

# Diabetes eye health

A guide for health  
professionals



**The Fred Hollows  
Foundation**



**International  
Diabetes  
Federation**

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# Diabetes eye health

Diabetic retinopathy affects over one third of all people with diabetes and is the leading cause of vision loss in working-age adults. Globally the prevalence of diabetes is increasing rapidly and without effective action, so too will the number of people with diabetic retinopathy.

The management of diabetes and its complications begins in primary health care and this should include screening for diabetic retinopathy. Those working in primary health care are at the frontline of supporting people with diabetes to understand how to look after their eyes, access eye health exams and to refer those requiring treatment.

The International Diabetes Federation and The Fred Hollows Foundation have entered into a partnership to raise awareness of diabetic retinopathy. An outcome of the partnership has been to support a group of international experts to develop this Guide. We look forward to working with partners to promote the use of the Guide and ultimately to ensure people with diabetes have access to eye health services.

On behalf of our two organisations, we commend *Diabetes eye health: A guide for health professionals*.

**Sir Michael Hirst**

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and

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Screening and photo grading services, Indonesia. Photo: Dwi Ananta, HKI. CC BY-NC 2.0 CEHJ

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# Foreword

Everyone with diabetes is at risk of losing vision. Good control of blood glucose, blood pressure and blood lipids will reduce the annual incidence of eye disease and vision loss and will also prolong life. Timely treatment can prevent almost all vision loss associated with diabetes and so regular eye exams become essential for all those living with diabetes.

Regular eye screening begins with primary health carers. There are only about 200,000 ophthalmologists worldwide and it would be impossible for them to undertake all the screening eye examinations required to detect those at risk of vision loss and in need of treatment. Screening for diabetic eye disease needs to become an integral part of the ongoing primary care of those with diabetes with the establishment of well-defined referral pathways for those needing further care.

This Guide builds on the guidelines developed by the International Council of Ophthalmology (ICO) *Guidelines*

*for Diabetic Eye Care 2014* that set out the need for regular eye care from an ophthalmic perspective. The ICO guidelines stress the need for a team approach to the provision of care. This new Guide extends this approach to highlight what is needed from diabetologists, primary care practitioners and others involved in the care of people with diabetes.

The ICO is delighted to see this collaborative approach to the provision of eye care for those people living with diabetes. We look forward to working with the International Diabetes Federation, The Fred Hollows Foundation, and others in the eye health and diabetes sectors, to promote the use of this Guide and to reduce the amount of blindness and vision loss from diabetes.

**Hugh R. Taylor AC MD**

President

*International Council of Ophthalmology*

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# Executive summary

The purpose of this document is to highlight for health professionals the rising prevalence of diabetic-related eye disease, particularly diabetic retinopathy, and outline the important role and actions they can take to address it.

As the incidence of diabetes increases worldwide, so does the incidence of its complications including diabetic eye disease. All patients with diabetes are at risk of developing diabetic retinopathy. Diabetic retinopathy is the only eye condition caused by diabetes; however diabetes may exacerbate other eye conditions such as cataract, glaucoma, loss of focussing ability, and double vision.

Diabetic retinopathy can cause blindness, yet in most cases blindness is largely avoidable. The condition is often asymptomatic in its early stages and regular eye examinations are the only way to determine the condition of the retina and take the appropriate action. Careful management of diabetes and early eye disease detection can help slow costly and debilitating visual impairment and blindness. Maintaining good vision requires optimising systemic factors (like blood glucose, blood pressure and blood lipid control), regular eye checks and timely referral for treatment.

Primary health practitioners play a crucial role in all stages of managing good eye health by facilitating early diagnosis and timely management of diabetic eye disease. Many people with diabetes—as well as many health professionals—are unaware of the critical need to undergo regular eye examinations. Primary health professionals, through their routine care

of people with diabetes, are most likely to have the opportunity to screen, educate and support management of diabetic eye disease. They can also facilitate timely referral to eye specialist services for treatment to reduce sight loss. More specialised eye health practitioners also have an important role however, as a relatively limited resource, they should focus on treatment rather than examination.

Key actions by health professionals in managing eye health in people with diabetes include:

- Optimising control of blood glucose, blood pressure and blood lipids in order to slow down the progression of diabetic retinopathy
- Ensuring that the person with diabetes has regular eye exams and timely treatment when required
- Educating and supporting the person with diabetes in managing their eye health and their diabetes

Effective strategies in managing diabetes to reduce or stabilise vision loss are through a combination of four key strategies: social support, nutritional support, medication, and medical examinations and treatment. The decision to undergo treatment should be made in cooperation between the person with diabetes and the health professional<sup>1</sup>.

If diabetic retinopathy has been detected, referral to an ophthalmologist for timely treatment with laser photocoagulation and/or intravitreal injections can prevent vision loss, stabilise vision, and in some cases even improve vision if performed early.

# The purpose and scope of this document

The worldwide rise of diabetes, and its complications, means there is an increasing need for health professionals to consider the possibility of diabetic eye disease even before the symptoms begin to show. Early detection and treatment of diabetic retinopathy can slow the deterioration of sight and reduce the burden of vision loss on individuals, their carers and society. Yet many people with diabetes—as well as many health professionals—are unaware of the critical need to undergo regular eye examinations.

The purpose of this Guide is to highlight for carers and health professionals the rising prevalence of diabetic-related eye disease, particularly diabetic retinopathy, and outline the actions they can take to

address it. By providing information about eye disease as a potential complication of diabetes, this Guide aims to encourage and facilitate early diagnosis and treatment of diabetic eye disease, in particular diabetic retinopathy, as well as to improve care for people with diabetes through encouraging integration and cooperation across the health system.

The primary audience for this document is the broad suite of health professionals and care givers who care for people with diabetes. This list includes primary health practitioners, general practitioners, endocrinologists, ophthalmologists and other eye care practitioners, nurses, diabetes educators and first contact health providers.



Participants in Trinidad, Tobago 'walk for sight' on World Sight Day 2013 Photo: IAPB/VISION 2020. CC BY-NC 2.0 CEHJ

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## What is diabetic eye disease?

Diabetic retinopathy occurs as a direct result of chronic hyperglycaemia causing damage to the retinal capillaries, leading to capillary leakage and capillary blockage. It may lead to loss of vision and eventually blindness. While diabetes may also cause

conditions such as cataract, glaucoma, loss of focussing ability and double vision, there needs to be a focus on diabetic retinopathy given the rapidly rising incidence of this largely avoidable form of vision loss.

## Diabetes is increasing and so is diabetic eye disease

Diabetes is increasing worldwide. As diabetes becomes more prevalent so do associated complications such as diabetic retinopathy. Of 415 million people worldwide living with diabetes in 2015<sup>2</sup>,

over one third will develop some form of diabetic retinopathy in their lifetime. More than 93 million people currently suffer some sort of eye damage from diabetes<sup>3</sup>.

More than **93 million** people  
suffer some sort of **eye damage**



More than **One** in **three** living with diabetes will develop diabetic retinopathy

# Managing diabetes to manage eye health

Managing diabetes goes a long way to managing diabetic retinopathy. People whose diabetes is not well controlled are more likely to develop complications of the disease, including retinopathy.

Diabetes management includes controlling blood pressure, blood glucose and lipid levels, and this can be achieved by encouraging a healthy lifestyle and medication as required. Improved control can slow the progression of eye disease, especially when initiated soon after diabetes is diagnosed.

Achieving and maintaining health-protective changes in behaviour can be difficult. Strategies which are found to be effective are socially and culturally appropriate structured interventions such as supportive group education sessions<sup>4,5</sup>. Increased physical activity, healthful dietary habits and improved understanding of the relationship between food and blood glucose levels can enhance metabolic control<sup>6</sup>.



*It is important to listen to the patient's point of view. Bangladesh. Photo: Lutful Husain. CC BY-NC 2.0 CEHJ*

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# Keeping good eyes – the key players

Management of diabetes and diabetic eye care require integration across the health care system and involve the patient, health professionals and supportive health policies.

## People with diabetes and self-management

People with diabetes need to play an active role in managing their disease to prevent complications affecting their quality of life. By maintaining good glycaemic and blood pressure control, a person with diabetes can prevent complications such as sight-threatening diabetic retinopathy. While effecting and maintaining behavioural change is ultimately up to the person with diabetes, the health professional can play an important role in providing information, tailored strategies and support.

## Health professionals

Different health professionals play an important role in managing diabetes, screening for eye conditions and supporting patients to manage their own health conditions. Management of diabetes and diabetic eye care requires integration across the health care system. In particular, access to more specialised eye health expertise may be limited—even in developed countries, rural areas may be underserved by specialists—and so it is important to consider how to make best use of these resources or alternatives.

**Eye care practitioners** include ophthalmologists and optometrists, who have a role in identifying eye disease and managing people with diabetic retinopathy.

**Primary health practitioners** provide an important opportunity to help to identify diabetes-related eye disease. Many people with diabetes, and health professionals who care for them, are not aware of the critical need to undergo regular eye examinations. These screening examinations should be done annually or at least every two years. Therefore these primary health professionals may have the best opportunity to identify those at risk and provide or facilitate regular screening. They can also initiate discussion of patient concerns, particularly a common fear of permanent loss of vision.

# The financial and social burden of eye disease

Management of diabetes and the prevention of eye disease can help avoid disabling and costly health complications. Visual impairment resulting from eye disease has wide-ranging implications in terms of the burden of dependence, the potential loss of earning capacity and the need for greater social support<sup>7</sup>.

The personal and social costs of severe visual impairment threaten to overwhelm health and social care systems. Poorer countries experience most of the burden. Of the one in 11 adults with diabetes globally, three quarters are living in low- and middle-income countries, where healthcare resources are already severely challenged<sup>2</sup>.



Patients wait for eye examination during community outreach. Democratic Republic of Congo.  
Photo: Daniel Etya'ale. CC BY-NC 2.0 CEHJ

# Identifying diabetic eye disease

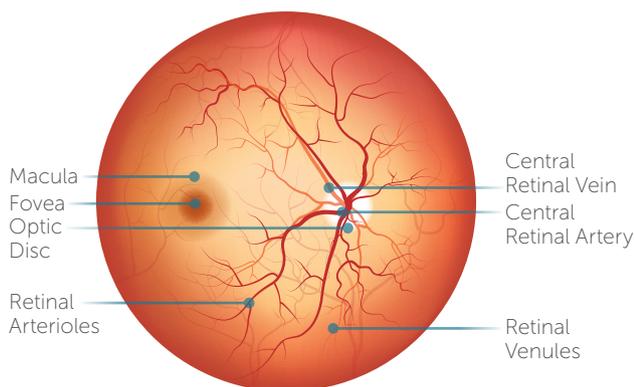
Eye diseases related to diabetes include a range of conditions such as refractive changes, double vision, cataract, glaucoma and diabetic retinopathy. Of these conditions, diabetic retinopathy is the only one that is directly caused by diabetes and that most frequently results in vision loss.

## An eye condition that is caused by diabetes – diabetic retinopathy

Diabetic retinopathy results from damage to the small blood vessels of the retina through changes in the blood flow. Initially diabetic retinopathy may cause few or mild symptoms but, as the disease progresses, it can lead to blindness. Diabetic retinopathy can cause changes in the eye including:

- Microaneurysms – small bulges in the blood vessels of the retina that can leak fluid into the retina
- Retinal haemorrhages – tiny spots of blood that leak into the retina
- Hard exudates – lipid deposits
- Cotton wool spots – swollen ischaemic axons in the nerve fibre layer
- Venous dilation and beading

## Normal retina



- Intraretinal microvascular abnormalities – abnormal branching or dilation of existing blood vessels
- Abnormal new vessels – depending on the location of the new vessels, these are classified as either “neovascularisation of the disc” or “neovascularisation elsewhere”

(See Appendix 1 for examples of retinal photographs)

## Non-proliferative diabetic retinopathy

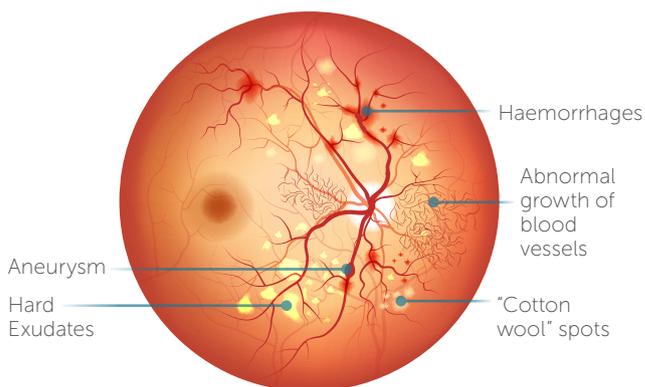
The early stage of diabetic retinopathy is known as “non-proliferative diabetic retinopathy”. During this stage the microvascular abnormalities are limited to the retina.

## Proliferative diabetic retinopathy

Proliferative diabetic retinopathy occurs as a result of microvascular abnormalities that restrict blood flow to the retina which deprives it of oxygen. In an attempt to supply blood to the deprived areas, new blood vessels grow from the retina into the vitreous cavity.

Proliferative diabetic retinopathy can cause severe vision loss via vitreous

## Diabetic retinopathy



haemorrhage, tractional retinal detachment and neovascular glaucoma.

### Diabetic macular edema

Diabetic maculopathy affects the central part of the retina—the macula— which is important for central vision. This may be through lack of blood flow or swelling and the most common form is diabetic macular edema (DME).

In clinical practice the presence and severity of DME is assessed and documented separately from the stage of diabetic retinopathy. DME is potentially sight threatening. If there are signs of DME particularly involving the centre of the macula, the patient should be seen as soon as possible by an ophthalmologist.

### Eye conditions that may be exacerbated by diabetes

These eye conditions are not caused by diabetes but are more prevalent and, in some cases, deteriorate faster in people with diabetes. While these conditions are less likely to cause vision loss they are still of concern and should be kept in mind by primary health professionals.

### Refractive changes

Variations in blood glucose levels may cause changes in the refractive power of the eye. If a person presents to an eye care practitioner with substantial refractive changes, this may indicate substantial changes in the level of blood glucose.

### Diplopia

Diplopia (double vision) is the simultaneous perception of two images of a single object that is caused by damage to the nerves that control eye movement coordination. Diabetes is the leading cause

of the nerve damage that disrupts normal eye movement.

### Cataract

Cataracts are characterised by clouding of the lens that affects vision and can appear in one or both eyes. Snowflake cataracts with white opacities may affect people with type 1 diabetes and sub-optimal metabolic control. Age-related cataract tends to occur earlier among people with diabetes than people without diabetes<sup>8</sup>.

### Glaucoma

Glaucoma is a group of progressive conditions that results in damage to the optic nerve. It usually occurs when fluid builds up in the front part of the eye. Glaucoma can permanently damage vision in the affected eye(s), reducing peripheral vision and resulting in irreversible visual loss.

- Open-angle chronic glaucoma develops slowly over time and often is asymptomatic until the disease has progressed significantly
- Closed-angle glaucoma is characterised by sudden eye pain and other symptoms, and is treated as a medical emergency
- Neovascular glaucoma can be seen in advanced cases of proliferative diabetic retinopathy.



#### Clinical Tip: Key risks

All people with diabetes are at risk of developing retinopathy.

The major risk factors for developing and progression of retinopathy are:

- The duration of diabetes
- High glucose levels
- High blood pressure

# Managing diabetes for good eye health

Effective management of diabetes is essential to prevent or delay the onset of diabetic eye disease, particularly diabetic retinopathy. The main focus of managing type 2 diabetes is through a healthy lifestyle (healthy diet and increased physical activity), supplemented with medication as required. Type 1 diabetes requires an appropriate diet and an insulin regime tailored to the person's needs. For more detail on management of people with diabetes, refer to Appendix 2.

There are many obstacles to living a healthy lifestyle, especially in low resource settings where it is often difficult to access healthy food, clean drinking water and affordable medications.

Management of diabetes to reduce the risk of visual impairment can be through four key strategies: social support, nutritional support, medication, and medical examinations and treatment – including a combination of all of these.



## Clinical Tip: Communication principles

For all strategies, guiding principles for communication are to:

- Ensure language used is accessible to the person
- Provide information on consequences
- Jointly set person-centred goals

## Social support

### Peer-to-peer

Peer-to-peer group care sessions are found to improve health behaviour, quality of life and improve metabolic control.

### Family support

Adding a family-based psychosocial support (where available), such as weekly meal planning, may help to improve diabetes management, especially for people with poorly controlled diabetes<sup>9</sup>.

Even among low-income households in low-resource settings, involving the family in meal planning can improve self-management of diabetes.

## Healthy eating support

### Good nutrition

Healthy eating and an improved understanding of the relationship between food and blood glucose levels can lead to improved metabolic control in people with diabetes.

### Metabolic control

Overall improved glycaemic control can slow the progression of diabetic retinopathy, especially when initiated soon after the diagnosis of diabetes.

## Control of other systemic factors

Medication such as anti-hypertensive and/or lipid-lowering drugs should be used to treat hypertension and dyslipidaemia, and when combined with lifestyle change, may slow the progression of diabetic retinopathy.



Examination of the eye. Mozambique. Photo: Riccardo Gangale/Sightsavers. CC BY-NC 2.0 CEHJ

## Medical examination and support

### Early detection and regular check-ups

Diabetic retinopathy can permanently damage the retina and lead to blindness; however vision loss can be prevented by timely diagnosis of the early stages of non-proliferative diabetic retinopathy. Therefore regular eye examinations are essential (see Table 1).

### Timely treatment

Timely treatment can prevent vision loss and even stabilise and improve vision for many people. The decision to undergo treatment should be made jointly by both the person with diabetes and the health professional.



#### Clinical Tip: Informing & empowering

When discussing treatment, health professionals should review with the patient:

- The costs and benefits of treatment
- What to expect during and after treatment
- The importance of continued eye examinations
- The role the person can play in their own self-management



#### Clinical Tip: Supporting regular check-ups

People may better adhere to regular eye examinations if you:

- Inform people with diabetes that eye examination is important even if their vision is not impaired
- Place reminders on a calendar or medical record
- Acknowledge and discuss a fear of blindness. This is one of the most common fears and one reason why people go into denial and do not seek treatment

# Different types of diabetes and implications for eye health

There are three common types of diabetes: type 1, type 2 and gestational diabetes.

**Type 1 diabetes** is a chronic autoimmune disease in which the immune system destroys the insulin-producing cells in the pancreas. People with type 1 diabetes need lifelong treatment with insulin on a daily basis to control blood glucose. The onset of type 1 diabetes is common in children and young adults but can affect people of any age.

**Type 2 diabetes** accounts for most cases of diabetes and is characterised by insulin resistance and insufficient insulin production. Type 2 diabetes can often be controlled through diet, weight loss where necessary and increased physical

activity. It can also require treatment with medication, including insulin. Type 2 diabetes usually occurs in adults but is increasingly seen in children and adolescents.

Many people live with type 2 diabetes for long periods without recognising symptoms or being aware of their condition. By the time of diagnosis, their organs may already be damaged by excess blood glucose and complications such as retinopathy may already be evident.

**Gestational diabetes** develops during pregnancy and usually resolves after the woman gives birth. Women who have gestational diabetes remain at significant risk of developing type 2 diabetes later in life.



Ophthalmic staff preparing to see patients, Ethiopia. Photo: Lance Bellers/Sight Savers. CC BY-NC 2.0 CEHJ

# Strategies to managing eye health

It is important that all people with diabetes are routinely screened for diabetic retinopathy in order to prevent progression and development of diabetes-related loss of vision. Duration of diabetes is a major risk factor associated with the development of diabetic retinopathy. Regular eye examinations are the only way to determine the extent of diabetic retinopathy: the patient may not yet be experiencing any vision loss as the early stages of retinopathy are asymptomatic.

Strategies used by health professionals to support people with diabetes include:

- Clearly communicate to the person with diabetes the need for ongoing eye exams over their lifetime
- Encourage lifestyle modification; give individually tailored diabetes-specific advice about physical activity and nutrition
- Develop individual plans that suit each person's needs and are appropriate to resources available
- Provide support for ongoing self-management
- Ensure regular contact with health professionals and supportive peers
- Ensure access to education programmes, including education on eye health.

**Table 1** Timing of initial and ongoing eye examinations for people with diabetes

Eye Examination	Type 1 diabetes	Type 2 diabetes	Gestational diabetes
Initial examination	<p>Initiate within five years after the diagnosis of diabetes</p> <p>If date of onset unknown, assume that the duration of diabetes is more than five years</p> <p>Children: five years after diagnosis or at puberty, whichever is the earlier</p>	Initiate as soon as possible after diagnosis of diabetes	Conduct on diagnosis of gestational diabetes
Ongoing examinations	<p>Conduct regular examination every one to two years if no abnormality is detected</p> <p>Once retinopathy is detected, frequency of assessments may need to increase depending on severity of the retinopathy and level of control of systemic risk factors. (See Table 5 <i>Referral criteria for people with type 1 diabetes and type 2 diabetes</i>)</p>		No need for further examination if diabetes resolves after delivery

# Detection of diabetic retinopathy

Screening should be undertaken by any suitably trained practitioner. Often it is not practical, or an effective use of resources, to have every person with diabetes screened by a specialised eye physician such as ophthalmologist or retinal specialist. Retinal screening for diabetic retinopathy and its severity can be performed by a person (who may not have a medical degree) if they have been properly trained to perform ophthalmoscopy or retinal photography.

In a primary care or non-speciality setting, eye examinations for detecting diabetic retinopathy can be carried out using a fundus camera to take retinal photographs. This requires a specifically designed digital camera to take images of the eye. The camera is not complicated and operators do not require advanced training. The images are either read locally or sent electronically to a central facility for reading<sup>10</sup>.

If no major eye problems are detected then regular visual acuity testing and retinal examination is recommended.



## **Clinical Tip:** **Eye examination at diagnosis**

Ideally, at the time of diagnosis of diabetes, a person should have a comprehensive eye examination alongside an assessment of the extent to which diabetes-related complications have already occurred.

Regular eye examinations should then be repeated over the person's lifetime.

## **Eye examination**

Ideally, examination methods should be identical in different settings and the same sequence should be followed in both low-resource and resource-rich settings. As a minimum, managing eye health in people with diabetes should include:

1. Medical history
2. Eye screening (see Table 2)
  - a. Visual acuity test
  - b. Retinal examination adequate for diabetic retinopathy classification which would generally involve each retina being closely inspected for signs of diabetic eye disease using one of the methods below

The method used for retinal examinations will depend on the resources available and the level of training of the practitioner. The health practitioner's role is central; either to perform the screening or to check that it is occurring regularly. Some form of patient recall system is a valuable tool to remind both practitioners and patients about the need for regular fundus screening.

A checklist for conducting a medical history and eye examination is provided at Appendix 1.

**Table 2** Eye screening for people with diabetes

**Visual acuity (test prior to pupil dilation)**

Refraction and visual acuity assessment with a visual acuity lane and a high-contrast visual acuity chart

Or

Near or distance eye chart and a pin-hole option to see if visual acuity is reduced

**Retinal examination**

**Non-mydratiac retinal photography** Recommended as a screening method  
Provides a permanent record  
Dilated pupils may improve sensitivity and image quality  
Can be carried out using telemedicine

Or

**Binocular indirect ophthalmoscopy** Pupils must be dilated  
Large field view  
Can be combined with slit-lamp examination to examine peripheral retina

Or

**Mydratiac retinal photography (conventional fundus camera)** Pupils must be dilated  
Provides a permanent record  
Sensitive method  
Can be carried out using telemedicine

Or

**Slit-lamp biomicroscopy** Used in routine clinical practice  
Pupils must be dilated for fundus examination  
Evaluation of the anterior and posterior segment with contact/noncontact lenses



**Clinical Tip:  
Pupil dilation**

Pupil dilation may improve the sensitivity and image quality, especially when the ocular media are not clear due to cataract.

# Grading of diabetic retinopathy and macular edema

The stages of diabetic retinopathy are classified in Table 3 using the International Classification of DR Scale. The retinal examination will indicate the most appropriate course of management.

Diabetic macular edema (DME) is complication of diabetic retinopathy and the presence and severity of DME should be assessed separately to that of diabetic retinopathy (see Table 4). DME can be associated with any of the stages of diabetic retinopathy.

## Referral criteria

Approximately one third of people with diabetes will have diabetic retinopathy and approximately one third of those will have a form of diabetic retinopathy that threatens their vision and requires treatment. Timely referral is crucial to ensure early intervention. The recommendations in Table 5 should be tailored for individuals according to their risks for the progression of diabetic retinopathy.



Mobile unit, India. Photo: Project Nayantara. CC BY-NC 2.0 CEHJ

**Table 3** Classification of diabetic retinopathy

<b>Diabetic retinopathy (DR)</b>	<b>Findings</b>
No apparent DR	No abnormalities
Mild non-proliferative DR	Microaneurysms only
Moderate non-proliferative DR	More than just microaneurysms but less than severe non-proliferative DR
Severe non-proliferative DR	Any of the following: Intraretinal haemorrhages ( $\geq 20$ in each quadrant) Definite venous beading (in two quadrants) Intra-retinal microvascular abnormalities (in one quadrant) No signs of proliferative DR
Proliferative DR	Severe non-proliferative DR and one or more of the following: Neovascularisation Vitreous/pre-retinal haemorrhage

Adapted from ICO Guidelines for Diabetic Eye Care<sup>11</sup>

**Table 4** Grading of diabetic macular edema

<b>Diabetic Macular Edema</b>	<b>Findings observable on dilated ophthalmoscopy*</b>
DME absent	No retinal thickening or hard exudates in posterior pole
DME present	Retinal thickening or hard exudates in posterior pole
Mild DME	Retinal thickening or hard exudates in posterior pole but outside central subfield of the macula (diameter 1000 $\mu\text{m}$ )
Moderate DME	Retinal thickening or hard exudates within the central subfield of the macula but not involving the centre point – also known as “centre-threatening DME”
Severe DME	Retinal thickening or hard exudates involving the centre of the macula—also known as “DME with centre involvement” or “centre-involved DME”

\*Hard exudates are a sign of current or previous macular edema. DME is defined as retinal thickening; this requires a three-dimensional assessment that is best performed by a dilated examination using slit-lamp biomicroscopy and/or stereo fundus photography. Optical coherence tomography is the most sensitive method to identify the sites and severity of DME

Adapted from ICO Guidelines for Diabetic Eye Care<sup>11</sup>

**Table 5** Referral criteria for people with type 1 diabetes and type 2 diabetes

Condition	Urgent referral as soon as possible	Referral within four months	Referral within six months	No referral	Repeat examination within one year	Repeat examination in one to two years
Sudden severe vision loss	●					
Retinal tear and/or detachment	●					
Proliferative diabetic retinopathy	●					
Severe DME	●					
Unexplained gradual worsening of vision		●				
Visual acuity below 6/12 (20/40)		●				
Symptomatic vision complaints		●				
Unexplained retinal findings		●				
Visual acuity cannot be obtained		●				
Retinal examination cannot be obtained		●				
Previous laser or anti-VEGF treatment		●				
Glaucoma		●				
Cataract		●				
Inability to visualise fundus		●				
Severe non-proliferative diabetic retinopathy		●				
DME without centre involvement		●				
Moderate non-proliferative diabetic retinopathy (no DME)			●			
Mild non-proliferative diabetic retinopathy				●	●	
No apparent diabetic retinopathy				●		●

# Ophthalmic assessment of diabetic eye disease

Once the person with diabetes has been referred to a specialist, they should undergo a complete ophthalmic examination including:

- A record of medical history
- An assessment of visual acuity
- Slit-lamp biomicroscopy
- Measurement of intraocular pressures
- A gonioscopy (when neovascularisation of the iris is seen or in eyes with glaucoma suspect)
- A fundus examination to assess diabetic retinopathy and DME using: slit-lamp biomicroscopy with dilated pupils or mydriatic retinal photography or non-mydriatic retinal photography with dilated pupil

Additionally, fluorescein angiography can be used to investigate unexplained decreased vision, identify capillary leakage and as a guide for treating DME, but is not needed to diagnose diabetic retinopathy or DME. Optical coherence tomography (OCT) is the most sensitive method to identify the sites and severity of DME and to follow-up<sup>14</sup>.



A photographer working with a mobile clinic team takes fundus images in a rural hospital.  
Photo: Cristóvão Matsinhe. CC BY-NC 2.0 CEHJ

# Treatment of diabetic retinopathy by ophthalmologists

If diabetic retinopathy and DME have been detected, referral to an ophthalmologist for timely treatment with laser photocoagulation and/or the use of anti VEGF treatments (intraocular administration of vascular endothelial growth factor inhibitors) can prevent vision loss, stabilise vision, and in some cases even improve vision if performed early, particularly for DME<sup>15</sup>(see Table 6).

In more advanced cases of diabetic retinopathy with associated vitreous haemorrhage, a vitrectomy may need to be performed.



## Clinical Tip: Prepare the patient for laser treatment

- Some patients may experience some pain during panretinal laser treatment
- Patient may have some vision loss as the laser may damage some cells in retina and macula. Vision loss caused by laser treatment must be measured against the more severe vision loss that could result from untreated retinopathy
- The patient's vision may be blurry after treatment and they may experience discomfort for a day or two
- Patients should be warned about these side effects to ensure that they are prepared and reassured
- If repeat therapy is needed, the patient should be supported to continue with therapy: irreversible vision loss may result from inadequate or delayed treatments



## Clinical Tip: Prepare the patient for eye injections

- Acknowledge common apprehensions including the thought of having an eye injection, fear of losing eyesight and fear of the unknown
- Advise that:
  - Drugs are given as an injection into the jelly-like substance inside the eye
  - An anaesthetic will first be given, and that the injection itself only takes a few seconds
  - Anticipated discomfort is often greater than actual discomfort
  - Vision may be blurry after treatment and there may be some discomfort for a day or two
- Patients should be warned about these side effects to ensure that they are prepared and reassured
- If repeat therapy is needed, the patient should be supported to continue with therapy: irreversible vision loss may result from inadequate or delayed treatments

**Table 6** Common treatments for diabetic retinopathy**Laser treatment (photocoagulation)**

Purpose	Can prevent vision loss and stabilise vision if performed early
Types/indications	Focal treatment – DME Grid treatment – DME Panretinal treatment – proliferative DR Panretinal treatment – selected cases of severe non-proliferative diabetic retinopathy
Mode of operation	Seals the leaking weak vessels in the retina in macular area Reduces stimulus for new vessel growth in the retina Regresses the new vessels and therefore prevents or stops bleeding
Procedure	Conducted by an ophthalmologist in an out-patient setting Topical anaesthesia is applied Laser beam guided precisely using a slit lamp and special condensing lens Additional treatment may be required depending on the person's condition
Follow-up	Regular follow-up examination is crucial to detect disease progression
Potential complications	Loss of peripheral vision Reduced night vision
Technique	Refer to <i>ICO Guidelines for Diabetic Eye Care</i> (16)

**Intravitreal anti-VEGF injections**

Purpose	Can prevent vision loss, stabilise vision, and in some cases even improve vision if performed early <sup>15</sup>
Indications	DME In some cases of proliferative DR
Mode of operation	Blocks the effect of vascular endothelial growth factor (VEGF) and slows vessel leakage
Procedure	Should be administered and tailored to visual stability and anatomical outcomes If there is persistent retinal thickening and leaking points, consider combining with laser treatment after 24 weeks If there is DME associated with proliferative DR, consider combining with laser treatment
Follow-up	Regular monitoring with optical coherence tomography
Potential complications	Conjunctival haemorrhage Endophthalmitis Retinal detachment
Contraindications	Ocular or periocular infections

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**Table 6 continued**

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**Intravitreal steroid injections**

Purpose	Can stabilise blood-retinal barrier, reduce exudation, and downregulate inflammatory stimuli
Indications	DME
Mode of operation	Injection of steroids into the vitreous part of the eye
Procedure	Performed under anaesthesia The steroid drug is inserted into the eye with a small injection Following the intravitreal injection, patients should be monitored for elevation in intraocular pressure and for endophthalmitis
Follow-up	Regular follow-up as determined by the eye specialist
Potential complications	Infectious endophthalmitis Noninfectious endophthalmitis Increased intraocular pressure
Contra-indications	Glaucoma Increase in intraocular pressure when previously treated with corticosteroids Active or suspected ocular or periocular infections

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**Vitrectomy**

Purpose	Can repair or prevent traction retinal detachment and tears, reduce severe vitreous haemorrhage, and reduce neovascularisation that continues despite repeated laser treatment
Indications	Severe vitreous haemorrhage of one to three months that does not clear spontaneously Advanced active proliferative DR that persists despite laser treatment Tractional retinal detachment involving/threatening the macula Combined traction-rhegmatogenous retinal detachment Tractional macular edema or epiretinal membrane involving the macula
Mode of operation	Removal of the vitreous gel, abnormal vessels, fibrous proliferations
Procedure	Performed under local or general anaesthesia Surgeon inserts instruments into the eye and removes vitreous gel and fibrous tissue; flattens retina and repairs retinal tears
Follow-up	One week, one month, three months and every six months thereafter, if not indicated otherwise
Potential complications	Retinal detachment High intraocular pressure Cataract

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## Post-treatment support

Following treatment there are several issues that need to be discussed with the person and their carers to ensure they understand the need for ongoing monitoring of their eye condition. These include:

1. Discuss clinical findings and implications, using a visual reference such as their own retinal images or photos. Use the images to reinforce the importance of both continued exams and of caring for their general health. Communicate eye exam results to the other health professionals who are involved in the person's care
2. Continue to provide education and support on in controlling blood glucose, blood pressure and lipid levels
3. Emphasise that treatment for diabetic eye disease is more effective with timely intervention and there is therefore the need for regular and ongoing eye examinations
4. Refer for counselling, rehabilitation or social services if available and appropriate.

## Everyone with diabetes is at risk of diabetic retinopathy

- DR is asymptomatic until an advanced stage and then it is often too late for effective treatment, therefore it is imperative to support people in managing their diabetes and to have regular eye examinations
- People with diabetes need to be supported to play an active role in managing their disease. By improving their blood glucose and blood pressure control a person with diabetes can prevent/slow down the progression of diabetic retinopathy<sup>17-19</sup>
- Most people with DR do not have to go blind, however for early detection and treatment to be successful, regular screening for DR must be integrated into their diabetes care, where timely detection, management and referral of DR are facilitated
- Primary health practitioners and those working in primary health care are at the frontline of supporting people with diabetes to understand how to look after their diabetes, including their eye health

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# Appendix 1

## Checklist for managing eye health in people with diabetes

### Medical history

- Duration of diabetes
- Past glycaemic control (HbA1c if possible)
- Medications – especially insulin, blood glucose-lowering medication, antihypertensives and lipid-lowering drugs
- Systemic history – renal disease, systemic hypertension, serum lipid levels and pregnancy
- Ocular history and current visual symptoms

### Eye screening

- a. Visual acuity test: using acuity lane and a high-contrast visual acuity chart. Alternatively, a near or distance eye chart and a pin-hole option to see if visual acuity is reduced. If visual acuity below 6/12 (20/40), refer to eye specialist
- b. Retinal examination adequate for diabetic retinopathy classification (see next page)

### Actions

- Referral to eye specialist if required
- Other points to discuss with the patient and their carer
  - Discuss management of patient's blood glucose, blood pressure and blood lipids
  - Discuss dietary and lifestyle changes and identify support, if available

## Retinal photographs

### Red Signs

- Venous beading (v)
- Haemorrhages (h)
- Microaneurysms (not shown)
- New blood vessels (not shown)
- Intraretinal microvascular abnormalities (not shown)
- Vitreous haemorrhage (not shown)

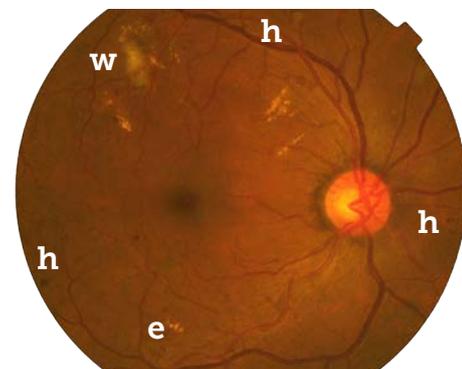
### White Signs

- Cotton wool spots (w)
- Hard exudates (e)

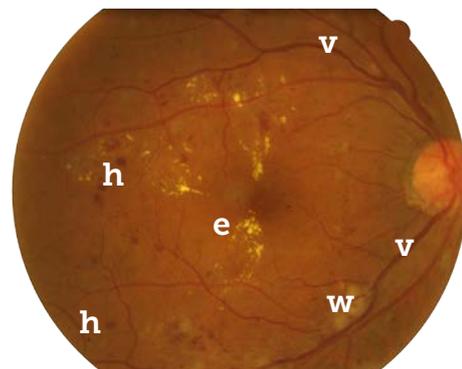
For more examples of retinal photographs, see:  
ICO Guidelines for Diabetic Eye Care<sup>11</sup>



*Normal retina*



*Moderate non-proliferative diabetic retinopathy*



*Severe non-proliferative diabetic retinopathy with severe diabetic macular edema*

# Appendix 2

## Managing diabetes for good eye health

Effective management of diabetes is essential to prevent or delay the onset of diabetic eye disease, particularly diabetic retinopathy. The main focus should be

on managing diabetes through a healthy lifestyle supplemented with medication as required<sup>20-22</sup>.

	Type 1 diabetes	Type 2 diabetes
<b>Healthy lifestyle</b>		
<b>Action by health professionals</b>		
Nutrition	Provide meal planning advice Teach how to match carbohydrate intake to insulin doses and how to adjust insulin for daily life	Provide advice on healthy nutrition as soon as possible after diagnosis of diabetes
<b>Action by people with type 1 diabetes</b>		<b>Action by people with type 2 diabetes</b>
Physical activity	Measure blood glucose before, during and after exercise Be prepared to treat hypoglycaemia May need to adjust food and insulin Seek a medical review before starting exercise programmes	Gradually increase physical activity, taking into consideration ability and specific goals Adjust medication and/or carbohydrate intake according to physical activity
Low resource setting	If glucose monitoring is not possible, people with type 1 diabetes should have a snack and/or reduce their insulin dose before physical activity	
Smoking	Strongly encourage smoking cessation	Strongly encourage smoking cessation
<b>Optimising metabolic control</b>		
<b>Action by people with type 1 diabetes</b>		<b>Action by people with type 2 diabetes</b>
Blood glucose self-monitoring	Test four to six times per day, every day Act on results to improve management	Make self-monitoring available for insulin users Consider self-monitoring for people using oral blood glucose-lowering medications
Low resource setting	Test two times per day if possible	Consider self-monitoring using visually read strips or meters with strips for people with diabetes using insulin

	Type 1 diabetes	Type 2 diabetes
	<b>Action by health professionals</b>	
<b>HbA1c monitoring</b>	<p>Recommend testing regime is:</p> <ul style="list-style-type: none"> <li>• Younger children: four to six times per year</li> <li>• Older children: three or four times per year</li> <li>• Adults: two to four times per year</li> </ul>	<p>Recommend testing regime is:</p> <ul style="list-style-type: none"> <li>• Two to four times a year, depending on blood glucose control and changes in therapy</li> </ul>
	<p>Target:</p> <ul style="list-style-type: none"> <li>• Children and adolescents: 7.5% (58 mmol/mol) or that recommended by local guidelines</li> <li>• Non-pregnant adults: 7.0% (53 mmol/mol) or that recommended by local guidelines</li> </ul> <p>In older people HbA1c goal may be higher and be based upon the individual's overall health</p>	<p>Target HbA1c of 7.0% (53 mmol/mol) or that recommended by local guidelines</p> <p>In older people and those on insulin, HbA1c goal may be higher and be based upon the individual's overall health</p>
	<b>Action by health professionals</b>	
<b>Sick-day rules</b>	<p>Provide information on how to manage periods of sickness and how to recognise and treat hypoglycaemia</p>	<p>Provide information on how to manage periods of sickness and how to recognise and treat hypoglycaemia</p>
	<b>Action by people with type 1 diabetes</b>	<b>Action by people with type 2 diabetes</b>
	<p>Ketone testing recommended for people with type 1 diabetes during periods of illness:</p> <ul style="list-style-type: none"> <li>• With fever and/or vomiting and/or</li> <li>• If blood glucose value is persistently above 14 mmol/l (250 mg/dl)</li> </ul>	

# Glossary

## **D Dyslipidaemia**

Dyslipidaemia is abnormal levels of fats (lipids) in the blood.

## **E Endophthalmitis**

Endophthalmitis is an inflammatory condition of the aqueous and/or vitreous humour, which is usually caused by infection.

## **F Fluorescein angiography**

Fluorescein angiography is used to examine blood vessels in the retina. A fluorescent dye is injected into a vein in the arm and images are taken as the dye passes through the blood vessels in the eye.

## **Fundus**

The fundus is the part of the eye opposite the lens. It includes the retina, optic nerve head (optic disc), macula and fovea. The fundus can be examined by ophthalmoscopy and/or fundus photography.

## **Fundus photography**

When performing ophthalmic fundus photography, the pupil is dilated with eye drops and a special camera is used to focus on the fundus. This painless procedure produces a sharp view of the retina, the retinal vasculature and the optic nerve head (optic disc) from which the retinal vessels enter the eye. The resulting images show the optic nerve through which visual signals are transmitted to the brain and the retinal vessels that supply nutrition and oxygen to the tissue. Ophthalmologists use these retinal photographs to diagnose and treat eye diseases.

## **G Glucose**

Glucose is the major source of energy for living cells produced in the body from proteins, fats and carbohydrates. It is carried to each cell through the bloodstream. However, the cells cannot use glucose without the help of insulin.

## **Glycosylated haemoglobin (HbA1c)**

Glycosylated or glycated haemoglobin is a test that gives a representation of the average blood glucose level over a three-month period, and gives an indication of the overall level of diabetic control.

## **Gonioscopy**

Gonioscopy is the examination of the angle of the anterior chamber of the eye with a gonioscope.

## **H Hyperglycaemia**

Hyperglycaemia is a raised level of glucose in the blood. It occurs when the body does not have enough insulin or cannot use the insulin it does have to turn glucose into energy.

## **Hypertension**

Hypertension is persistently elevated blood pressure.

## **Hypoglycaemia**

Hypoglycaemia is low blood glucose: the level has dropped below 72mg/dl or 4 mmol/L. This occurs when there is too much insulin for the amount of food or when glucose has been used up quickly during and after activity. A person with hypoglycaemia may feel hungry, nervous, shaky, weak and sweaty and have a headache and blurred vision.

## **I Insulin**

Insulin is a hormone produced in the pancreas. Its main action is to enable glucose to be transported from the blood into the cells so it can be used for energy.

## **Insulin resistance**

Insulin resistance is a state in which the body produces insulin but the cells do not respond to the hormone's normal action. The cells become resistant to the action of insulin, causing glucose to build up in the blood.

## **Intravitreal**

Intravitreal means literally "inside the vitreous". An intravitreal injection is delivered into the vitreous fluid in the back of the eye.

## **M Macula**

The macula is located roughly in the centre of the retina. It is a small and highly sensitive part of the retina responsible for detailed central vision.

## **Mydriatic**

Mydriatic means causing dilation of the pupil.

## **O Optical coherence tomography**

Optical coherence tomography is a non-invasive imaging test that uses light waves to create cross-section images of the retina. These images display each of the retina's distinctive layers, allowing an ophthalmologist to measure their thickness.

## **P Photocoagulation**

A procedure by an eye care professional who makes tiny burns on the retina with a special laser. These burns seal the blood vessels and stop them from growing and leaking.

## **S Slit-lamp biomicroscopy**

A biomicroscope or "slit lamp" is composed of a binocular viewing system that allows the assessment of nearly all structures of the eye by using different type of contact/noncontact lenses.

## **V Vitrectomy**

Vitrectomy is surgery to remove some or all of the vitreous humour from the eye.

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## Additional sources of information

- Treating and managing DR and DME: International Council of Ophthalmology  
[www.icoph.org/resources.html](http://www.icoph.org/resources.html)
- Treating and managing glaucoma and cataract: International Council of Ophthalmology  
[www.icoph.org/resources.html](http://www.icoph.org/resources.html)
- Treating and managing diabetes: International Diabetes Federation  
[www.idf.org/guidelines](http://www.idf.org/guidelines)





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