figure 2. Full thickness lid laceration with an intact globe

Commonconditionsrequiringmanagement and appropriate time for referral

Corneal foreign bodies

Often occur following the grinding of metal where the hot (usually sterile) metal fragment adheres to the outer corneal epithelium. They may be seen with a torch, and can sometimes be removed using a cotton bud or the tip of a large gauge needle. The metal can be removed but may leave a rust ring (Figure 3) which will usually also need to be removed, sometimes with a needle tip or burr drill.[4]

If no FB is seen on the cornea, fluorescein dye might show linear abrasions on the cornea suggesting a FB trapped under the upper lid. An abrasion of the cornea may feel the same to the patient as a FB (Figure 4).

Management: Instill local anaesthetic drops and stain with fluorescein. If the FB is not visible, evert the upper lid and look at the tarsal plate carefully. FB's are usually easy to see but it is easier with some magnification, like a loupe or plus 3 glasses. After removal of the FB warn the patient that the

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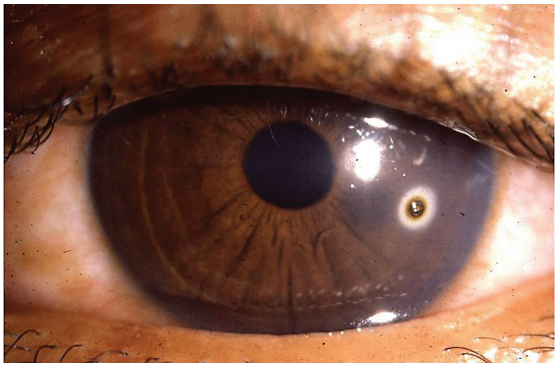

Figure 3. Metallic rusted superficial corneal foreign body with surrounding rust ring and white cuff of oedema

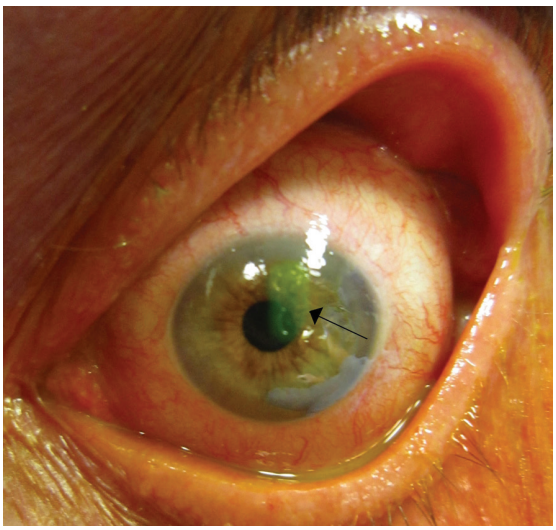

Figure 4. Corneal abrasion with green fluorescein dye showing the area of epithelial defect

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FB sensation might return when the anaesthetic wears off and rather pad the eye closed and use an antibiotic ointment overnight, to let the abrasion heal. Although there is no evidence to show that abraded areas heal faster with padding,[8] some patients are more comfortable with the lid not moving over the abraded cornea. Use oral analgesia as required.

Referral: Rust rings that remain symptomatic should be referred over 1–3 days.

Arc eye

Invariably arc eye occurs after arc welding and results in a UV light-induced superficial punctate keratitis. It causes a burning pain usually affecting both eyes and photophobia.

Management: Local anaesthetic drops can be used to make the patient more comfortable to enable easier examination for diagnostic purposes only. This condition is self-limiting, and does not require any treatment. However, cold compresses may help symptomatically and a topical antibiotic/steroid combination used 6-8 hourly may help the inflammation although there is no evidence it will shorten the duration. Use oral analgesia as required.

Referral: Usually do not need referral.

Conjunctivitis

Infective conjunctivitis is probably not work-related but may be spread among people working together. It may be viral (pink eye), bacterial or non-infective allergic. It is often bilateral and the redness is seen in the conjunctiva on the globe and under the lids. Patients complain of a gritty, sandy, scratchy foreign body sensation and discomfort. Viral conjunctivitis may have a tender preauricular lymph node, and a more watery discharge. A sticky discharge ('eyes stuck shut') is suggestive that it is a bacterial conjunctivitis, whereas a recurrent history or itchiness suggests allergic conjunctivitis.[9]

Management: Viral conjunctivitis is mostly self-limiting and requires the same antibiotic approach used for bacterial cases to treat or prevent secondary infection. Upper respiratory tract infection – sore throat, fever may be associated with or precede adenoviral conjunctivitis which can be quite severe and persist for up to three weeks. Patients should be advised to take precautions to limit spread e.g. avoiding the use of the same towels as others.[4] Routine swabs for bacterial culture are only done in severe cases. Irrigation of exudate from the eyes with water is helpful and the patient can do this as often as necessary. For bacterial conjunctivitis, use a topical broad spectrum antibiotic drop hourly to six hourly[10] and a similar antibiotic ointment at night. Beware of gonococcal conjunctivitis where there is a copious purulent discharge. This requires a systemic antibiotic for the gonococcal infection as well as topical treatment. The conjunctivitis can progress to corneal perforation, endophthalmitis and blindness. For allergic conjunctivitis use anti-histamine drops and mast cell stabilisers.[10]

Referral: In 1-2 days if there is corneal involvement such as opacities or areas of ulceration (fluorescein stain) otherwise it is self-limiting.

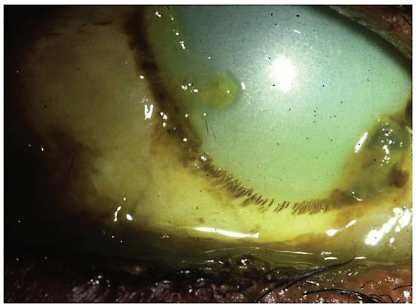

Figure 5. Severe corneal burn with corneal opacification and intense limbal ischaemia due to alkali burn

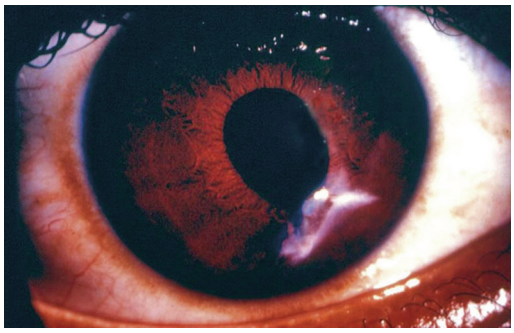

Figure 6. Corneal laceration with iris prolapse

Ocular burns

Chemical or thermal burns need immediate attention and are true emergencies[4] as the damage can be ongoing (see Figure 5). Alkalis penetrate faster and deeper than acids but both are very damaging if strong solutions are involved. All require immediate and profuse irrigation[4] then refer ASAP to an ophthalmologist. Tap water can be used but it is better to use local anaesthetic drops then irrigate with a sterile drip solution eg. Ringers or saline. Direct the stream of water away from the unaffected eye or chemical might be irrigated into the normal side. There are better available irrigation solutions like Diphoterine. Never attempt to neutralise the acid with an alkali and *vice versa*.

Lack of corneal clarity so that iris detail is obscured as well as pallor of the limbal conjunctiva indicating ischaemia are ominous signs and indicate severe damage with a poor prognosis for healing and vision.

Referral: ASAP if there is corneal involvement with cloudy iris detail or they look to be severe but initial copious irrigation is the cornerstone.

Eyelid lacerations

Eyelid skin lacerations can be sutured but do not attempt

"Males are . . . at particular risk but those in less developed countries are . . . at higher risk."

this if the lid edge or canaliculi are involved – these need referral.[4] If they are not correctly repaired, the eyelashes turn in and subsequently scratch the globe. Ensure the globe is not also damaged.

Conjunctival lacerations

These are only repaired if very large. Make sure there is not an underlying scleral laceration. If in doubt refer ASAP for slit-lamp assessment.

Penetrating eye injuries

Where penetration is diagnosed or suspected, avoid further damage to the eye. The patient should not bend over but rather keep the head upright. The eye must not be rubbed and neither should the doctor apply pressure to the eye during the eye examination. A soft eye (hypotony) is such an important sign that in the case of possible penetrating globe injury, compression of the globe should be very gentle. After assessment, protect the eye with a pad or shield, without antibiotic ointment or drops. X-ray if intra-ocular foreign body or fractures are suspected and refer patient ASAP.

• *Corneal and corneo-scleral lacerations:* The actual wound can be seen and usually there is also iris or ciliary body prolapsed (see Figure 6). The anterior chamber may be flat with the eye soft. Swelling around the eye may make it difficult to exclude a penetrating injury. It is less common to have a penetrating injury where there is a good red reflex as there is often blood inside the eye, either a hyphaema or vitreous haemorrhage.

• *Penetrating wire injuries:* This can be a difficult injury to diagnose because the penetrating wound may be small and not easy to see. Any intraocular haemorrhage, reduced vision or hypotony should raise suspicions. Wire may be contaminated and give rise to endophthalmitis (intraocular infection) or cause extensive intra-ocular damage to the iris, lens or retina.

• *Intra-ocular foreign bodies:* Often the small entry wound can be missed. When a history suggesting the possibility is present, an X-ray must be done. Referral for urgent surgery is required as endophthalmitis will also be a threat in these patients.

Conclusions and recommendations

Many eye injuries are effectively managed in the workplace but efforts to prevent injuries are needed worldwide. The key to accurate eye assessment is thorough and systematic examination of the eye and being alert for the vision-threatening but less common injuries that will need to be definitively managed by an ophthalmologist.

Lessons learned

1. The history will often provide a clue as to the nature of the injury. Beware of people who were hitting or hammering metal and felt something strike the eye. They usually do not have a superficial corneal FB – those are caused by grinding – suspect an intra-ocular FB. An X-ray of the orbit is mandatory. An MRI scan is contra-indicated because the metal can heat up and move, causing further damage.
2. NEVER give a patient local anaesthetic drops to take home as it is toxic to the cornea if used excessively.
3. One of the important decisions with eye trauma is to establish whether the injury was blunt or penetrating. The eye will usually be soft with decreased vision and loss of the red reflex due to vitreous haemorrhage after penetrating injuries.
4. In the case of a chemical burn, try and establish whether the agent was an acid or alkali – acid is less harmful because strong alkali penetrates deeper into the eye. Special effort is needed in alkali burns to eliminate all of the chemical from the eye.
5. With eye injuries there might be legal consequences so carefully document the visual acuity. If no Snellen chart is available use a magazine or newspaper and if the patient can read that with either eye it should be noted. With a patient in bed it can be useful to have the patient compare how your hand and fingers appear with either eye. If vision seems the same in the injured and normal eye it is noted and is an important finding.

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The initial management of ocular chemical burns in an academic hospital

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Abstract

Purpose: **To report the clinical findings of a case of ocular chemical burns following cement alkali burn to both eyes to illustrate the importance of using protective eye wear and the need for immediate treatment following chemical injury to the eyes.**

Methods: **Case report.**

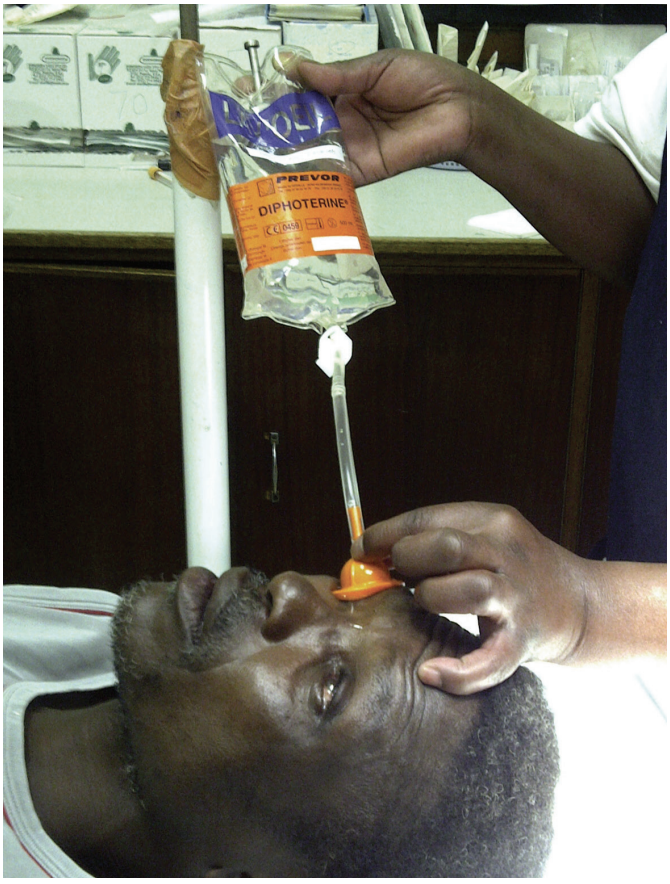
Results: **A 31-year-old man had a delayed presentation with an occupational injury due to cement in both eyes. He had a Grade 3 chemical burn in his right eye and Grade 1 burn in his left eye. Immediate irrigation was done but his right eye required surgical debridement.**

Conclusions: **This case illustrates the consequences of not using protective eye wear when working with chemical substances and the need for immediate and effective irrigation following chemical injury to the eyes.**

Key words: chemical burns, irrigation, occupational injury

Introduction

Chemical burns of the eye are an ophthalmological emergency and prompt and appropriate management is important to prevent the potentially visually disabling complications of this ocular injury. The purpose of this case study is to illustrate the consequences of not using protective eye wear when working with chemical substances and the need for immediate and effective irrigation following chemical injury to the eyes.



Irrigation of the eye.

Case study

A 31-year-old male patient presented to Chris Hani Baragwanath Hospital with a history of cement burns to both eyes. He was working as a casual labourer on a building site and while mixing cement some of the cement powder entered his eyes. He immediately put his head into a bucket filled with tap water to wash out the cement. He still had remnants of the cement in his eyes and when he went home and he washed his eyes with sugar water. He presented to hospital 23 hours after the initial injury.

On initial assessment, the pH of the conjunctiva in the inferior fornix was 9 in both eyes. Both eyes were irrigated with 500 ml Diphoterine®, a first aid eye wash, and residual cement particles were removed from both conjunctivae. Most of the cement particles from his right eye were removed and the pH was 7 after irrigation. We were unable to remove all the cement particles in his left eye as they were embedded in the conjunctiva and his pH remained 9 after irrigation. Further irrigation was withheld as the patient needed surgical debridement.

On subsequent examination, his visual acuity in the right eye was hand movements and 6/12 in his left eye which improved to 6/6 with pinhole occluder. His lids on the right eye were swollen but he had no burns of the skin. Both conjunctivae were injected and his right eye had cement particles adherent to the conjunctiva under his upper lid. He had four clock hours of limbal ischaemia superonasally in his right eye and no limbal ischaemia in his left eye. His entire right cornea had stromal haze with iris details poorly visible through the cornea. His left cornea was clear with an epithelial defect

of a quarter of the corneal area inferonasally. The anterior chamber of the right eye could not be assessed due to the corneal haze but the anterior chamber in his left eye had no signs of inflammation. The intraocular pressure in his right eye was 18 mm Hg and 10 mm Hg in his left eye. His hazy cornea prevented a view of the lens, vitreous and fundus of his right eye. The media were clear in his left eye and fundoscopy was normal. His injuries were graded according to severity.[1] His right eye had a Grade 3 burn, which indicates three to six clock hours of limbal involvement and 30-50% conjunctival involvement. His left eye had a Grade 1 burn, which has the best prognosis with only corneal involvement and no limbal or conjunctival involvement. He was started on prednisolone acetate 1% drops 4 times a day, atropine sulphate 1% twice a day and chloromycetin ointment 1% three times a day in both eyes. In addition he received oral doxycycline 100 mg twice a day and oral ascorbic acid 2 g four times a day. Due to the residual cement remnants in his right eye medical therapy alone was insufficient and he was taken to theatre for surgical debridement of the remaining cement particles.

Discussion

Chemical burns of the eye form a small fraction of ocular trauma.[2] The majority of injuries are occupational injuries and, because of their more frequent presence in household cleaning agents and industrial and building materials, alkali injuries are more common than acid injuries.[3,4] The injuries caused by chemical burns to the eye can range from mild unilateral conjunctival or corneal epithelial damage to sight threatening bilateral burns. The severity of the injury is related to the surface area of contact, the degree of penetration and the concentration and nature of the agent involved.[5] Injuries caused by alkalis are usually more severe as they penetrate the cornea more effectively than acids. Immediate and thorough irrigation is the most important intervention affecting the prognosis and outcome of ocular chemical burns.[3,6,7] Water or saline is commonly the initial irrigating fluid used but it may not be the most effective fluid to use as large quantities are required to dilute the chemical.[8] New agents, such as Diphoterine®, have been developed which effectively remove the chemical from the eye and neutralise both the acid and alkali.[3,7-9]

Conclusion

Prevention of ocular injury is important when working with chemicals and protective eye wear should always be used. In the occupational setting, factories and building sites should have eye wash solutions readily available. In the event of an injury to the eye/s, immediate and prolonged irrigation of the eye/s should be undertaken. Patients should be taken to their nearest hospital as soon as possible to ascertain the degree of injury. With early treatment some of the blinding complications can be prevented.

Ethics

Ethics approval was obtained from the University of the Witwatersrand Human Research Ethics Committee. The patient signed informed consent after the initial irrigation was performed, having been given an information sheet and an opportunity to ask questions.

"Chemical burns of the eye are an ophthalmological emergency and prompt and appropriate management is important . . ."

Lessons learned

1. The severity of the injury is related to the surface area of contact, the degree of penetration and the concentration and nature of the agent involved.
2. Alkali injuries are more common than acid injuries, and are usually more severe as they penetrate the cornea more effectively than acids.
3. Immediate and prolonged irrigation is the most important intervention.
4. Water or saline is commonly the initial irrigating fluid used but new agents may be more effective.
5. Patients should be taken to their nearest hospital as soon as possible to ascertain the degree of injury.

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Eye safety in the work environment and the role of the optometrist

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Abstract

Occupational eye injuries often result in permanent damage and even blindness, yet most can be avoided if visual safety is practiced in the work environment and the appropriate eye protection is worn. However, visual safety in a work environment extends beyond injury prevention. Employee vision assessments (screenings/examinations and surveys), taking account of the specific job requirements should be conducted pre-placement and periodically to ensure the minimum level of visual functioning needed to accomplish visual tasks.

Optometrists have the appropriate skills required to play a key role in the workplace by conducting visual examinations and eye screening, and also contributing to appropriate eye safety policies and procedures. This article examines the role of the optometrist within the work environment, explains vision assessment and visual requirements at the workplace, describes hazards within a work environment and the necessary safety precautions required for eye safety.

Keywords: vision assessment, eye safety, workplace ocular hazards, lighting, visual task details

Introduction

Thousands of South African employees experience occupational eye injuries, often resulting in permanent damage and even blindness in some cases.[1] The impact of industrial processes on eye health are caused by the emissions of unacceptable levels of toxins, particulate matters, chemical waste and fumes, and a large content of sulphur dioxide, which are characteristic of industrial processes and activities.[2] Chemical waste and toxins associated with industrial activities and processes cause significant eye irritations and injuries, which can lead to permanent ocular damage.[3-5] Nine out of ten eye injuries could be avoided if visual safety was practiced in the work environment and the appropriate eye protection provided and used.[1]

However, visual safety in a work environment extends beyond the prevention of eye injuries. Vision assessments should be conducted to ensure that workers possess the minimum level of visual functioning needed to accomplish visual tasks and that ocular hazards are identified.[6] An optometrist can assist with the establishment and maintenance of a safe work environment in terms of eye safety.[6] This article examines the role of the optometrist within the work environment, explains vision assessment and visual requirements at the workplace, describes hazards within a work environment and the necessary safety precautions required for eye safety.

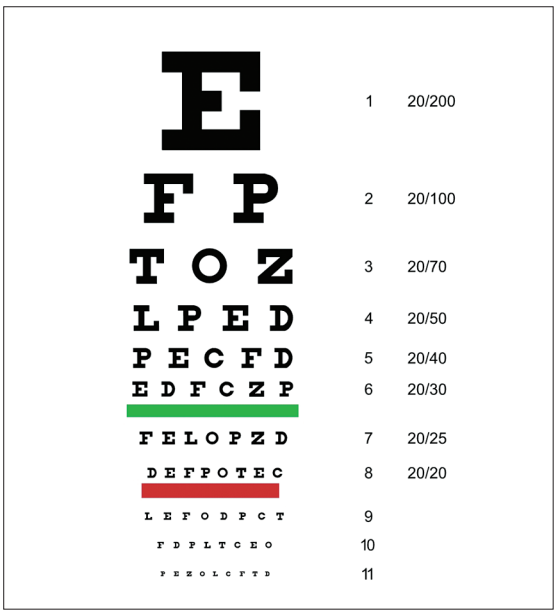

Figure 1. Snellen Chart for Visual Acuity

Role of an optometrist as an eye-safety consultant

Optometrists are primary health care providers who diagnose and treat ocular health problems and visual defects. As an eye-safety consultant, they can participate in an eye safety programme by:

- determining ocular hazards present at different workstations (occupational assessment);
- providing education on the threats posed by workplace eye injury[6];
- selecting protective devices appropriate for each workstation[6];
- explaining to employers and workers the importance of proper eye protection, the different types of eye protectors available to suite a particular job activity, and how to select the most appropriate eye protector[7];
- determining whether the given type of protective eyewear can accommodate the worker's refractive prescription;
- overseeing the ordering, verifying, dispensing, and periodic adjustment of worker's safety eyewear;
- facilitating eye safety sessions, including steps to take if an eye injury occurs in the workplace[7]; and
- counselling[6] to promote compliance with safety policies.

A pre-placement examination by an optometrist, as a component of a comprehensive eye safety programme, is essential to identify workers with suboptimal vision. Existing

eye conditions in new workers can be remedied so that occupational activities are performed more efficiently and safely with clear and comfortable vision. Although the use of contact lenses has been suggested as safe for most industrial operations, their use remains controversial.[6] Thus optometrists can educate workers and safety personnel on their use and the range of new and improved safety eyewear. Consulting services concerning visual efficiency, eye safety and primary eye care issues in the work environment can be provided.[8] As work productivity is often limited by unsuitable or inefficient lighting, contrast, or working distance,[6] the optometrist can make recommendations to employers based on workers' vision assessments to prevent or reduce errors.

A comprehensive eye examination to detect eye diseases, binocular vision disorders, or refractive problems and the need for and types of correction should be incorporated into workplace safety plans, regulations, policies and programmes, especially those with eye hazards. Annual vision screenings allow the employer and optometrist to identify changes in the visual function and ocular health of a worker that could potentially affect safety or eye health in the future.

Essentials of vision assessments conducted by optometrists

Vision assessment is performed in the sequence that follows.

Comprehensive case history

The occupational history should include a detailed description of the specific visual tasks performed and possible eye exposure to workplace hazards. History should be obtained on the main eye complaint, overall visual and ocular history, general health, medication usage, family eye and medical histories, and occupational visual requirements. It should include questions concerning eye safety or previous eye injuries as well as current spectacle and contact lens usage.

Monocular and binocular vision

Visual acuity: A measure of a person's acuteness of vision,[1] and the most commonly used measurement of visual function and status. Patients are examined at distance and at near to assess what can be seen without their current correction by using a standard Snellen Acuity Chart (Figure 1) which has a series of letters, numbers, or a combination of letters and numbers, with the largest at the top. The person being tested reads down the chart. The result is taken as the smallest row that is accurately read. A system using a 6/12 visual acuity standard for coarse detail, 6/9 for medium detail, and 6/7.5 for fine detail can be used as a guide for the appropriate placement of workers.

Colour blindness: A screening test that assesses colour vision to exclude colour blindness, can detect hereditary colour vision deficiencies and possible eye health problems that may affect the patient's colour vision. Colour vision defects can lead to difficulty in tasks such as mixing paints or endanger safety in connecting electrical wires.

The Farnsworth Panel D-15 test can be used to screen for colour vision when moderate levels of colour discrimination are needed.[6] Pseudoisochromatic plates such as Ishihara are often used as the initial screening instrument, and are designed to pass all individuals with normal colour vision and fail all those with defective colour vision.

"Nine out of ten eye injuries could be avoided if visual safety was practiced . . ."

Binocular vision: Binocular vision, the ability to maintain focus on an object with both eyes thus viewing a single image instead of experiencing double vision,[9] is tested in various ways including the following.

Cover test: A cover test measures how well the eyes work together. Whilst the patient fixates on a near or distant object and covers each eye alternatively, the optometrist assesses if the uncovered eye moves to pick up fixation on the target, indicating strabismus/tropia (crossed eyes) which can lead to amblyopia (lazy eye) or a phoria (latent deviation of the eyes from the normal relative direction) which can cause eye strain.

Stereopsis or depth perception: Refers to the ability to detect distances between objects and the determination of an object's position.[10] It is a useful indicator of a patient's binocular status, is critical in those tasks that demand the determination of the position of one object relative to another, and its absence can impact on safety and efficiency in the work environment. There are monocular cues to depth (e.g. overlay, motion parallax, and atmospheric haze) however when precise judgement of relative depth is essential to job performance, there is a justification for a binocular vision requirement.[6]

Refraction

A refraction is performed to determine the exact spectacle prescription needed by the patient due to refractive error (short sighted, farsightedness).

Objective refraction

Retinoscopy: The refractive error can be measured objectively with retinoscopy, which is conducted by neutralising the movement along the principal meridians of the eye viewed when directing a light through the pupil using a retinoscope. Generally performed early in the exam, it provides a starting point to estimate the prescription for spectacles or contact lenses.

Autorefraction: An autorefractor is an instrument/machine (Figure 2) used to objectively determine the patient's prescription. A chin rest firmly positions the patient's head while the patient typically looks at a pinpoint of light or other image. It accurately determines the lens power required to focus light on the retina, takes a few seconds to conduct and provides a starting point for the subjective refraction.

Subjective refraction

After objective refraction, the patient is presented with a series of lens choices to help fine tune the lenses for both distance and near viewing. A trial frame (into which lenses are inserted) or a phoropter (an instrument equipped with numerous lenses) is used to find the most appropriate lens combination that will provide clear vision for the patient. The portability of the former makes it more appropriate when refraction is conducted at the worksite or outside an optometry clinic.

Refraction determines if the patient has hyperopia (farsightedness), myopia (nearsightedness), astigmatism (irregularly shaped cornea or lens) or presbyopia (age-related farsightedness).

The patient's visual acuity is re-tested, on completion of the refraction to establish the best vision that the patient can achieve with the spectacles. An assessment of the patient's binocular and accommodative status after the lens combination providing the best visual acuity is also determined to ensure that the new spectacles provide the patient with clear, comfortable vision.

Near vision/accommodation: Refers to the eye's ability to increase its focusing power to clearly view objects closer than 6 m.[11,12] The measure of this ability is referred to as the amplitude of accommodation. Amplitude of accommodation can be measured by asking the patient to fixate on a small letter on a target which is moved closer to the patient till blur is reported. The distance from the eye that the letter becomes blurry is measured and is converted into a lens power in dioptres. This function is reduced with age and most adults over 40 years experience difficulty in focusing at near (presbyopia). As such, this could have serious implications for affected workers that function at a near working distance.

Figure 2. Autorefraction

Ocular health

Ocular health is determined by examining the anterior and posterior segment.

Slit lamp: An instrument called a slit lamp or biomicroscope, which provides a magnified view of the ocular structures and the surrounding tissues, is used to examine the anterior segment and posterior segment of the eye. It is useful in the evaluation of trauma, irritation, infection and a range of diseases.

Tonometry: Is the measurement of the eye's pressure or intraocular pressure best determined using a contact tonometer. After placing a drop of anaesthetic and then a small amount of fluorescein (a yellow dye) into the eye, the tonometer is moved close to the eye until it gently touches the cornea. The measurement is taken because the risk of developing glaucoma, a potentially blinding disease, increases if the eye pressure is high.

Fundus examination: An ophthalmoscope (Figure 4) is used to evaluate the retina, optic nerve and ocular media (at the back of the eye) to detect eye diseases. It can be conducted without the dilation of the pupils, but dilation gives a better view.

Visual fields

The clinical visual field is best described as a check for blind spots in peripheral or side vision.[2] The monocular dimensions of the visual field in an average person extend to 60 degrees superiorly and 70 degrees inferiorly. Horizontally, the nasal visual field extends 60 degrees and 100 degrees temporally.[13] Visual field defects generally result from a wide range of ocular diseases, such as glaucoma. Generally a gross testing is suitable using a target presented at different points in the field and is measured monocularly. This is followed by a computerised field test should any anomalies or relevant ocular diseases be detected.

Occupational health and safety legislation relating to vision safety

The Occupational Health and Safety Act[14] and the Mine Health and Safety Act[15] and their regulations give direction on the

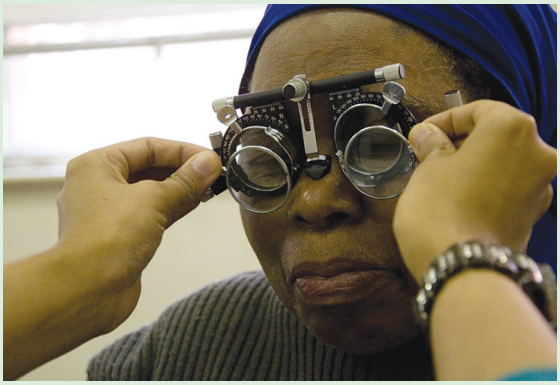

Figure 3. Near vision evaluation with a trial frame and lenses

Figure 4. Ophthalmoscopy examination

provision of a safe working environment to mitigate hazards and ensure workers' health and safety. Eye health and safety has recently been recognised as an essential component of occupational health and safety regulations. For example, the Driven Machinery Regulations and the National Code of Practice for the Evaluation of Training Providers for Lifting Machine Operators[16] provides guidance for drivers of heavy duty, lifting machinery, such as forklifts. It indicates that any person undergoing training to control such machinery, such as a forklift, must be in possession of an Optometrist Certificate or a valid Professional Driver's Permit issued by a doctor (see Adams paper in this issue) which confirms that the trainee has adequate day and night vision and depth perception.[16] The certificate or permit is used to declare the person suitable for the operation of the lifting machine.[6] Since thousands of forklift operators sustain injuries to themselves annually, mostly resulting from the failure of the safety programme in place,[6] optimal visual function, as recommended by an optometrist cannot be overstated.

Eye hazards and ocular protection

Most workplace eye injuries result from small particles or objects entering and abrading the eye, often penetrating it causing permanent loss of vision.[1] Projectiles, chemicals and radiation are major hazards that require protection in the workplace.[6] If the hazard cannot be controlled or eliminated at source, appropriate eye protectors can be used to protect the eyes.[17] Generally more than one type of eye protection, such as safety glasses/spectacles, goggles, screens, fixed shields, visors or helmets may be provided depending on the type of hazard.[17]

Projectiles: Occurs in any form, size or shape, and may travel at high or low velocity. Common projectiles include pieces of screwdriver blades, drill bits, grinding wheels, metal debris, rock and steel rods, many of which can be toxic to the eye.[6] Industrial safety glasses are the most commonly used protection.[17]

Chemicals (splashes and fumes): Liquid chemicals splashing into the eye can result in chemical burns.[7] Serious ocular injury can also result from fumes, vapors, and dry chemicals that enter the eye. Such chemicals include acids, alkalis, organic solvents, and surfactants.[6] Face-fitting goggles can provide protection from splashes and high impact resistance. Spectacle wearers can use over-goggles, vented to prevent fogging,[17] with vents covered to prevent the entry of splashed chemicals. Face shields provide protection against flying particles, molten materials and chemical splashes. They give an excellent field of view[17] and can easily be used over prescription spectacles and other types of eye protection.

Radiation (infrared radiation (IR), visible light, ultraviolet (UV) radiation and heat): Molten materials, particularly glass and metal are the primary sources of IR. Automation protects workers from IR exposure. However, despite being automated, activities such as glassblowing, even at low levels, may produce significant exposure to IR over time,[4] leading to damage such as cataracts. Availability of spectacle lens materials that provide IR protection is limited. Metallic (copper) coated lenses that reflect IR are the

most appropriate protector.[18] UV radiation, produced by the sun and artificial sources in industrial situations, commonly affects the eyes. An electric welding arc, which emits large amounts of UV-C, UV-B, UV-A, visible light, and IR is the commonest UV source in industries. Other ocular problems associated with welding include foreign objects entering the eye and eye injuries resulting from explosion.[19] A welding helmet with a multilayered faceplate (filter plate) prevents harmful radiation from reaching the eyes, whilst allowing the worker to view the work, thereby protecting the eyes, face and neck from IR and spatter. The faceplate must meet specific impact resistance and radiation absorption requirements[6] (see Burrow paper in this issue). Sunlight is a major source of an individual's total exposure to UVB radiation. Individuals working outdoors during the day are at higher risk of developing eye damage such as cataracts and pterygium due to chronic high exposure to solar UVB.[6]

Biological hazards: Infections can be transmitted via the mucous membranes of the eye following direct exposure through blood splashes, respiratory droplets generated during coughing or suctioning, or from touching the eyes with contaminated fingers or objects.[7]

Health effects (clinical signs and symptoms) of certain chemical and physical agents are not evident until maximum exposure is reached.[6] Occupational exposure to ionising radiation, chemical agents and some physical agents such as heat, humidity, and optical radiation are controlled by setting limits (maximum permissible exposure) at a fraction of the threshold limit values (TLV) which result in clinical onset of adverse effects.[6] Therefore, it becomes critical that occupational health and safety programmes include visual task assessments by optometrists that assess the visual functioning required for specific tasks and the associated eye impacts they may have.

Visual task assessment

As occupational tasks place varying demands on workers' eyes, each worker's visual tasks must be carefully considered and a visual standard for the task established. If it is unique or complex, a detailed assessment and analysis should be conducted. Some jobs require the highest visual standards, e.g. those involving delicate mechanism assembly or some danger, whereas others such as those of porters or caretakers can be performed adequately despite poor vision.[8] For example, the tasks performed by a lathe operator may require the use of a metal or wood stock for the alignment of the cutting tool, close observation of the cutting action when the machine is engaged, and setting of instrument controls to ensure proper dimensions, demanding good stereopsis (depth perception) and near visual acuity.[6] Another example is tasks performed by a forklift operator, which may include needing to move safely with a load throughout a warehouse, and accurately positioning and moving the forklift forward to precisely situate the load in a specific location, as well as reading writing on a hand-held piece of paper (from a distance of 40 cm) or reading on crates or boxes (from a distance ranging from 6 to 12 m).[6] Workers must express their visual challenges experienced in the workplace to employers, who must then seek professional assistance from an optometrist.[6]

Ergonomic factors in the occupational environment

Visually related symptoms and difficulties occur when the demands of the visual task exceed an individual's ability. Occupational tasks that require intensive near work and extensive viewing are much more demanding on the visual system. Near vision tasks requires both eyes to converge and focus on the near distance target.[20] The visual demands of such tasks can be lessened if the following ergonomic factors are improved.[20]

Target size: The size of the task must be large enough that the worker can perform it comfortably and efficiently without having to strain his/her vision. In general, the work detail should be at least three times the minimum size required by the worker to resolve the detail.[20] Visual performance for reading increases with letter sizes up to 6/24 (Snellen Acuity). The worker's performance decreases when letters are significantly smaller or larger than 6/24. If increasing the letter size is not possible, decreasing the working distance is an alternative method. The angular size of the task detail is significantly more important than the absolute size.[21]

Contrast: Regardless of the size of an object, low contrast objects are difficult to see. Overall performance can be increased by increasing task contrast. Light level recommendations for all essential industrial and office tasks are available.[21] Auxiliary lighting may be beneficial when visual performance is less than optimal, even with the recommended level of illumination.[20] If necessary, it should be orientated so that reflections are diverted away from the worker.[16]

Viewing time: A longer viewing time is required to recognise details that are difficult to see at a glance. Colour coding and other strategies can reduce search time for operations in which viewing time cannot be changed, such as in assembly line work, which will improve worker efficiency.[20]

Lighting: Good lighting is one of the most essential elements of visual comfort. Poor lighting creates an uncomfortable environment for any employee, irrespective of the work task or characteristic. Usually, the illumination in most workplaces is adequate, but is significantly reduced by the shadow of the worker when they are positioned at the workstation.[20] Discomfort glare is often created from bright objects, fluorescent lights, windows and auxiliary light sources and highly reflective sources.[20] Light quality assessments involve looking for sources of shadow and glare and evaluating the colour specifications of the lighting systems. Light levels should be compared with those listed for the specific task in the IES Lighting Handbook.[22]

Eye injuries in the work environment: important procedures

Eye injuries in the workplace are common and despite having an eye safety programme in place, an eye injury may still occur. It therefore becomes critical that every worker and employer

"... each worker's visual tasks must be carefully considered and a visual standard for the task established."

knows what to do as soon as the injury occurs in order to best deal with the situation. This could help prevent permanent eye damage before being treated by an occupational nursing or medical practitioner or being referred to an ophthalmologist. For example, immediate flushing of the eyes and face can aid the return of normal vision and avoid permanent loss of vision[6] by diluting the chemicals and thereby decreasing their effect on eye tissue. In work environments such as chemical industries, access to appropriate eye wash stations is imperative.[6]

Conclusions and Recommendations

Visual safety in any workplace extends beyond the prevention of eye injuries. It also includes periodic visual assessments and recommendations from an optometrist on eye safety protective wear that are appropriate to a particular task of the worker. An optometrist must be engaged to educate workers and employers on all aspects of eye health and safety in the workplace, as well as to ensure that essential components of eye safety programmes are appropriately established and adhered to. This will enhance eye safety in the workplace and ensure greater work efficiency and productivity.

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EN safety specifications for eye protection

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Abstract

Personal protective eyewear must be worn when eye and face hazards are present in workplaces. It should fit the individual or be adjustable to provide appropriate coverage, be comfortable and allow for sufficient peripheral vision. EN standards have been developed to create a minimum benchmark for safety eyewear, with regards to their performance and subsequent marking requirements. This paper describes the European Standards relating to such eyewear, specifically EN 166, and outlines factors driving future developments to enhance worker compliance.

Key words: eye protection, EN 166, optical correctness, optical clarity

Introduction

When work activities or settings present eye hazards personal protective eyewear, such as goggles, face shields, safety glasses, or self contained full face respiratory devices must be used.[1] The selection of the type of protection must be determined by the nature and extent of the hazard associated with each activity based on a risk hazard assessment, the circumstances of exposure, other protective equipment used, personal vision needs and legal requirements.[1] It should fit the individual or be adjustable to provide appropriate coverage, be comfortable and allow for sufficient peripheral vision.[1] This paper describes the European Standards relating to such eyewear, specifically EN 166,[2] and outlines factors driving future developments to enhance worker compliance.

EN Standards

The European Committee for Standardization (CEN) is responsible for the development, maintenance and distribution of coherent sets of standards and specifications,[3] including the technical European Standards (prefixed European Norm or EN).[4] Amongst other purposes, they promote free trade, the safety of workers and consumers, and the interoperability of networks. International Standards (prefixed ISO) may supersede ENs in some cases.[4] Design, performance and marking requirements for the different types of equipment are contained in the standards.[4] According to the author's experience, the role of EN specifications and those of other standards, namely the American Standards (ANSI) and Australian/New Zealand Standards (AS/NZS), are to:

- set a minimum requirement in terms of product performance;
- offer guidance to end-users of expected performance;
- ensure ongoing consistency in terms of quality; and
- reduce risk in the workplace.

EN standards relating to protective eye wear

A number of EN standards have been developed for eye protection (see Table 1) and these should be used to ensure that the eyewear selected is appropriate for the hazards in the work setting.

EN 166

The EN 166:2002[2] is a basic European standard that is applicable to all types of eye protection that are to be used to prevent eye injury or alteration of vision from a variety of hazards, with a few exceptions.[4] These are radiation of nuclear origin, X-rays, laser beams or infrared rays given out by sources at low temperature.[5] Specific standards for

Table 1. Main EN standards for eye protection[5,6]

Standards – Basic (General requirements)		EN166	Technical performance standard – The core technical standard
		EN167	Methods for optical tests
		EN168	Methods for tests other than optical
Standards – Product type		EN169	Filters for welding and related techniques – Transmittance requirements and recommended utilisation
		EN170	Ultraviolet filters – Transmittance requirements and recommended utilisation
		EN171	Infrared filters – Transmittance requirements and recommended use
		EN172	Solar radiation filters – Sunglare filters for industrial use
Standards – Field of use	Welding	EN175	Equipment for eye and face protection during welding and allied processes
		EN379	Specification for welding filters with switchable and dual luminous transmittance
	Laser	EN207	Filters and eye protection against laser radiation
		EN208	Eye protection for adjustment work on lasers and laser systems
	Mechanical/ heat protection	EN1731	Mesh type eye and face protectors for industrial and non-industrial use against mechanical hazards and/or heat

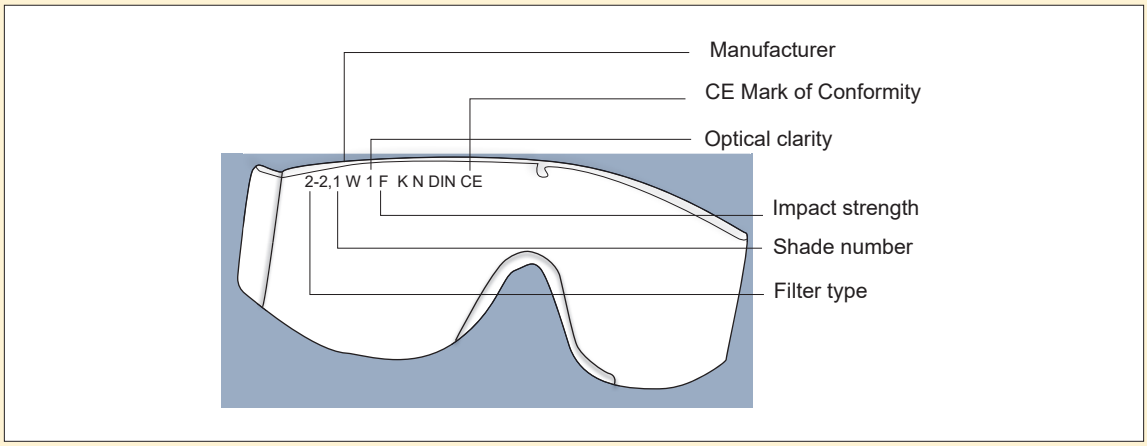

Figure 1. EN 166 Standard – lens markings

eye protection have been developed for these, for example anti-laser eye protection and all-purpose solar spectacles (see Table 1).[5] Eye protectors that are fitted with corrective lenses are not excluded from the application field.[5]

The general requirements standard for eye protection in South Africa, which is comparable to EN 166 is SANS 1404.[7,8] SANS 1404:2009 (previously SABS 1404:2002) is summarised as follows: "Eye protectors for industrial and non-industrial use. Specifies the characteristics of personal eye-protectors for industrial and non-industrial use. Covers eye-protectors embodying afocal or prescription lenses or combinations of these. The hazards covered are impact, molten metals, hot solids, dusts, gases, liquids and any combination of these. For protection against harmful radiation, see SANS 1400, and for more information on oculars, see SANS 50169."[8]

The classifications and marking for eye wear that is EN 166 compliant are shown in Table 2. The first column lists the classifications which reflect the requirements, whilst the second and third indicate the corresponding markings that must appear on the frame and lens respectively.

The CE Mark of conformity is categorised into three sections:

Category 1: Low risk applications: Where the user can determine the risk, and the effects of the hazard are gradual and can be identified in good time.

Category 2: Intermediate risk and design: Products where the user is able to identify the potential risks, but the effects of the risk could be more severe than Category 1 risks.

Category 3: Complex/irreversible/mortal risk: Risks which could seriously or irreversibly negatively damage the health of the worker, the effects of which cannot be identified in time.

The CE Mark of conformity is the final approval required for a product to be sold and/or traded within the European Union.[2]

Factors influencing the need for new developments in protective eyewear

Optical correctness or optical clarity

One of the key components of the EN standard on protective eyewear is the issue of optical clarity or correctness. The highest level of optical clarity or correctness is Class 1 (0.06 dioptres), which means that it is as close to being perfectly clear as possible. A dioptre is a unit of measurement

"One of the key components . . . is the issue of optical clarity or correctness."

Table 2. EN 166 requirements for eye protection[2]

EN 166	Frame marking	Lens marking
Manufacturer/ importer/ agent logo or mark	E.g."W"	E.g."W"
Optical class:		
Refractive tolerance ± 0,06 dioptre	–	1
Refractive tolerance ± 0,12 dioptre	–	2
Refractive tolerance ± 0,12 – 0,25 dioptre	–	3
Mechanical strength: Test conducted using 6 mm steel ball	–	–
Minimum robustness	–	S
Increased robustness (general purpose) – oculars only	F	F
High-speed particles, low-energy impact 45 m/s/162 km/h (applies to safety spectacles, acetate lens goggles)	B	B
High-speed particles, medium-energy impact 120 m/s / 432 km/h (applies to polycarbonate goggles and face shields only)	A	A
High-speed particles, high-energy impact 190 m/s / 684 km/h (applies to face shields only)		
Field of use:		
Basic	–	–
Liquids (chemical)	3	–
Large dust particles (dust)	4	–
Gas and fine dust particles (gas)	5	–
Short-circuit electric arc	8	–
Molten metals and hot solids	9	9
Optional requirements:		
Resistance to misting	–	N
Resistance to surface damage	–	K

of the optical power of a lens.[9] As the dioptre level drops the degree of clarity increases.

A common reason for workers not wearing their protective eyewear is poor optical clarity which produces distortion of the work area. Optical clarity is a perceptual expression denoting the absence of light diffusion and image distortion due to optical aberrations in the lens.[10] Commonly known as haze, light diffusion results from small-angle light scattering at imperfections and impurities in the lens material and lens coating, as well as scratches and fog on the lens. As a consequence, the brain needs to make significant background compensation, leading to eye strain, fatigue and loss of productivity, especially when the eyewear needs to be worn for extended periods of time.[10]

Current measurement of prescription lenses is done in increments of 0,25 dioptres (Class 3), whereas safety class requirements are differentiated by increments of 0,06 dioptres (Class 1), requiring far higher levels of precision. There are 43 possible aberrations/conditions which could adversely affect optical correctness. These are classified from High order (Complex) to Low order (Simple). Low order aberrations are inherently easier to compensate or adjust for but tend to have the most noticeable effect. The current EN Standard only deals with the three lowest order aberrations. Despite a Class 1 optical correctness, there may still be users who encounter symptoms such as eye fatigue, headaches, and blurred vision. This would only affect a limited number of users with exceptionally sensitive eyes. It may also affect users who have never worn any eyewear, sunglasses or prescription before. Cases were more isolated traditionally due to "flatter" lenses with less curvature. However, as lenses become more comfortable by being more curved, this becomes even more critical.

Wrap-around design

Glasses made from polycarbonate, a robust plastic, can be curved to wrap around the sides of the eyes thereby affording more protection from splashes, dusts, etc. A wrap-around design has arms that are inherently flexible and therefore it will fit more faces. The variety of faces which can comfortably be accomodated by safety spectacles can be inhibited by the lower curvature of the spectacle frame and thus lens. In order to counteract this, more adjustments in temple length and inclination are required. The assumption is that the fewer adjustments required the less high-tech it is. However, this is not so as the manufacturer will then need to compensate for the lower optical correctness, by improving the optical qualities of such a curved lens. This is because increasing curvature could decrease optical clarity of a product if the manufacturer

does not or cannot compensate for this. The central portion might be a Class 1 but unless the necessary corrections are made, magnification and blurring occurs at the edges.

Scratch and misting resistance

As optional requirements, safety eyewear can be coated to be resistant to scratches and misting.[1] Their resistance is checked by measuring the length of time they take to mist up when held over a cup of boiling water, and steel wool is rubbed on the lens to check if scratches occur. The quality of such coatings can vary.

Conclusion and recommendations

The achievement of both good optical clarity and good fit of protective eyewear together with effective and long-lasting anti-scratch and anti-misting coating will enhance compliance and reduce eye injuries in hazardous work situations. Manufacturers are striving to improve the design of this equipment so that future developments may allow for a total absence of magnification, blurring, ocular fatigue, headaches and risk related to impaired vision.

Many makes and types of protective eyewear are available in the market. They vary according to design, specifications and cost. Decisions regarding their selection for purchase should be governed by factors affecting their compliance with the relevant EN and SANS standards, the quality of their optical clarity and fit, rather than just cost.

Lessons learned

1. The selection of the type of protection must be determined by the nature and extent of the hazard associated with each activity based on a risk hazard assessment, the circumstances of exposure, other protective equipment used, personal vision needs and legal requirements.
2. It should fit the individual or be adjustable to provide appropriate coverage, be comfortable and allow for sufficient peripheral vision.
3. The EN 166:2002 is a basic European standard that is applicable to all types of eye protection that are to be used to prevent eye injury or alteration of vision from a variety of hazards, with a few exceptions.
4. The general requirements standard for eye protection in South Africa, which is comparable to EN 166 is SANS 1404.

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"A common reason for workers not wearing their protective eyewear is poor optical clarity which produces distortion of the work area."

Driver fitness evaluation with respect to vision

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Sections based on The South African Society of Occupational Medicine's Guideline No.6, Medical requirements for fitness to drive. 2009.

Abstract

Drivers with a marked loss of visual acuity or visual field will not be able to drive safely as they may not detect other vehicles or potentially dangerous situations. Workers whose jobs involve driving and who have reduced vision can be a threat to their own safety as well as co-workers, the public and the environment. Various medical conditions can affect vision. The purpose of this article is to describe visual disorders indicated in driver fitness standards and discuss driver fitness evaluation with respect to vision. Relevant legal requirements in South Africa and standards of fitness to drive are outlined.

Key words: vision, driving, fitness, evaluation, visual disorders

Introduction

Good vision is essential for jobs involving driving, as drivers with a marked loss of visual acuity or visual field will not be able to drive safely as they may not detect other vehicles or potentially dangerous situations.[1] Various medical conditions can affect vision. The purpose of this article is to describe visual disorders indicated in driver fitness standards and discuss driver fitness evaluation with respect to vision.

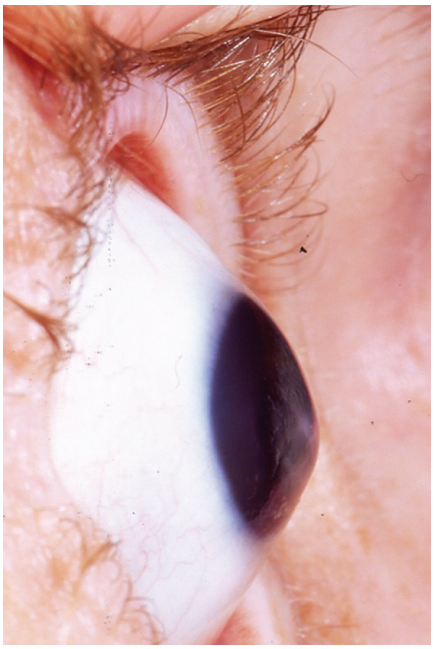

Photo 1. A photo of human eye showing typical conical bulge caused by keratoconus. Courtesy of Indiana University School of Medicine, Department of Ophthalmology.

Source: http://en.wikipedia.org/wiki/File:Keratoconus_eye.jpg

Visual disorders indicated in driver fitness standards

Visual acuity[1-3]

Visual acuity is the best obtainable vision with or without glasses or contact lenses.[1]

Cataract

A cataract is an opacity of the lens. Loss of contrast, glare (halos and starbursts around lights), requiring increased light to see well, and difficulty in differentiating dark blue and black are early symptoms. Later, painless blurring of vision is experienced, with the degree of blurring related to location and extent of the opacity. Diplopia or double vision occurs rarely. An opacity in the centre of the lens (a nuclear cataract) worsens distance vision. In a posterior subcapsular cataract, vision is disproportionately affected because the opacity is at the crossing point of incoming light rays. With this type, visual acuity is most reduced with pupil constriction such as in bright light or during reading, and loss of contrast as well as glare from bright lights or car headlights is common.[3] Diabetes can cause swelling of the eye lens, causing blurring of vision and cataracts.[4] Cataracts are also more common in the elderly.

Diabetic or hypertensive retinopathy [4]

Diabetes can affect the fine network of blood vessels in the retina resulting in retinopathy. It occurs in two forms, maculopathy and proliferative diabetic retinopathy. In maculopathy the blood vessels in the retina leak so that central vision deteriorates and the person experiences difficulty in recognising objects at a distance or seeing detail, such as road signs. Proliferative diabetic retinopathy refers to occlusion of the retinal blood vessels and the resultant growth of new but weak vessels on the retinal surface. These

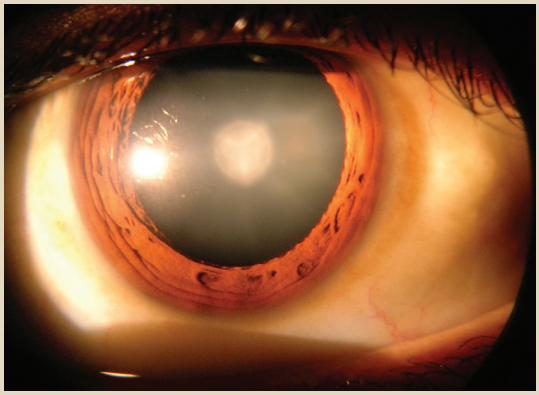

Photo 2. Cataract

Source: http://en.wikipedia.org/wiki/File:Cataract_in_human_eye.png

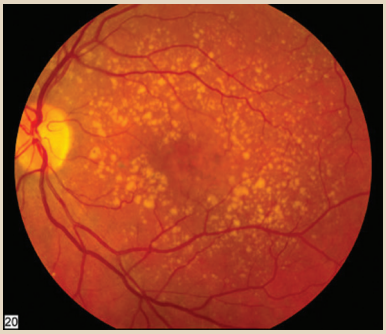

Photo 3. A fundus photo showing intermediate age-related macular degeneration.

Source: National Eye Institute, National Institutes of Health, http://en.wikipedia.org/wiki/File:Intermediate_age_related_macular_degeneration.jpg

". . . drivers with a marked loss of visual acuity or visual field will not be able to drive safely . . ."

bleed easily, forming scar tissue which distorts the retina. Blurred and patchy eyesight and even total loss of vision can follow. Hypertensive retinopathy is characterised by haemorrhages and infarcts visible on the retina which may lead to papilloedema (swelling of the optic disc). Malignant hypertension (severe uncontrolled hypertension) may present with visual disturbances.

Keratoconus[3]

Keratoconus is a slowly progressive thinning and cone-shaped bulging of the cornea, which is usually bilateral. The changes in the refractive characteristics of the cornea (irregular astigmatism), reduces visual acuity which cannot be fully corrected with glasses.

Macular degeneration[3]

Degeneration of the macula results in permanent central vision loss, commonly in the elderly. The dry form causes retinal pigmentation changes in the form of yellow spots and areas of chorioretinal atrophy. The wet form can follow, in which choroidal neovascularisation occurs under the retina. Haemorrhage or localised macular oedema can elevate an area of the macula or result in a retinal pigment epithelial detachment. Eventually, an elevated scar is formed under the macula.

Diplopia[3]

The perception of two images of a single object is termed diplopia. It may be monocular (present when only one eye is open) as a result of distortion of light transmission through the eye to the retina, due to a cataract, corneal shape problems, uncorrected refractive error (e.g. astigmatism), scarring and a dislocated lens. Binocular diplopia (disappears when either eye is closed) suggests disconjugate alignment of the eyes. Possible causes are 3rd, 4th, or 6th cranial nerve palsy, myasthenia gravis, orbital infiltration, mechanical interference with ocular motion or a general neuromuscular transmission disorder.

Visual fields

Driving requires adequate visual fields since peripheral vision is important in tasks such as merging into a traffic stream, changing lanes, and seeing objects to the side of the line of vision.[1] Lesions in the neural visual pathways from the optic nerves to the occipital lobes can affect the visual field.[3] Apart from the conditions listed hereafter, head trauma, brain tumour, stroke, cerebral infection, optic atrophy, retinal detachment, localised retinal or choroidal infection,[1] and ptosis or lid redundancy and blepharospasm[3] can also reduce visual fields.

Homonymous hemianopia is the loss of part or all of the left half or right half of both visual fields (it does not cross the vertical median). Homonymous quadrantanopia refers to the loss of part or all of the left quarter or right quarter of both visual fields. The loss of all or part of the lateral half of both visual fields (does not cross the vertical median) is known as bitemporal hemianopia.

Glaucoma[3]

The glaucomas are a group of eye disorders, which are the third most common cause of blindness worldwide. They are characterised by progressive optic nerve damage at least partly due to increased intraocular pressure.

Retinitis pigmentosa[3]

Genetic mutations cause a slowly progressive, bilateral degeneration of the retina and retinal pigment epithelium, resulting in night blindness and loss of peripheral vision.

Contrast sensitivity

The ability to perceive visual stimuli that differ in contrast and spatial frequency declines with age. Although binocular measures of contrast sensitivity have been found to be a valid predictor of crash risk in patients with cataracts, there are no standardised cut-off points for contrast sensitivity and safe driving, and it is not routinely measured in eye examinations.[1]

Defective colour vision

Despite evidence that people with red deficient vision have difficulty in detecting red lights and stopping in laboratory testing, there is no unequivocal evidence that colour-blind drivers are less safe drivers.[1,2] Red-deficient persons should be warned that they may be less aware of detecting red lights and hence should pay particular attention to traffic lights, rear braking lights and other sources of red light relevant to driving.[1]

Poor night vision and glare recovery

Ageing can decrease the person's ability to adapt to changes in light and heighten their sensitivity to glare, which impair night driving.[3]

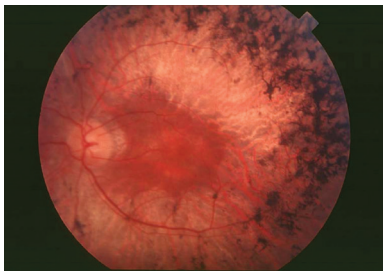

Photo 4. Fundus of patient with retinitis pigmentosa, mid stage. Bone spicule-shaped pigment deposits are present in the mid periphery along with retinal atrophy; the macula is preserved although with a peripheral ring of depigmentation; retinal vessels are attenuated.

Source: Hamel Orphanet Journal of Rare Diseases 2006 1:40 doi:10.1186/1750-1172-1-40. http://en.wikipedia.org/wiki/File:Fundus_of_patient_with_retinitis_pigmentosa,_mid_stage.jpg

Fitness evaluation of drivers with respect to vision

Legal requirements

The most important of the statutes relevant to work fitness and disability in South Africa is the Road Traffic Act (RTA)

Table 1. SASOM categories of driver in relation to the Road Traffic Act[5] and other legislation[8-10]

SASOM category	Categorisation in terms of the legislation
I	**RTA: Standard vehicle drivers operating light vehicles** Driving in standard transport circumstances where no special requirements exist over and above the required licence and personal skills to operate the vehicle.
II	**RTA: Drivers who require a PDP** The highest risk category. Within this group, there is a gradient of risk as follows: • Category "D": highest risk – authorises the driving of a motor vehicles carrying hazardous/dangerous goods; • Category "P": second highest risk – authorises the carrying of passengers; and • Category "G": third highest risk – authorises the driving of large motor vehicles conveying goods.
III	**Special vehicle drivers in control of specialised vehicles** Vehicles used for specific purposes where skill, method of operation and place of operation require attention, e.g. forklift truck operators, crane drivers, etc. Note that the legislation that governs fitness to drive these vehicles is not the RTA, but the Construction Regulations (regulation (21)(1)(d)(ii) – Operators of construction vehicles and/or mobile plants)[9] and the National code of practice for the evaluation of training providers for lifting machine operators (GNR.145 of 18 February 2005), as per the Driven Machinery Regulations of the Occupational Health and Safety Act.[10] Therefore, the provision of a certificate of fitness does NOT automatically entitle the driver to operate the applicable mobile equipment on the public roads. The risks associated with drivers in this category can vary enormously, depending upon the circumstances, such as the terrain, traffic density (people and/or equipment), equipment size, and the material being worked, making it difficult to place minimum standards on this group. For some, the mix of circumstances requires that the driver meet the most stringent minimum standards, whilst for others the requirements would be far more tolerant. Consequently, the minimum standards are to be considered on a case-by-case basis, in accordance of the mix of circumstances. As a guideline, the medical adjudicator should consider the category 1 standards as a minimum, although in MOST circumstances, the standards for category 2 would apply.

Table 2. Health evaluation interval schedule[8]

Type of health evaluation			
	I	II (D/P/G)	III special
Pre-employment	Yes	Yes	Yes
PRDP (Time interval in months)	24	24	N/A
Periodic (recommended time interval in months)	On request	12	12
Return to work after significant ill-health absence (>10 days)	On request	Yes	Yes
Post incident (evaluation immediately or soon after incident)	Yes	Yes	Yes

Table 3. Health evaluation action protocol[8]

		Pre-employment	Periodic/PRDP	Return to work	Post incident
Medical:	Past history	Required			
	Current history	Required	Required	Required	Required
Occupational:	Past history	Required			
	Current history	Required	Required	Required	Required
Physical examination		Required	Required	Required	Required
Sensory:	Vision (and fields)	Required	Required	Optional	Optional
	Hearing	Required	Required	Optional	Optional
Special investigations		Required	Optional	Optional	Optional

". . . peripheral vision is important in tasks such as merging into a traffic stream, changing lanes, and seeing objects to the side of the line of vision."

No. 93 of 1996,[5] which outlines the health conditions that would disqualify applicants from driving. With respect to vision, Section 15 of Chapter IV states that "15(1) A person shall be disqualified from obtaining or holding a learner's or driving licence if he or she is suffering from ....(i) defective vision ascertained in accordance with a prescribed standards." Section 16 gives a legal responsibility to the holder of a driving licence to disclose any disqualification on health grounds when applying for a new licence or if a new problem, within 21 days, to the licencing authority.

Other statutes focus more generally on fitness standards and the management of ill-health and disability in the workplace, for example, the Occupational Health and Safety Act[6] and the Mine Health and Safety Act.[7]

Categories of drivers

The employer is required in terms of the RTA to categorise all drivers according to the relative risks involved specific to their industry and according to the requirements for the issuing of the Professional Driving Permit (PDP). Table 1 shows the categorisation recommended by South African Society of Occupational Medicine (SASOM).[8]

Driver health evaluation

Goals of driver health evaluation[11]

- To determine whether the driver meets the minimum fitness standards to enable him to perform his duties as a driver, safely and effectively.
- To determine whether the driving duties are impacting negatively on his health and make recommendations on how best to address this.
- To ascertain whether the driver is suffering from any health condition which is likely to impact on his driving ability in the future such as epilepsy or diabetes or which may disqualify him from holding a licence in terms of the RTA.
- To ascertain continued fitness to drive following major illnesses and surgery which may cause impairment affecting the ability to drive.

Health evaluation interval schedule

SASOM's recommended health interval schedule is shown in Table 2.[8]

Health evaluation action

The evaluation requires a clear understanding of the inherent visual requirements of the job which could impact on driving ability. All new drivers must have a full history and examination to provide information for baseline measurements. Baseline clinical status and identification of progression of disease necessitates good record-keeping and continuity of care. For SASOM's recommended health evaluation protocol see Table 3.[8]

Table 4. Minimum requirements for fitness to drive with respect to vision[8]

VISUAL DISORDERS	GROUP 1: Cars, LMVs, Motor Cycles	GROUP 2(3): Trucks, Passenger, Special
ACUITY	According to the Snellen rating a minimum visual acuity, with or without refractive correction, of 6/12 (20/40) for each eye, or where the visual acuity of one eye is less than 6/12 (20/40) or where one eye of the person concerned is blind, a minimum visual acuity for the other eye of 6/9 (20/30).	According to the Snellen rating a minimum visual acuity, with or without refractive correction, of 6/9 (20/30) for each eye.
VISUAL FIELD DEFECTS Disorders such as severe bilateral glaucoma, severe bilateral retinopathy, retinitis pigmentosa and other disorders producing field defect including partial or complete homonymous hemianopia/quadrantanopia or complete bitemporal hemianopia.	A minimum visual field of 70 degrees temporal, with or without refractive correction, in respect of each eye, or where the minimum visual field in respect of one eye is less than 70 degrees temporal, or where one eye is blind, a minimum total horizontal visual field of at least 115 degrees with or without refractive correction.	A minimum visual field of 70 degrees temporal in respect of *each* eye, with or without refractive correction.
MONOCULAR VISION (Includes the use of one eye only for driving)	Complete loss of vision in one eye (ie. If there is any light perception, driver is not considered monocular). May drive when clinically advised that driver has adapted to the impairment and the prescribed eyesight standard in the remaining eye can be satisfied and there is a normal monocular visual field in the remaining eye, i.e. there is no area of defect which is caused by pathology.	See appendix in the Guideline 6.[8]
COLOUR BLINDNESS	Driving may continue with no restriction on licence.	Driving may continue with no restriction on licence.
NIGHT BLINDNESS	Acuity and field standards must be met. Cases will be considered on an individual basis.	Group 2 acuity and field standards must be met and cases will then be considered on an individual basis.
CATARACT Includes severe bilateral cataracts, failed bilateral cataract extractions and post cataract surgery where these are affecting the eyesight.	Must be able to meet the above eyesight requirement. In the presence of cataract, glare may prevent the ability to meet the number plate requirement, even with apparently appropriate acuities.	Must be able to meet the above prescribed acuity requirement. In the presence of cataract, glare may prevent the ability to meet the number plate requirement.
DIPLOPIA	Cease driving on diagnosis. Resume driving on confirmation to the Licensing Authority that the diplopia is controlled by glasses or by a patch which the licence holder undertakes to wear while driving. (If patching, note requirements above for monocularity). Exceptionally a stable uncorrected diplopia of 6 months' duration or more may be compatible with driving if there is consultant support indicating satisfactory functional adaptation.	Permanent refusal or revocation if insuperable diplopia. Patching is not acceptable.
BLEPHAROSPASM	Consultant opinion required. If mild, driving can be allowed subject to satisfactory medical reports. Control of mild blepharospasm with botulinum toxin may be acceptable provided that treatment does not produce debarring side effects such as uncontrollable diplopia. MEC should be informed of any change or deterioration in condition. Driving is not normally permitted if condition severe, and affecting vision, even if treated.	Consultant opinion required. If mild, driving can be allowed subject to satisfactory medical reports. Control of mild blepharospasm with botulinum toxin may be acceptable provided that treatment does not produce debarring side effects such as uncontrollable diplopia. MEC should be informed of any change or deterioration in condition. Driving is not permitted if condition severe, and affecting vision, even if treated.

Declaring a vehicle driver fit/unfit in relation to vision for driving duties

SASOM has developed a list of criteria to assist the medical officer in deciding on endorsement or rejection of a driver on health grounds with respect to vision.[8] Special investigations or specialist opinion may be required for some decisions. Clinical experience, an understanding of the illness, the nature of the workplace and occupational requirements of the job as well as the safety risk posed by the driver will guide decisions. Minimum requirements for fitness to drive with respect to vision are listed in Table 4.[8] A prescribed incapacity is a medical condition listed in terms of the RTA (Section 15(1)(f)&(g)) and its presence legally bars the person from the holding of the licence.[8] A licence holder or applicant is regarded as suffering a prescribed incapacity if unable to meet the eyesight requirements. A relevant incapacity is any medical condition that is likely to make the person a source of danger while driving, such as a visual field defect.[8] The Snellen standard equates to the ability to read in good light (with the aid of glasses or contact lenses if worn) a registration mark fixed to a motor vehicle and containing letters and figures 79 mm high and 50 mm wide at a distance of 20 metres, or at a distance of 20.5 metres where the characters are 79 mm high and 57 mm wide.[8] People unable to meet this standard must not drive and the licence must be refused or revoked.[8]

The South African legal standard is based on category of vehicle, so the lesser standard is prescribed for drivers of categories code A1, A, B or EB vehicles (motor cycles and old code 08) (equivalent of SASOM Group 1), and the higher standard is prescribed for drivers of categories code C1, C, EC1 or EC vehicles (old code 10+) (equivalent of SASOM Group 2 or 3).[8] Registration for sight impairment or severe sight impairment will normally be regarded as incompatible with holding a driving licence. However, attention will be given to the standards indicated in Table 4 in deciding on fitness to drive.[8] Guideline 6 also contains an appendix on the field of vision requirement for the holding of group I licence entitlement.[8]

Vision testing (apart from the use of the Snellen wall chart and confrontation tests to check visual fields) is covered in detail in the SASOM Guideline for vision testing. A detailed and comprehensive list of conditions and fitness standards for driving is contained in the SASOM Guideline 6[8] and the Driver and Vehicle Licensing Booklet.[12] They provide clear management strategies for most conditions that could impair driving ability.

Conclusion and recommendations

Various visual disorders can have an adverse effect on vision. Since good vision is necessary for safe driving, workers whose jobs involve driving and who have reduced vision can be a threat to their own safety as well as co-workers, the public and the environment. It is therefore essential that their health is evaluated to check that they meet the fitness standards to drive with respect to vision.

"SASOM has . . . a list of criteria to assist the medical officer in deciding on endorsement or rejection of a driver on health grounds . . ."

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Analysis of attendance records for the Occupational Dermatology Clinic, Groote Schuur Hospital, Cape Town, during 2008 and 2009

Abstract

Occupational skin disease is common. In South Africa, the prevalence is largely unknown. The records of clinic attendance at the Occupational Dermatology Clinic, a specialist referral clinic at Groote Schuur Hospital, Cape Town, during 2008 and 2009 were reviewed to gain an insight into the diagnoses seen, industries represented at the clinic and referral patterns to the clinic. Fifty-nine patients were seen during the study period. Twenty-one patients were diagnosed with ACD and four with ICD. Skin patch testing was done on 38 patients. Twenty-nine tests were positive and 19 of these were related to occupation.

Key words: occupational skin disease, contact dermatitis, occupation, primary site, referral

Introduction

Occupational skin disease is common, and represents approximately 30% of reported occupational diseases in European countries.[1] In South Africa, the prevalence of OSD is largely unknown, but large cross-sectional studies have shown very high prevalence of irritant and allergic contact dermatitis in particular industries.[2] It is probable that OSD is under-reported for several reasons, including a lack of access to occupational health care, the patient's decision not to seek treatment for mild symptoms, and misdiagnosis.[1]

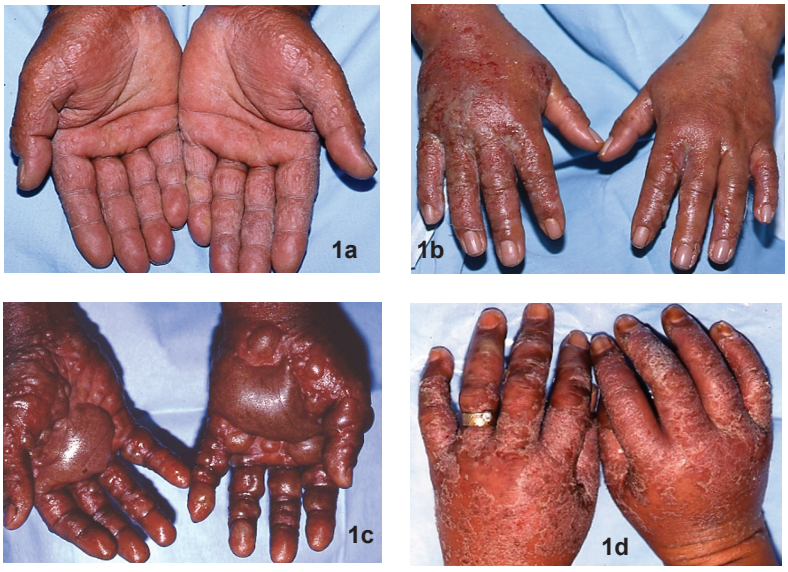

Figure 1. Acute hand eczema. a. Vesicles on a background of erythema and mild scale. b. Vesicles, eroded, wet and weeping skin on a background of erythema and oedema. c. Extensive blister and vesicles with barely visible erythema. d. Peeling of the skin following acute eczema

The most common occupational disease by far is contact dermatitis, but contact urticaria, nail disorders, leukoderma, acne, infections and cancer are all reported.[3] Although irritant contact dermatitis has traditionally been thought to be more common in the workplace than allergic contact dermatitis, some researchers argue that allergic reactions are more common if you look hard enough for the agent.[4,5] Patch testing is, therefore, an essential part of the investigation of OSD. It is not foolproof, though, as there is the possibility of false positive reactions and interpretation of tests is largely subjective and depends on the skill of the reader.[1]

Several industries are high risk for occupational contact dermatitis, particularly healthcare, hairdressing, the food industry, metal work[6] and construction.[7] The most common allergens are metals and components of rubber.[7]

The Occupational Dermatology Clinic at Groote Schuur Hospital

The Occupational Dermatology Clinic is a specialist clinic which runs twice a month at Groote Schuur Hospital. It is a referral clinic for people with skin conditions thought to be related to their work and serves a large catchment area including Cape Town and surrounds. Referrals to the clinic come from occupational nurses and doctors, private general practitioners and dermatologists, and clinics and hospitals within the state sector. The clinic is staffed by a dermatology professor and two registrars – an occupational medicine registrar and a dermatology registrar who rotate through the clinic for six months at a time.

A full occupational and dermatological history is taken from each patient and a dermatological examination is performed. When indicated, patch testing is done with 45 commercial allergens commonly associated with allergic contact dermatitis by an experienced sister from the dermatology ward, and

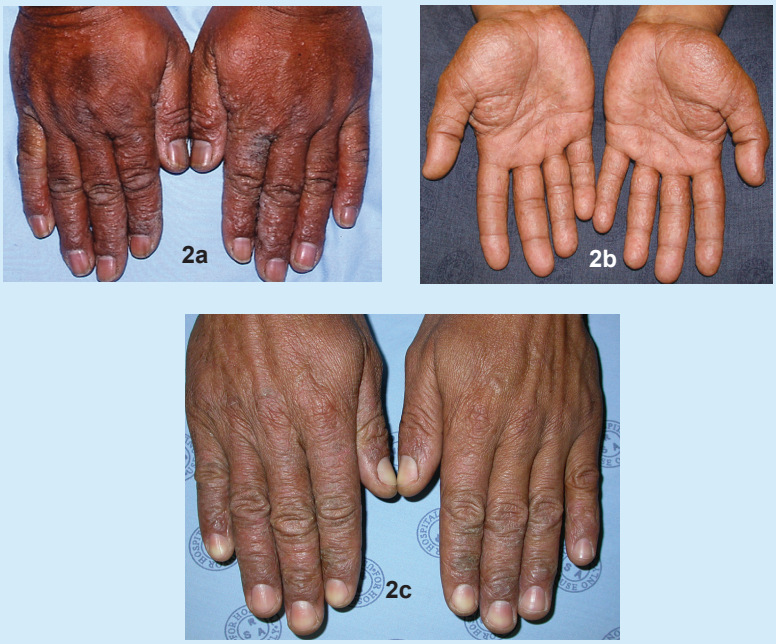

Figure 2. Acute on chronic hand eczema. a. Diffuse vesicles on a background of erythema, hyperpigmentation and lichenification (increased skin markings). b. Diffuse vesicles on a background of erythema, lichenification and scale. c. Scattered vesicles and weeping on a background of erythema and dry, scaly, thickened, mildly pigmented (lichenified) skin

"The most common occupational disease by far is contact dermatitis . . ."

patients are asked to return for reading of the patch test after 72 hours. In selected cases, further patch testing may be performed with specific chemicals from the workplace. Workplace visits are an essential part of the service and are carried out if exposures are not apparent after the patient interview.

As there is very little data about OSD in South Africa, the data from the clinic was analysed to determine:

1. the types of occupational skin disease seen at the clinic;
2. the primary site of dermatitis;
3. the frequency of positive patch tests;
4. the occupations represented at the clinic; and
5. referral patterns to the clinic.

Methodology

A medical record review was undertaken between April and June 2010. Attendance at the Occupational Dermatology Clinic was ascertained from computerised clinic statistics, and individual files were then searched by hand. All patient files from the period Jan 2008 to December 2009 were reviewed by one reviewer. This period was selected as the clinic was running well during this time, and records were easy to obtain. The relevant data was extracted and stored in Microsoft Excel. Ethics clearance for the study was obtained from UCT's ethics committee (HREC REF 090/2011).

Results

The Occupational Dermatology Clinic was run on 36 occasions in 2008 and 2009. In total, we saw 59 new patients, of whom 28 were female and 31 were male. The median age was 38 years. Sixteen workplace visits were conducted when we could not obtain a good understanding of the work from the patient's description alone and when we felt it would be helpful to see the job being performed.

Of the 59 patients seen, 31 (53%) were diagnosed with OSD, 16 (27%) with non-occupational skin disease and in the remaining 12 (20%) a conclusion was not reached about the work-relatedness of the condition, in most cases because the patient did not return for follow-up. In contrast to the recent findings from the NIOH Skin Disease Clinic,[8] the most frequent OSD seen was allergic contact dermatitis (ACD) (Figures 1 to 3), followed by irritant contact dermatitis (ICD) and paronychia (Figure 4). Table 1 contains details of all OSD diagnoses.

In the 25 cases of occupational contact dermatitis (both irritant and allergic), the most common site was the hands (92%). Only two cases did not involve the hands, and the primary site in these two were the feet and forearms respectively. See Table 2 for the sites of occupational dermatitis.

Patch testing with 45 commercial allergens was conducted on 38 patients with dermatitis. Eleven of these patients had additional patch tests with specific substances obtained from their workplaces. Twenty-nine (76%) of the patients tested with the commercial allergens had positive reactions to at least one agent. Of the 11 patients tested with additional agents, five had a positive reaction, and one of these was an irritant reaction. All of the patients who

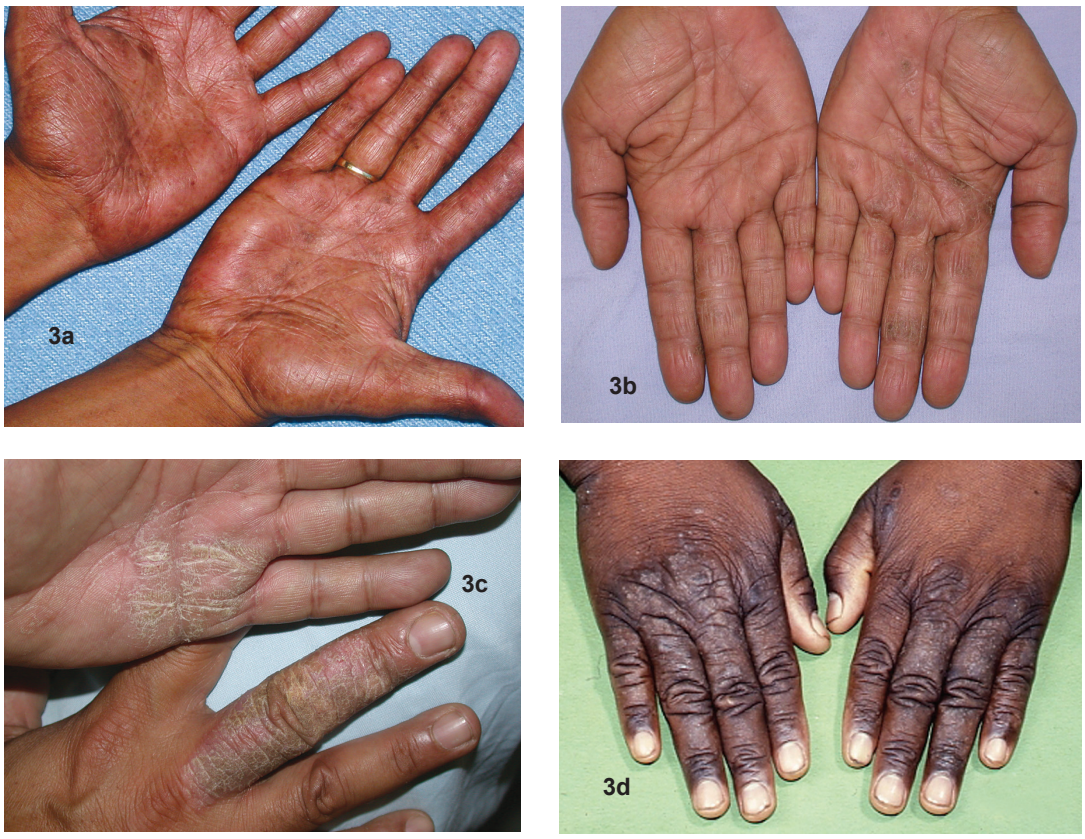

Figure 3. Chronic eczema. a. Dry, scaly, thickened, hyperpigmented skin with increased skin markings (lichenification). b. Dry, scaly, thickened, skin with increased skin markings and mild erythema. c. Focal areas of dry, scaly, thickened, skin with increased skin markings and mild erythema and fissuring. d. Dry, scaly, thickened, markedly pigmented and lichenified skin

had positive reactions to their own agents also had positive reactions to agents on the commercial battery.

Nickel was the most common cause of a positive reaction in both non-occupational and occupational dermatitis. Amongst people with occupational ACD, the next most common reaction was to potassium dichromate. The frequency of positive reactions to specific agents in cases of occupational ACD is seen in Table 3. The agents which caused positive reactions varied by profession. Patients from the healthcare industry had higher frequencies of reactions to thiomersal and carbamix, whereas those patients from the manufacturing and maintenance sectors had more frequent positive reactions to the metals (nickel, chromate and cobalt).

Patients attending the occupational dermatology clinic worked in diverse fields, ranging from agriculture and food and beverage handling, to manufacturing (including pharmaceuticals, clothing, electronics, furniture and more), construction, engineering, healthcare and retail. The industry with the largest representation in the clinic was the healthcare sector, including nurses, allied health professionals and hospital cleaners. For those with a confirmed OSD, the frequency of occupation can be seen in Table 4.

Many of the referrals to the clinic were made by occupational health nurse practitioners or occupational medicine practitioners based in the workplace. There were also high numbers of patients referred from the general dermatology

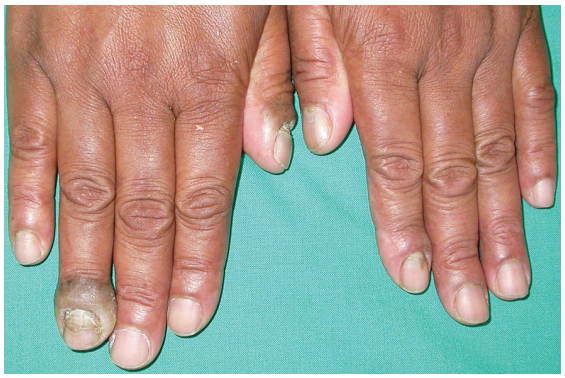

Figure 4. Swollen nail folds with associated loss of cuticle of the affected nail and nail dystrophy. On the right hand (fingers 1 and 4) the skin of the nail fold is pigmented and lichenified suggesting a chronic problem. On the left hand (finger 2) the skin is erythematous supporting a more recent inflammatory process

outpatients department and other outpatients departments at Groote Schuur Hospital, such as the neurology, respiratory and occupational medicine clinics. The remainder of the referrals came from private general practitioners and dermatologists, with very few from secondary hospitals in Cape Town. Table 5 provides a list of the facilities from which patients were referred.

Table 1. Breakdown of occupational skin diseases seen at the Occupational Dermatology Clinic in 2008 and 2009 (n=31)

Diagnosis	Frequency	Percentage
Allergic contact dermatitis	21	68
Irritant contact dermatitis	4	13
Paronychia	3	10
Urticaria	1	3
Leukoderma	1	3
Angioedema	1	3
Mercury toxicity	1	3
Total	32*	103

*One case had paronychia and allergic contact dermatitis.

Table 2. Primary Site of occupational dermatitis (n=25)

Site	Frequency	Percentage
Hands only	16	64
Hands and forearms	3	12
Hands and feet	2	8
Hands and face	1	4
Hands, face and forearms	1	4
Forearms only	1	4
Feet only	1	4
Total	25	100

"... 81% of the patients with OSD had either irritant or allergic contact dermatitis."

Table 3. Numbers of positive reactions to patch testing with commercial allergens in cases of occupational ACD during 2008 and 2009 (n= 42)

Agent	Number of positive reactions
Nickel	8
Potassium dichromate	5
Colophony	4
Thiuram mix	4
Carbamix	3
Cobalt	3
Formaldehyde	3
Thiomersal	3
Quaternium 15	2
Fragrance mix	2
Benzocaine	1
Epoxy	1
Fentichlor	1
Mercaptomix	1
Vioform	1
Total	42

Table 4. Frequency of occupation amongst patients with confirmed occupational skin disease (n=31)

Occupation	Frequency	Percentage
Healthcare	7	23
Manufacturing	5	16
Maintenance	5	16
Agriculture	4	13
Food production	4	13
Laboratory	2	6
Construction	1	3
Explosives	1	3
Hairdressing	1	3
Retail	1	3
Total	31	99

Table 5. List of health facilities from which all new patients seen in the Occupational Dermatology clinic were referred in 2008 and 2009 (n=59)

Health facility	Frequency	Percentage
OHNP/OMP in workplace	23	39
Dermatology OPD at Groote Schuur	13	22
Private dermatologist	7	12
Other department at Groote Schuur	6	10
Private general practitioner	4	7
Secondary hospital	1	2
Primary care facility	1	2
Unknown	4	7
Total	59	100

OHNP – Occupational health nurse practitioner
OMP – Occupational medicine practitioner

Discussion

Overall, our results are in accordance with previous reports which show that contact dermatitis is the most common type of OSD.[1,8,10-13] In our clinic, 81% of the patients with OSD had either irritant or allergic contact dermatitis. There is conflicting evidence in the literature with some writers reporting a predominance of irritant contact dermatitis,[10-13] and some reporting more ACD[5,14] in OSD. In our clinic, ACD was far more common than irritant contact dermatitis. This may be due to the fact that we are a tertiary referral clinic, and that irritant dermatitis is diagnosed and managed in the primary care setting without a need for referral. As in other studies[8,14,15], the most common primary site of both ACD and ICD was the hands as this is the usual site of exposure during work.

Although several cases of chronic urticaria were referred to the clinic, only one had a confirmed occupational exposure causing the urticaria. In most of the other cases, the patient was not followed-up for a sufficient length of time to obtain adequate information about exposures, so no definitive cause was found. In other reports,[8] urticaria is a common cause of OSD. We could, therefore, assume that some of those lost to follow-up had occupational factors playing a role in the development of the skin condition. We would need to record exposures for each patient more formally in order to make definitive diagnoses.

Patch testing was performed on 38 patients with dermatitis. In the 21 patients eventually diagnosed with

occupational ACD, only one had a negative patch test, and the remainder had one or more reactions resulting in 42 positive reactions. Just two patients (10%) were diagnosed with ACD on the basis of the additional specific agents obtained in their workplace (metal grinding soap and a metal coolant), and would have been missed if the extra agents had not been used. Thus, it appears that the commonly available patch tests would allow for diagnosis of most of the cases of ACD, and should be sufficient for a clinic that is not dedicated to occupational health.

Interestingly, the four cases of occupational ICD all had positive reactions on their patch tests. However, they were due to nickel or fragrance mix which are ubiquitous in the environment and not limited to a workplace. The result was not thought to be contributing to their clinical presentation.

The most common allergen to which patients reacted on patch testing was nickel, but potassium dichromate was the most common occupational allergen. The patients who reacted to potassium dichromate all had exposures to substances which are known to contain chromium e.g. cement and leather, and worked in construction or maintenance. Both the frequency of positive tests and the associated occupations are consistent with reports in the literature which report high levels of chromate sensitisation in general, and particularly in the construction industry.[9,10] Nurses have previously been reported to be over-represented in occupational patch test clinics which found high levels of sensitisation to agents in rubber.[15] This is in agreement with our results where healthcare was the most frequently represented occupation amongst those with OSD and healthcare workers were most likely to be sensitised to carbamix and thiomersal.

Limitations

There are several limitations to our study. It was a retrospective record review, and not all records were complete. The clinic does not use a formal data capture form (as at the NIOH[8]), so the reviewer had to rely on what individual doctors had recorded in the notes. It may be that investigations were performed but not recorded, so the number of patch tests and workplace visits may be underestimated. There was a large loss-to-follow-up (20%), so we are probably underestimating the frequency of occupational contact dermatitis. The patients whose diagnoses were unclear at their last visit (before loss-to-follow-up) came from many different industries (including healthcare, manufacturing and maintenance), so there is not likely to be selection bias.

We have a large proportion of referrals from the retail industry due to a close relationship with a large retailer. We have very low levels of referral from other sectors of industry such as the construction industry. Therefore, our results cannot be taken to represent the frequency of ACD or ICD in the general population.

Conclusion and recommendations

The study showed that contact dermatitis was the most common OSD. The hands were the site usually affected, and patch testing with a commercial battery showed that potassium dichromate was the most common occupational allergen. The healthcare and manufacturing sectors were the occupations most frequently represented amongst patients with OSD. The majority of the referrals to the clinic came from industry clinics, with very low levels of referral from the state sector outside of Groote Schuur.

In future, a formal data capturing form should be developed to ensure more complete information about exposures and diagnoses. It would also be interesting to contact all the patients seen (including those lost to follow-up) to research the consequences of their skin disease, especially given recent South African articles which suggest that the number of cases receiving compensation is low.[16]

Lessons learned

1. Contact dermatitis was the most common type of OSD, and allergic contact dermatitis was far more common than irritant contact dermatitis.
2. The most common primary site of both ACD and ICD was the hands as this is the usual site of exposure during work.
3. The most common allergens were nickel and chromate.
4. Healthcare, manufacturing and maintenance were the jobs most commonly associated with OSD.

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Exciting international occupational health congresses on home soil

Recent contact with presenters and delegates from African countries and overseas has rekindled the excitement of putting together an interesting international congress. Many readers will remember the 4th Pan African Conference on Occupational Health (PACOH) held in Durban in September 1997 and the more recent International Commission on Occupational Health (ICOH) Congress in Cape Town in March 2009.

4th PACOH Conference 1997

This Conference was presented under the banner of the Africa Regional Association of Occupational Health by SASOM and SASOHN. In his opening address the then Minister of Labour, Mr Tito Mboweni, stated that "the health of a nation, particularly the health of its workforce, is crucial for economic development and therefore should be provided for when economic activities are engaged in." He added that we all, as role players in the working environment, have a responsibility in terms of the Constitution, to provide for the right of every person to a healthy environment and a safe workplace.

The theme of the PACOH Conference was 'Occupational Health Challenges for Africa' and the topics for the eight sessions included: Occupational disease management, ergonomics, research in Africa, occupational environment and risk, health and safety in agriculture, the vulnerable worker, occupational health and primary health care and, finally, lung diseases. Excellent papers were presented, most of which showcased South African expertise, while 12 were by international presenters. After two full days of presentations the 285 delegates were divided into groups on the third afternoon to visit different industries in Durban and this exposure to workplaces was highly appreciated by all.

ICOH2009 Congress

SASOM played the major role in organising this Congress with support from the MMPA, NIOH, SASOHN and SASTM. The ICOH2009 Congress theme was 'Occupational Health: A basic right at work – An asset to Society' and the nearly 1300 delegates chose to attend many of the 15 keynote addresses, 96 special session papers and 430 oral presentations and studied 446 posters of which 84 were by South African specialists. Many of the delegates were also presenters and interesting discussions were overheard in corridors and at refreshment breaks. Forty-four business meetings of ICOH scientific committees and partners were held at the end of each day's proceedings during the course of the five days. One such meeting was of 42 representatives from African countries who agreed that the revival of the Africa Regional Association of Occupational Health was vital for the upliftment of occupational health services in Africa.

ARAOH revival

The revival was fanned when ten of those who were at the meeting in 2009, attended the SASOM Annual Congress in July 2010 and also a special meeting where Dr Kader Toure and Dr Khalifa Cisse from Senegal, Mrs Uche Ojomo from Nigeria and Dr Musa Nyandusi from Kenya committed to serving on the interim ARAOH board. The decision to hold an international Congress in 2011 was taken and SASOM offered to arrange the Congress and to update the ARAOH Constitution and have it translated into French for members of francophone countries.

ARAOH/SASOM Congress 2011

A search for the best venue for this congress led us back to Johannesburg as flights are less costly from any African country to Johannesburg than those between countries. So the ARAOH Congress, under the auspices of SASOM, will take place from 25–27 August 2011 at the Birchwood Hotel in Boksburg, which is only 7 kilometres from the Oliver Tambo International Airport and provides a free shuttle service for residents.

The congress theme is 'Occupational health: Care for the Occupational Health Needs of the Worker – Biological, Physical and Psychological'. It allows for the widest range of occupational health presentations – both oral and poster. The programme will be adjusted to include abstracts from interested persons in sessions for special interest groups such as ARAOH, ICOH, Mine Medical Professionals Association, National Institute of Occupational Health, Occupational Therapy Association of South Africa, South African Institute of Occupational Hygiene, South African Society of Occupational Health Nursing Practitioners, SASOM, South African Speech and Hearing Association, South African Society of Travel Medicine, National Council for Persons with Physical Disabilities, the Chiropractic Association of South Africa and many more.

To date, SASOM has had a great response from international presenters and delegates and very interesting abstracts have been received. We are hoping for many abstracts from local presenters before the closing date of 30 June 2011. The abstracts will be evaluated and categorised according to the affiliation of the sender or the topic and a final programme will be available in July 2011.

Registration and abstract forms are available on the SASOM website – www.sasom.org. You may also call the SASOM National Office on +27 (0)12 803 7418 or e-mail at info@sasom.org for more information.

Jenny Acutt
SASOM Project Coordinator

SASOHN Academic Day – 2011

Snoring, shortness of breath, coughing and heavy breathing were the order of the day at the 6th SASOHN Academic Day. Fortunately these were not symptoms experienced by the attending delegates but they formed the basis for the theme of the workshop "Managing Occupational Respiratory Dilemmas". The academic programme kicked off with a presentation on the development of SANS 451 by Karen Michell. The presentation concentrated on the fact that obstructive and restrictive lung diseases cause more ill health than accidents and fatalities together in the mining industry. A key problem is the under-diagnosis and poor reporting of respiratory diseases. A starting point in addressing the concerns of poor quality spirometry testing is SANS 451 and if practitioners comply they will produce valid results which in turn will determine the presence of ill health and better employee health monitoring.

Lindsay van der Linden presented a step by step interpretation of the spirogram. She stressed the difference between interpretation and diagnosis and that a good quality spirogram can suggest a diagnosis but cannot be used as a standalone tool to diagnose ill health. Other uses for a good test result include identification of an abnormality, classification of the type of abnormality to suggest a restrictive and/or obstructive pattern, and grading of the severity of the defect.

The day continued with information from 3M on the four steps to respiratory protection reminding delegates of the importance of proper selection of respiratory protection. It is not merely a case of purchasing a respirator or mask but more of ensuring the risks are known and the type of protection needed is understood. Incorrect selection may lead to a false sense of security where the employee is still exposed despite the protection provided.

Obstructive sleep apnoea is a condition which causes significant impairment in sufferers, with a huge impact on productivity and activities of daily living. Marietjie Smit from Respiratory Care Africa demystified this subject and discussed treatment modalities as well as the importance and benefits of managing obstructive sleep apnoea in the workplace.

Another hot topic currently is the management of tobacco dependence. Tobacco consumption is the leading cause of premature deaths in the world and Dr Lerato Rabanye from Pfizer highlighted the barriers to and the manangement of smoking cessation.

Prof. Jill Murray from the NIOH discussed the identification of respiratory diseases in the clinical setting and the benefit and value of early detection. She used lung cancer, silicosis and tuberculosis to illustrate the merits of early detection.

TB in healthcare workers is a subject that is not often highlighted and the academic day ended with an informative presentation on this subject by Dr Muzimkhulu Zungu, also from NIOH. The day was made even more special by the fact that it was International Nurses' Day which was enjoyed by all. SASOHN would like to thank all our speakers and sponsors for making this day possible. We hope the information shared empowered members to confidently deal with respiratory dilemmas in the workplace.

Sonja Kruger
SASOHN Education Representative

NDoH National Nursing Summit

The National Department of Health (NDoH) recently hosted a National Nursing Summit which resulted in the Nursing Compact shown below. It represents a collective call for greater attention, investment and integrated action to build capacity, professionalism and commitment within the nursing workforce in relation to teaching, service delivery, research, leadership, governance, and mentoring of the next generation of nurses. More than 2000 nurses from across different levels of service, districts and provinces, and contexts contributed to the compact, including SASOHN President Karen Michell. President Zuma opened the summit and in closing it Dr Motsoaledi, the Minister of Health accepted the Nursing Compact on behalf of the Government.

NURSING COMPACT
NATIONAL NURSING SUMMIT – APRIL 2011

We, the nurses of South Africa, supported by our stakeholders, gathered in the Sandton Convention Centre from the 5th – 7th of April 2011 for the National Nursing Summit on Reconstructing and Revitalising the nursing profession for a long and healthy life for all South Africans;

Guided by the Government's vision as contained in the Negotiated Service Delivery Agreement (NSDA) as well as the four strategic outputs therein; and

Rights as enshrined in the Constitution of the country;

Taking note of the president's challenge to nurses in his keynote address;

Taking note of the agreed ten-point plan;

Recalling the National Nursing Summit held in 1999;

Recalling the National Nursing Strategy;

Recognising the skills and experience brought by retired nurses;

Deeply concerned at the lack of progress in addressing the quadruple burden of disease and that South Africa will not be able to meet internationally agreed goals including the Millennium Development Goals if the current state of affairs

is maintained, in particular to reduce maternal mortality, to reduce child mortality and to combat HIV, AIDS and TB;

Concerned at the declining life expectancy;

Disturbed about the decline in quality of care;

Taking note of inadequate health system effectiveness;

Deeply concerned about the negative image and social position of nurses in the community; and

Recognising that nurses, as the engine of an effective health system, play a pivotal role in service delivery;

We hereby declare as follows:

We reaffirm that the reengineering of the health care system must drive the refocusing of service delivery and developments in the nursing profession, particularly the development of a District Health System (DHS) based on the following three streams of PHC:

Multi-disciplinary teams of clinically competent professionals in which nurses play a critical role;

Community ward based multi-disciplinary health teams with nurses playing a critical role; and

The effective implementation of national school-based PHC system led by nurses.

We urge the NDoH to establish a task team that will develop and implement a comprehensive national policy on nursing education and training which examines the new Nursing Qualifications' Framework and which addresses among other things: student status, funding models, the positioning of public and private nursing education, norms and standards for nursing, and specialised skills.

Noting that nursing and midwifery practice must inform nursing education, we urge SANC to finalise and promulgate the scope of practice regulations for nurses (basic and post-basic). We urge government to declare nursing education a national competency. We call on the Minister of Health to facilitate the declaration of public nursing colleges as Higher Education Institutions.

We call upon SANC in collaboration with NDoH, Council of Higher Education and SAQA to fast-track the processing and implementation of the new Nursing Qualifications' Framework and appropriate transitional arrangements.

We urge the nursing education institutions to strengthen the implementation of Recognition of Prior Learning for access and entry into nursing training programmes in line with national policy and SANC guidelines. Reiterating the commitment to produce clinically competent nurses we: Call on SANC, after consultation with relevant nursing stakeholders, to develop core national standards for curricula that respond to national population health and health system needs;

Urge the NDoH with relevant stakeholders to cost and evaluate an appropriate clinical training model and for SANC to regulate for its implementation; and

Call on the NDoH to increase investment in nursing education.

Call on the NDoH to develop, implement and allocate adequate resources for a national nursing educator and nurse manager development programme. We urge the NDoH to urgently review the occupation specific dispensation (OSD) and other financial incentives for all categories of nurses, and to ensure the alignment of nurses' remuneration with other health professionals in the health care team.

We urge the NDoH urgently to establish dedicated structures with executive decision-making powers to deal with nursing issues at the national, provincial and district levels. We call on government to prioritise the creation of a conducive environment for student learning, including: Recognising the overwhelming support for a stipend paid through PERSAL, we urge the NDoH to standardise and implement financial assistance for nursing students;

A standardised national model for student funding; and

Appropriate accommodation, transport and learning materials for students. Recognising the overwhelming support for a standardised white uniform, we call on the government and private employers to issue nurses with complete outfits. We support the establishment of the office of standards compliance.

Noting with concern the shocking state of some of the nursing education institutions and clinical facilities, we urge the NDoH to give urgent attention to the revitalisation of these education and training institutions including accommodation for students and nurses, and non-infrastructure related requirements in support of training of nurses. We urge the NDoH to develop staffing norms, and to fund and fill vacant nursing posts. We note the negative impact of strikes on the provision of essential services and the health of the community and therefore urge employers and organised labour to urgently conclude the matter. We call upon all categories of nurses to commit to the nurses' pledge and the rights and provisions of the South African Constitution and international treaties.

We call on the Nursing Summit organizing committee to develop a Strategic Plan for nursing, taking into account the national Nursing Strategy and the detailed inputs of the commissions at the Summit. We urge the NDoH to ensure implementation of the strategic plan, a biennial review, and ongoing monitoring and evaluation. Recognising the need for a positive practice environment for nurses, we urge employers to ensure implementation of ICN guidelines as well as the provision of appropriate ICT support.

We urge government, the private sector, professional associations and labour unions to ensure the development of nurse leaders able to lead and implement change. We urge government and the private sector to develop and implement policy for succession planning, career progression and access to continuing learning for all categories of nurses. Recognising the negative health system consequences of moonlighting, we urge the NDoH and the private sector to implement measures to manage moonlighting. We urge the NDoH to develop regulations for the control of nursing agencies in South Africa.

Nursing Education Association
Available at: http://www.fundisaforum.org/new.htm

Upcoming events

INTERNATIONAL CONFERENCES

Date	Place	Topic	More information
9 – 12 Aug 2011	Boston, Massachusetts, USA	5th International Conference on Nanotechnology Occupational and Environmental Health.	www.uml.edu/nano/nanoehs/Contact_Us.html
25 – 27 Aug 2011	Birchwood Hotel, Boksburg, South Africa	African Regional Association of Occupational Health (ARAOH) SASOM Congress. Occupational health: Care for the biological, physical and psychological needs of the worker.	Jenny Acutt SASOM National Office Tel: +27 (0)12 803 7418 Fax: +27 (0)11 507 5085 E-mail: info@sasom.org
11 – 15 Sept 2011	Istanbul, Turkey	XIX World Congress on Safety and Health at Work – Building a culture of prevention for a healthy and safe future.	E-mail: info@safety2011turkey.org
21 – 23 Sept 2011	Hansaari Cultural Centre, Espoo, Finland	4th Int Conf on Unemployment, Job Insecurity and Health.	www.ttl.fi/forum2011
18 – 21 Oct 2011	Ghana College of Physicians and Surgeons, Ridge, Accra, Ghana	ICOH Int. Conf. on Small and Medium Scale Enterprises – Learning From Good Practices in Small Workplaces.	E-mail: ochealth@ghsmail.org
18 – 24 Mar 2012	Cancun, Mexico	30th ICOH Congress – Occupational Health For All: From research to practice.	E-mail: admin@icohcongress2012.org www.icohcongress2012.org

LOCAL CONFERENCES

Date	Topic	Region	Target	Cost	ContactName
25 Nov 2011	Academic day and SASOM AGM	Western Cape	All OH&S practitioners	To be announced	Jenny Acutt Tel/Fax: +27 (0)12 803 7418 E-mail: info@sasom.org

2011 SAIOH COUNCIL AND CERTIFICATION BOARD MEETINGS AND EXAMINATION DATES

1 July	07h00	OHPC/Oral
5 August	07h00	Council/Written
7 October	07h00	OHPC/Oral

HEALTH AWARENESS DAYS, WEEKS AND MONTHS

JUNE
National Youth Month
Men's Health Month
National Blood Donor Month

Day	Topic
1	International Children's Day
4	International Day of Innocent Children – Victims of Aggression
5	International Cancer Survivors Day
5	World Environment Day
14	World Blood Donor Day
15	World Elder Abuse Awareness Day
16	Youth Day
20–26	National Epilepsy Week
21	National Epilepsy Day
20–24	National Youth Health Indaba
20–26	SANCA Drug Awareness Week
26	International Day Against Drug Abuse and Illicit Drug Trafficking

JULY
Mental Illness Awareness Month

Day	Topic
11	World Population Day

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