

# Eradicating preventable blindness – Vision 2020

**P**reventable causes of blindness are a worldwide issue. Blindness impacts on the individual's ability to work and they require a significant amount of help. On a national level, these diseases increase healthcare costs and have a negative effect on the economy. Current estimates suggest that there are 167 million people with visual impairment worldwide.<sup>1</sup> Of this group, 45 million are blind – defined as visual acuity of less than 3/60 in the best eye with best possible correction. Blindness in the developing world is 10 times higher than the developed world.<sup>2</sup>

The World Health Organisation (WHO) has developed an initiative called Vision 2020, with the aim of eliminating preventable blindness by 2020. This involves more than 20 organisations worldwide. The aim of Vision 2020 is to affect this change through seven major diseases. These are cataracts, trachoma, onchocerciasis, causes of childhood blindness, causes of refractive error and low vision, diabetic retinopathy and glaucoma.

This article will focus principally on the Vision 2020 diseases and strategies to prevent blindness. It will cover the diseases that are less familiar to optometrists in the UK in more detail.

## CATARACTS

Cataract formation is a major problem in trying to prevent treatable blindness. Of 45 million blind people worldwide, 20 million people have cataracts. The commonest cause is old age. The aim of Vision 2020 is to prevent cataract formation and treat those that occur. Cataracts are predominant in the older generations; in the next 20 years it is estimated that the number of people over the age of 65 will double.<sup>3</sup>

Recent evidence from the UK suggests that half of nuclear and two-thirds of cortical cataracts have a genetic predisposition. This presents a difficulty in attempting to minimise cataract formation.

There are, however, risk factors that can be minimised. Cataracts increase with age; because of the summary exposure to different causative effects. These risk factors include UV-B light, alcohol, radiation, patients with diabetes mellitus, obesity (in posterior sub-capsular

Dr Iain Phillips looks at the diseases Vision 2020 aims to eradicate and strategies the WHO initiative is adopting to prevent blindness



The Onchocerciasis Control Programme in West Africa has been very successful at controlling disease spread by parasites

cataracts), corticosteroids and nicotine. Severe diarrhoea and dehydration have a subtle association with cataract formation.

At present, surgery remains the only option to treat cataracts. There are no pharmacological agents that will either cure or slow cataract formation. Some research has suggested that antioxidants (particularly vitamins A, C and E) could have a role in slowing cataract formation.

In the developing world, access to surgery is limited, it is therefore important to decide who needs surgery. Such a decision will depend on several factors. These include the level of disability that prevents the individual from living a normal life, are they able to work or fulfil their role in their family and at what level is society prepared to support a visually impaired individual. These decisions will depend on the availability of surgery.

Recent research in Australia suggests that by using visual acuity as the discriminating factor in deciding who gets surgery, the number of people requiring surgery increases 2.5 times when the threshold is moved from 6/60 or less, to 6/24 or less.

The best prognosis without surgery

is to avoid UV-B light and stop smoking. This would lead to a 14 per cent 'combined population risk' attributable to these two risk factors. The effect would be to delay onset by 10 years, from an average age of 70 to 80 years old.<sup>3</sup>

## TRACHOMA

Trachoma is a chronic repetitive bacterial infection of the eye caused by *Chlamydia trachomatis*. It is the leading cause of infective blindness worldwide, it affects 500 million people world and 5.9 million people are blind due to the effects of trachoma.<sup>4</sup> A quarter of those affected over 60 will be blind. It is mainly found in Africa, the Indian sub-continent, the Middle East and South East Asia.<sup>5</sup>

Infection leads to the development of follicles and red spots (papilla) on the conjunctiva. In the presence of follicles, the number of papillae relates to the severity of infection. Other features of active infection can include the presence of punctate keratitis, inflammatory infiltrates and, as chronic infection develops, corneal opacification. ▶

Chronic signs of infection include the presence of resolved follicles called Herbert's pits and patches of scar tissue which coalesce and distort conjunctival anatomy. Scarring distorts the alignment of meibomian glands and pulls the margin of the eyelid in causing entropion and trichiasis. The intumed eyelashes irritate and then scar the cornea.

The most important risk factor that leads to loss of vision is repetitive infection. The disease can be spread within the same individual, from infected to non-infected tissue, through sexual intercourse, during passage through the birth canal during delivery, through fomites (inanimate objects) including towels, clothes and flies which feed on the exudates produced in the secretions of the infection. The presence of these risk factors makes the cycle of re-infection more likely. Treatment strategy is through a WHO scheme called SAFE (Surgery for trichiasis, Antibiotic provision, Facial cleanliness and Environmental improvement).<sup>6</sup>

Effective treatment of trachoma is available through the use of single-dose azithromycin. In hyper-endemic regions, bi-annual treatment controls the infection.<sup>7</sup> Surgery to resolve trichiasis is a simple procedure. However, as the disease is mainly present in the developing world, surgical resources are scarce. As with cataract surgery, it is important to decide who gets surgery according to who will benefit the most.

## ONCHOCERCIASIS

Onchocerciasis is a parasitic helminth (worm) disease spread by black fly of the *Simulium* species. The infected insect bites the human host, transmitting the larvae. Over the next 18 months they develop into adult helminths. The symptoms and signs of the disease are due to the deaths of the immunogenic larvae.

The disease manifests itself in the skin and eyes. Onchocerciasis causes pruritus and significant chronic skin changes including thickened (lichenified) hyperkeratotic lesions and pigmentation change either darker (Sowda) or lighter (leopard skin). Skin loses its elasticity due to a chronic papular dermatitis, which destroys the sub-cutaneous elastic tissue.<sup>8</sup>

Onchocerciasis causes vision loss. The larvae penetrate the cornea and as they die they induce a punctate keratitis. This process precipitates sclerosing keratitis, causing haziness at the medial and lateral corneal margins. New blood vessels form. These changes induce corneal opacity. The larvae can penetrate into the posterior compartment, causing choroidoretinal lesions and in some cases optic neuritis.

The drug of choice to treat onchocerciasis is Ivermectin. This is only efficacious against the larvae, not the adult worm. This means it reduces pathological effects of the disease, but has to be given annually for the life of the adult worm, which can be 15-20 years. The Onchocerciasis Control Programme in West Africa has been very successful at controlling the disease and preventing blindness.<sup>9</sup>

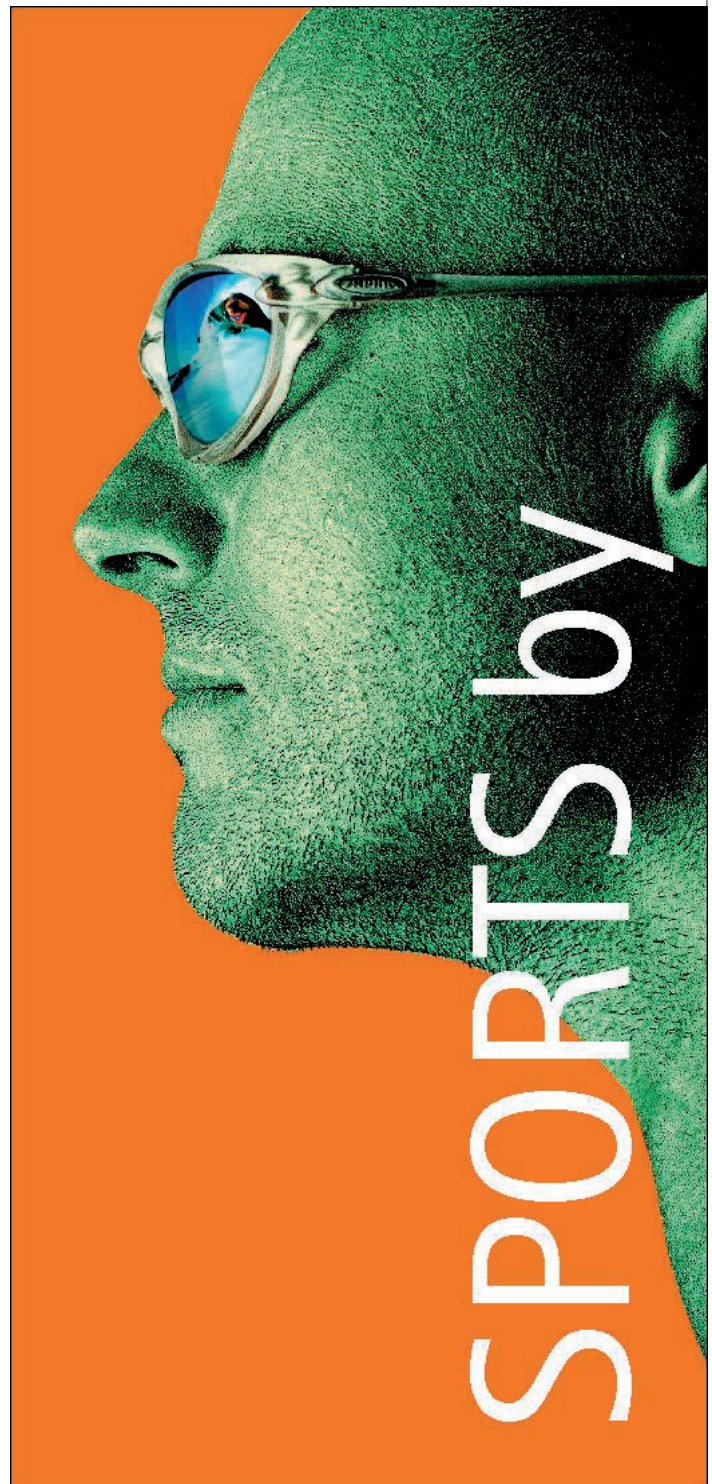
## CHILDHOOD BLINDNESS

This term relates to conditions that cause visual impairment and blindness in children and adolescents. These conditions, while treatable in early life, are untreatable as the disease progresses. These causes are divided according to the socio-economic background of the child, the country they live in and the level of health services available.<sup>10</sup>

In children from poor socioeconomic groups with poor health provision the common causes of visual impairment include corneal scarring from measles, vitamin A deficiency, harmful traditional eye remedies, *ophthalmia neonatorum* and congenital causes, particularly rubella. In countries with a higher standard of living such as the UK, the most common cause of blindness and visual impairment includes optic nerve lesions and abnormalities of the higher visual pathways.

In the developed world, children are vaccinated against ►

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measles and rubella, have ready access to good, safe medical care and are well nourished, avoiding vitamin deficiencies. Their improved general state of health reduces the severity of infections. These children also avoid the growing epidemic of HIV and AIDS.

The level of blindness in children is associated with the level of child mortality and inversely proportional to the level of socioeconomic development. In countries with a low income and high infant mortality, childhood blindness is approximately 1.5 per 1,000 children. In high income countries with a low infant mortality rate, prevalence is 0.3 per 1,000 children. This means that there are approximately 1.4 million blind children worldwide. Of this population, three quarters live in the poorest parts of Africa and Asia.

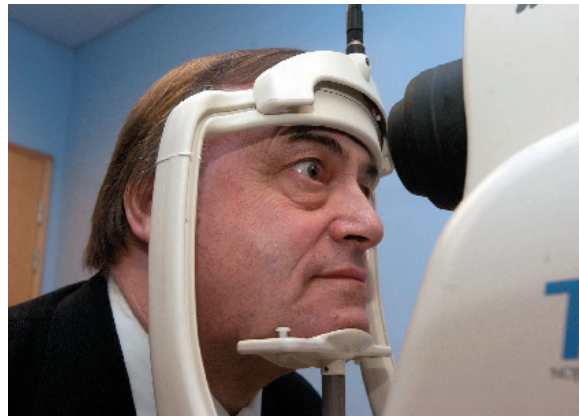
Measles is a viral illness, commonly seen in developing countries. It is rare in the developed world, due to the presence of an effective vaccine. In healthy well-nourished children measles is usually a self-limiting infection. Complications are more likely in those who are malnourished and particularly vitamin A-deficient. The ocular complications of measles and vitamin A deficiency can lead to blindness.<sup>11</sup> Measles can cause a secondary corneal ulceration, leading to secondary infection, followed by corneal scarring and visual loss.

*Ophthalmia neonatorum* occurs in babies born to mothers infected with gonorrhoea. The eyes are coated with the infective gram-negative diplococci (pairs of round gonococci bacteria) as they pass through the birth canal. The disease presents as a purulent discharge with associated peri-orbital oedema in the first few days after delivery. This disease can progress to blindness if left untreated.

Rubella (German measles) is a mild self-limiting viral infection. However, if caught by an unvaccinated pregnant woman, it can infect the foetus. Congenital rubella infection can cause cataracts (unilateral or bilateral), micro-ophthalmia, glaucoma and pigmentary retinopathy.<sup>12</sup>

Vitamin A deficiency is usually seen in developing countries, in the developed world it is considered as a complication of inadequate supplementation compounded by fat malabsorption. Vitamin A deficiency causes blindness.

HIV-positive children can develop a range of ocular problems due to the



Regular fundoscopy can be achieved through annual diabetic checks

immunosuppressive effects of the virus.<sup>13</sup> They can develop HIV-related retinopathy, cytomegalovirus, maculopathy and ocular syphilis and tuberculosis. Some of the drugs cause ocular side effects.

Of the congenital causes of loss of vision or blindness that occur in the developed world, 50 per cent are thought to have a genetic aetiology. Few cases can be successfully treated.

However, support is available. Services include access to Braille teaching, rehabilitation, low vision aids and special schooling. These facilities are tailored to the needs of the child.

Preventing blindness in children can be achieved through infectious disease prevention. Vaccines are available for measles and rubella, women can be screened for gonorrhoea and immunity to rubella, and vertical transmission of HIV can be prevented with anti-retroviral drugs.

### REFRACTIVE ERROR AND LOW VISION

The definition includes myopia and hyperopia with or without astigmatism. The WHO definition is less than 6/18 and equal to or better than 3/60 with the better eye and the best correction available.

There are thought to be a large population worldwide who have uncorrected refractive errors. This has a large impact on economic development and the quality of life of an individual.

Severe refractive errors account for approximately 5 million blind people worldwide. These refractive errors can be best treated with appropriate optical correction. Those with low vision require access to low vision aids. These steps will

improve the sufferer's quality of life.

To achieve this it is necessary to provide these services and aids worldwide at an affordable cost. In children, correcting the refractive error prevents childhood amblyopia. With the correct facilities, children with low vision could move to mainstream schools from schools for the blind.

### DIABETIC RETINOPATHY

Diabetic retinopathy is a relatively common condition in the UK. It is one of the few diseases within the Vision 2020 programme that is likely to increase in prevalence as socio-economic conditions improve. It is important both to treat and prevent.

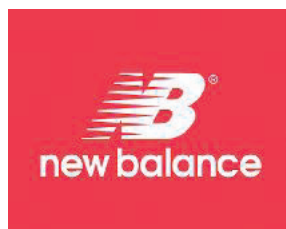
Prevention comes with preventing type 2 diabetes mellitus in patients, through lifestyle choices including a low refined carbohydrate diet and regular exercise.

Diabetic retinopathy lends itself to screening and because it is sight-threatening there is a well-defined population at risk, early treatment gives a favourable outcome and the screening test is simple. Regular fundoscopy can be achieved through annual diabetic checks.

### GLAUCOMA

Controlling glaucoma is difficult because the nature of the disease is poorly understood. Diagnosing it is more complex when compared to other eye diseases in the Vision 2020 programme. Assessing visual fields, intraocular pressure or the optic disc, are not sensitive and do not indicate the future severity of the condition.

At the moment, all three tests have to be used in combination. Treatment to



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reduce the intraocular pressure does not necessarily preserve the visual fields for longer in chronic glaucoma.

## OTHER CAUSES OF LOSS OF VISION

The WHO is concentrating its efforts on the seven major causes of preventable blindness worldwide, the reason for this is that these diseases are the major causes of preventable blindness and effective treatment exist.

## PLANNING FOR THE FUTURE

In the developing world there is a shortage of ophthalmologists, trained support staff, equipment and medication.

In Germany there is one ophthalmologist for 20,000 people, in Ethiopia one for 2,000,000 people. Expatriate doctors have some impact on eye health, but are not in sufficient numbers to overcome the level of poverty and the sheer scale of eye pathology in the developing world.

It has been argued that to combat blindness in the developing world, effective organisation is as important as extra resources. The prevalence of different diseases can vary significantly, even within the same country, affecting the type of health provision that is required.<sup>14</sup>

In an attempt to better combat preventable causes of sight loss, simple strategies are being used. Ophthalmic assistants are healthcare professionals (usually nurses and paramedics) that receive a year of extra training. As 42 per cent of blindness worldwide is due to cataracts, it is possible to train staff that specifically operate on cataracts.

In Africa, ophthalmic assistants have been trained to do this; they carry out 100 cataract extractions under supervision, then they work independently. They can also be trained to carry out other simple procedures such as terminal tarsal rotation to alleviate trichiasis in trachoma. These simple procedures are very effective. Cataract surgery restores sight and surgery for trichiasis prevents otherwise inevitable blindness.

Staff are organised into a pyramid of three layers. The first layer are the ophthalmic assistants, who are community-based practitioners. Their main role is in preventing eye disease. They also treat the common simple eye

diseases and refer more complex cases to more specialist staff.

The second layer of the pyramid is the local district hospital, staffed by an ophthalmologist or assistant who can perform surgery. Simple operations for cataracts and trachoma are performed.

The highest level of the pyramid is the tertiary centre. In poor countries there will be only one or two centres, if there are any. Their main aim is teaching and treating the more complex cases, including surgery for diabetic retinopathy, corneal transplants and cataract surgery in children.<sup>15</sup>

The aim of setting up ophthalmology services in this manner is to ensure the maximum number of patients can be seen and that the experts see the complex cases that require their expertise.

Other strategies include manufacturing useful materials locally, including eye drops and spectacles that improve the majority of refractive defects (using only second-hand frames and a hand-edging machine).

Intraocular lenses are now made in Nepal and India, allowing increasing numbers of people to have lens implant surgery. In Kenya, sufficient provision of low vision aids would allow nearly a third of children in blind schools to see well enough to read.<sup>15</sup> In areas with a dense population 'eye camps' have been successful. Specialists and their assistants carry out a large number of simple operations in the community. Their success depends on adequate publicity and the willingness of the population to bring their blind relatives.

Traditional beliefs in many communities see blindness as an incurable handicap, but they do not see themselves as 'ill'. They are usually very dependent on family. Community rehabilitation improves both their families and their own quality of life, as they gain confidence in becoming more independent.

The issues surrounding reducing visual impairment and blindness worldwide are complex. They have only been covered in general terms, however the technology to eradicate preventable blindness is within our grasp. Strategies such as SAFE for trachoma and the Onchocerciasis Control Programme in West Africa have shown that organised prevention campaigns can be successful if the funding and infrastructure is available.

What is needed is effective organisa-

tion of a larger reservoir of resources to prevent and treat these illnesses.

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