



DMO/PDR

Keeping an eye on the eyes with diabetes

Diabetes-related retinopathy

Information for patients and relatives

 **NOVARTIS**



Imprint

All rights reserved. This brochure and its contents are protected by copyright. The brochure or parts thereof may not be reproduced, distributed or otherwise used in any form without the express written permission of Novartis Pharma GmbH.



Novartis Pharma GmbH
Roonstraße 25, 90429 Nuremberg, Germany
www.novartis.de
www.ratgeber-makula.de

Concept and Text:

Jutta Heinze
Schlebuschweg 34, 21029 Hamburg, Germany
jutta.heinze@hamburg.de

Design/Realisation/Concept

McCANN Health Germany GmbH
Großer Hasenpfad 44, 60598 Frankfurt, Germany
www.mccannhealth.de

Final Editing:

Text+Plan Dr. Ira Lorf
Fischers Allee 59 e, 22763 Hamburg, Germany
info@textundplan.de

Images:

Getty Images
iStock
Dr. med. Robert Wilke
(Bayreuther Straße 30, 01187 Dresden, Germany)



Content

Diabetes – what causes it?	6–17
Consequences: Attack on the blood vessels	18–21
The human eye	22–23
How the eye works	24–25
Diabetes-related retinopathy	26–29
How diabetes affects vision	30–31
Simple self-examination with the Amsler Grid and ACTO vision test	32–35
Taking a closer look: Examining the eyes	36–37
Improving vision: Options for treating damage to the eyes	38–41
Vision problems lower the quality of life	42–45
Eating with pleasure	46–49
Helpful addresses and websites	50–51





Diabetes – what causes it?

Diabetes mellitus, commonly known as diabetes, is one of the **most common chronic metabolic diseases worldwide**. Based on the typical sugar excretion in urine, diabetes mellitus literally means ‘honey-sweet discharge’. Because in ancient times, scholars diagnosed the disease by tasting a urine sample. Today, there is a wide range of diagnostic options available to determine the metabolic disorder.

Sugar metabolism gone astray

With diabetes mellitus, the body cells can no longer properly absorb the sugar from the blood (**glucose = dextrose**). This makes the blood sugar level rise (hyperglycaemia). The body provides the hormone **insulin**, which is formed in the pancreas, for glucose uptake from the blood. Like a doorman, insulin ensures that the blood sugar arrives in the body cells and is converted into **energy** there. The more sugar circulating in the blood, the higher the secretion of insulin.

In diabetes patients, however, this interaction longer functions properly. Physicians classify diabetes into roughly in two categories: **type 1 and type 2 diabetes**.

Typical of type 1 diabetes

› Lower insulin production:

In this autoimmune disease the pancreas produces too little or no insulin.

Typical of type 2 diabetes

› Reduced insulin secretion:

The insulin only has a limited effect in the body cells.

It's all about a question of type

Once **type 1 diabetes** or **type 2 diabetes** has been diagnosed, different laboratory tests make it possible to further classify the disease into special forms and sub-types.



Type 1 diabetes

This form of the disease, previously known as **juvenile diabetes**, usually occurs, with some exceptions, before the age of 40 and often in children and adolescents. All these patients need treatment with insulin from the beginning. Unfortunately, type 1 diabetes is not curable. However, a healthy lifestyle, well-adjusted treatment and regular check-ups now allow these patients to lead a normal life to a great extent.

Type 2 diabetes

This form of diabetes, formerly known as **adult-onset diabetes**, usually does not occur until after the age of 50. However, there is now an increasing number of cases among very young patients.

People with type 2 diabetes usually (initially) do not need insulin as tablets to lower blood sugar (sometimes special injections) and a healthy lifestyle are usually sufficient.

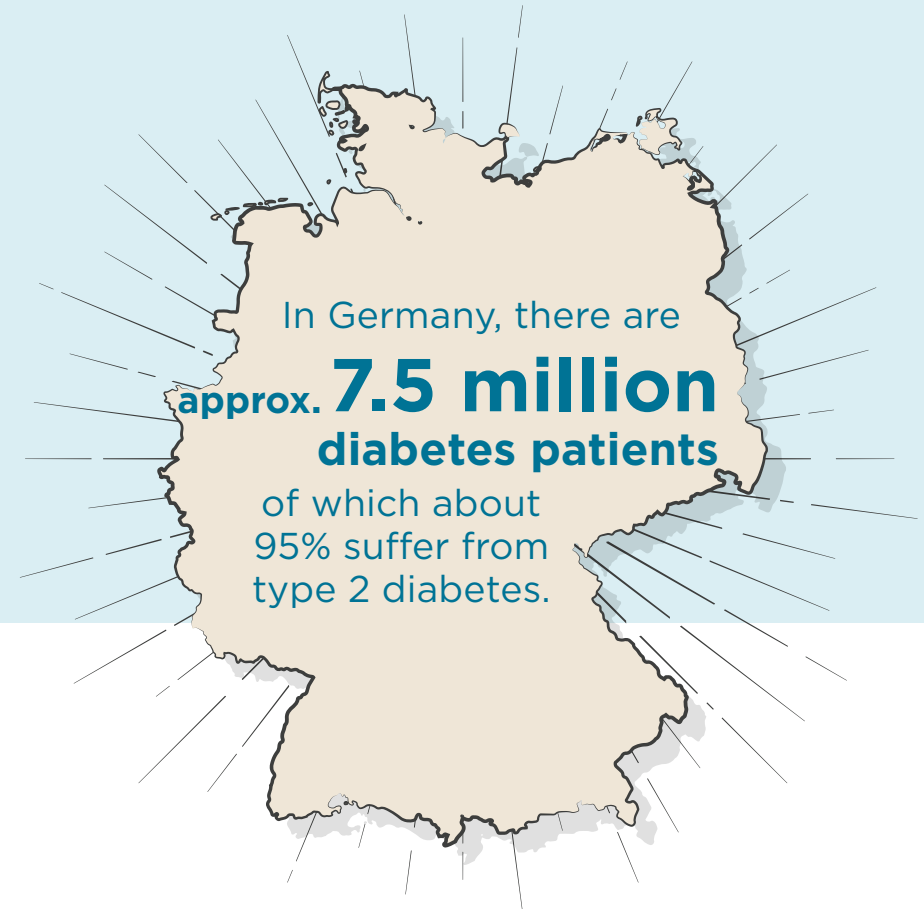


Facts and figures on diabetes

- › It is estimated that there are 7.5 million diabetes patients in Germany, about 95 per cent of them suffer from type 2 diabetes.
- › Diabetes is considered the most common chronic metabolic disease among children and adolescents in western countries.
- › The World Health Organization (WHO) lists diabetes as the seventh leading cause of death worldwide.
- › Diabetes patients are two to three times more likely to suffer a heart attack or stroke than people without diabetes.



Regular preventive care is necessary, as only prompt treatment can maintain vision as best as possible!



Possible causes

There are different reasons why someone becomes diabetic. **Type 1 diabetes** is one of the autoimmune diseases in which the immune system suddenly goes crazy, for example due to a genetic predisposition or physical stress (e.g. a serious disease/operation).

Type 2 diabetes, however, is explained by scientists as a result of a combination of hereditary factors and an unhealthy lifestyle. These include above all poor nutrition, obesity and lack of physical exercise.



Dangerous quartet: the metabolic syndrome

Some diabetes patients suffer from other diseases which, together with diabetes, form an extremely dangerous quartet: the metabolic syndrome. This fatal interplay massively damages the heart, circulation and blood vessels as well as increases the risk of heart attack and stroke:

- › Elevated blood sugar or identified type 2 diabetes
- › Lipometabolic disorders (elevated blood lipid levels)
- › High blood pressure (> 130/85 mmHg)
- › Abdominal obesity (waist circumference $\geq$ 94 cm (men) or $\geq$ 80 cm (women))

Typical symptoms

When the sugar metabolism goes completely out of control, experts speak of hyperglycaemia or hypoglycaemia – regardless of the respective type of diabetes (see p. 16–17). In addition, however, the classic symptoms of the two forms of the disease differ.



Symptoms of type 1 diabetes

- › Severe thirst, frequent urge to urinate
- › Weight loss, increased appetite
- › Vision impairment, head pressure

Symptoms of type 2 diabetes

- › Constant feeling of hunger, weight gain
- › Itchy skin (with no visible skin changes)
- › Tiredness, exhaustion, depressive moods
- › Women: Menstrual disorders
Men: Erectile dysfunction
- › Susceptibility to infections (especially blister, skin)
- › Sometimes: increased thirst, increased urge to urinate, vision problems

Too much or too little: Hypoglycaemia and hyperglycaemia

In diabetic patients, the sugar metabolism sometimes gets out of balance, especially if the dosage is too high or too low. Extreme upward or downward disturbances can, in worst cases, cause a diabetic coma. For this reason, please watch out for the following signs:

- › **Low blood sugar (hypoglycaemia)**
restlessness, confusion, cravings (for sweet), sweating, trembling, vision impairment, rapid pulse

First aid:

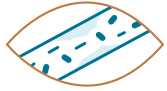
Administer sugar-containing products (fizzy drinks, dextrose – followed by a piece of bread), call a doctor immediately.

- › **High blood sugar (hyperglycaemia)**
acetone smell when exhaling (smells like nail polish), clouding of consciousness, stomach ache, nausea

First aid:

Call a doctor immediately (if necessary, emergency doctor, tel.: 112).





Consequences: Attack on the blood vessels

Damage from the disease shortens the life expectancy of diabetes patients by about 8 years compared to people without diabetes. In addition to the risk of hyperglycaemia and hypoglycaemia, poorly adjusted blood sugar levels can lead to various health risks.

Effects throughout the body – in particular on the **blood vessels and nerves**. In the long term, increased blood sugar levels affect various organ systems.

Macroangiopathy

Damage to the major arteries by diabetes is what doctors call **macroangiopathies**. The vessels altered by high blood sugar levels calcify and narrow (arteriosclerosis), the risk of heart attack, stroke and circulatory disorders in the legs (peripheral arterial occlusive disease/PAOD – also known as “intermittent claudication”) increases significantly.

Every year, diabetic macroangiopathies cause around 40,000 amputations in Germany! In addition, the risk of stroke increases two to three fold.

Microangiopathy

Microangiopathies cause damage to the small blood vessels (capillaries), which mainly affect the eyes (diabetic retinopathy) and kidneys (diabetic nephropathy). The dreaded late effects include loss of vision and kidney failure. In Germany, a patient with diabetes loses their eyesight every 6 hours due to diabetic retinopathy; nephropathies cause more than 2,000 new dialysis cases each year.

When sugar is bad on the eyes

The eye, our most important sensory organ, suffers particularly from poor blood supply. Eye damage is one of the worst late effects of diabetes. Despite improved diagnostics and good treatment options, diabetes is still considered the most common cause of severe visual impairment/blindness between the ages of 40 and 80 in industrialised countries.

Neuropathy

Prolonged diabetes also affects the nerve tracts. Discomfort in the legs and feet (such as tingling, burning or pain) are associated with **peripheral neuropathy**.

Autonomic neuropathy affects the internal organs and affects, among other things, gastrointestinal and bladder function (emptying disorders) and the cardiovascular system (heart rhythm and blood pressure disorders).



The best protection: regular check-ups

Regular checks of blood sugar and treatment (tablets, insulin and lifestyle changes) tailored to the patient and their personal indicators offer the best protection against secondary diabetic diseases. The better and more constant the blood sugar level is adjusted, the lower the risk of permanent damage to the body.



That is why the following applies to all diabetes patients:

- › Regular check-ups by your doctor (blood sugar, blood lipids, blood pressure, kidney levels).
- › Regular eye examinations by an ophthalmologist, even when there are no existing visual problems (the intervals between checks depend on the diagnosis).



The human eye

“He kept him as the apple of his eye,” says the Bible (Deuteronomy 32:10). This comparison from the Old Testament symbolises caring for something very valuable like hardly any other proverb or quote.

Even then, people were well aware of how valuable eyesight is and how much we need to protect and care for one of our most important sensory organs.

The eye: the most important organ

Our eye is an exceptional organ: in a healthy state, it can differentiate between **600,000 shades of colour** and absorbs more than **10 million pieces of information per second** which it passes on to the brain. All that is needed for this remarkable achieve are **around 7.5 grammes** – the same weight as the human eye.

Essential to the senses

Almost three-quarters of all the information we take in is through the visual system!



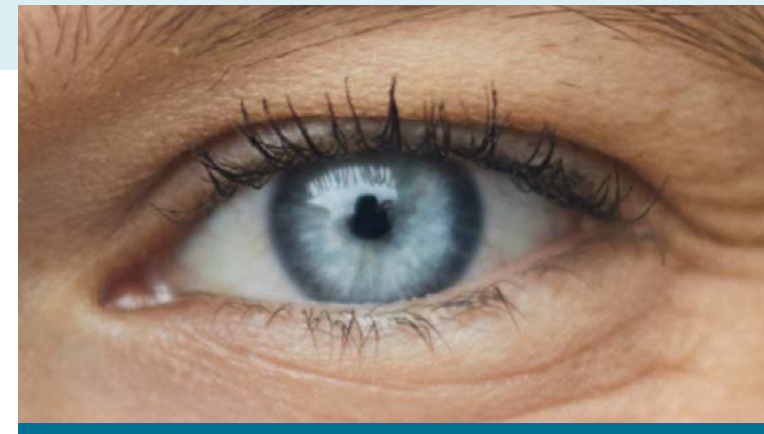
Interesting facts about the eye

› Eye colour

Only about one-tenth of the world population has blue eyes. The most people with blue eyes live in Scandinavia and the Baltic States. The iris is the part of the eye that determines our eye colour.

› Eye muscles

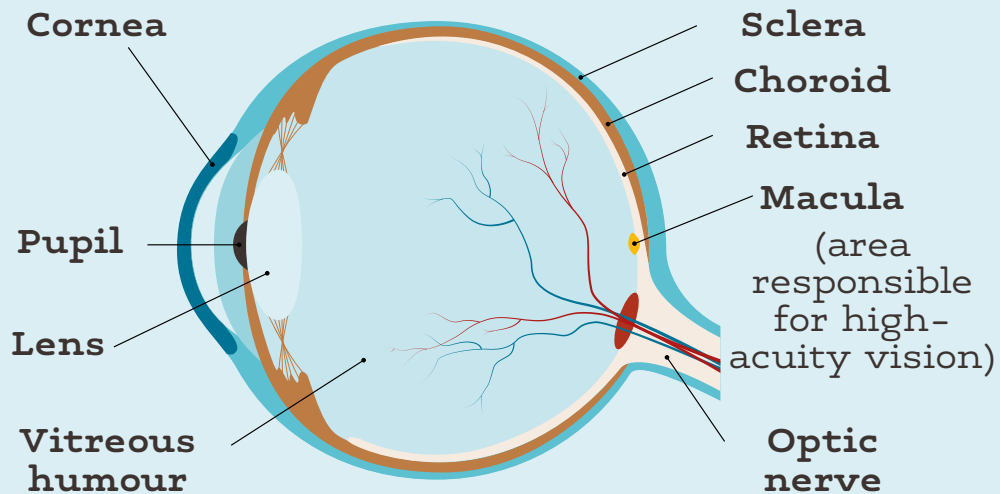
Tedious activities: six different eye muscles control the movement of each of our eyes in the direction we look – several hundred thousand times a day! If one of these muscles is weak or damaged, double vision occurs.





How the eye works

Our eyes work like a state-of-the-art camera. Whereas a common miniature camera weighs around 100 grams, less than 10 grams are enough for our eyes to perform far better technically.



From the first moment to the final image

When we look at something, for example a house, the light rays bounce off this house and enter the cornea first. **Incoming light is focused by the cornea** and passes through to the iris.

The iris – an open and shut case

The iris works similar to a camera's aperture: in dark conditions, the transparent centre (**pupil**) expands, and in bright conditions it contracts. The **lens** behind the iris regulates near and distant vision and loses its elasticity with increasing age. This is also the cause of presbyopia. After passing through the cornea, pupil and lens, the light ray travels through the vitreous humour to the **retina**, on which the photoreceptors are located and in the centre of the retina, the **area responsible for high-acuity vision (macula)**.

Millions of cells – one image

More than 100 million photoreceptors convert light into nerve impulses that the **optic nerve** transmits to the brain, thus enabling us to see the house we are looking at. The photoreceptors known as **cones** are responsible for colour vision, and the **rods** for perceiving lower and higher intensity light. Roughly 95 per cent of the photoreceptors are located in the **macula**. Medical professionals call the **blind spot** the point at which the optic nerve leaves the eye.



Diabetes-related retinopathy

There are two main diseases that affect the eyes of diabetes patients: **diabetic retinopathy** and **diabetic maculopathy** or **diabetic macular oedema**. In many cases – but not always – the disease will eventually affect both eyes; especially if one eye already has diabetes-related retinopathy.

Diabetic retinopathy

In the long term, high blood sugar levels damage the fine retinal vessels and lead to the most common diabetic retinal disease, **diabetic retinopathy (DR)**. Various types of damage increasingly impair vision depending on the severity of the disease. In addition, **diabetic macular oedema (DMO)** can occur at any stage of DR and lead to loss of vision (see pages 30, 31).

Creeping danger

Experts refer to the initial stage of the disease as non-proliferative **diabetic retinopathy (NPDR)**. The vascular changes are restricted to the retina. Bleeding, deposits of fat and protein and small vascular sacculations occur; as a result, areas of the retina are no longer sufficiently supplied with nutrients and oxygen.

This stage is rarely noticed by those affected, as they usually do not suffer from deteriorating vision despite previous damage to the retina. If, in the further course of the disease, undesired and pathological new blood vessels are formed that also grow into the vitreous humour of the eye, the term **proliferative diabetic Retinopathy (PDR)** is used. These newly formed vessels tend to bleed. If there is a bleeding into the vitreous humour, visual acuity deteriorates massively.



Why do eye problems only become noticeable at a later stage?

Initially, diabetes-related retinal damage often affects only the peripheral areas of the retina (periphery) and thus lies outside the central field of vision. At this stage there is usually no visual impairment at first. In addition, the healthy other eye can compensate for possible visual impairment for a long time.

Diabetic maculopathy and macular oedema

Because of the creeping course of diabetic retinopathy, those affected usually only notice visual impairments in advanced retinal damage in the area of sharpest vision, the **macula** in the middle of the retina (**maculopathy**). Fluid accumulations and a thickened retina in this area (**macular oedema/DMO**) endanger the eyesight of diabetes patients.

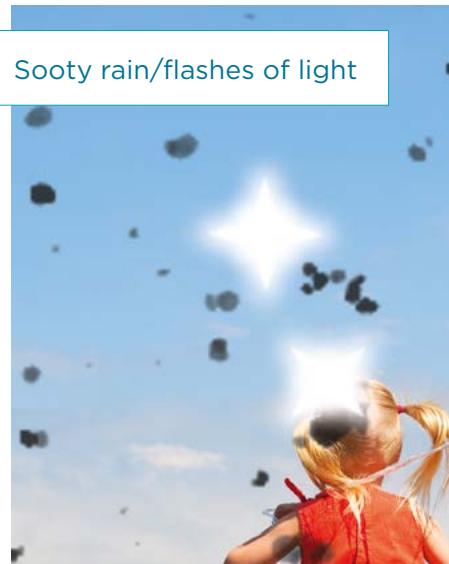
E How diabetes affects vision

Diabetes patients often learn about mild retinopathy by chance during a visit to the eye doctor. In the advanced stage, however, there are characteristic impairments which are quite noticeable in everyday life. You will find visual examples of this on the following page.

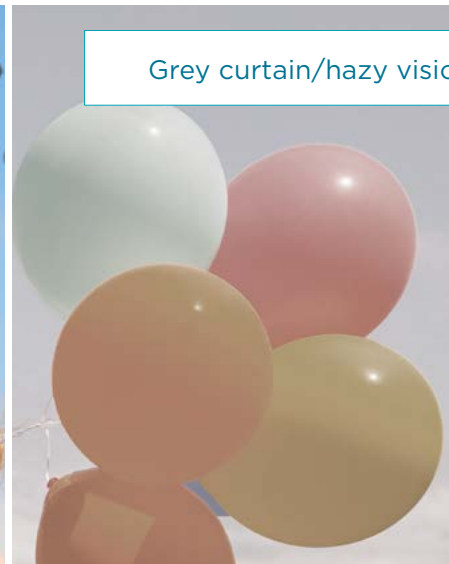
Typical symptoms of diabetic eye damage

- › Blurred, blurred vision (with macular oedema)
- › Dark spots and/or red haze in the field of vision (if there is bleeding into the vitreous humour or if retinal areas have already been destroyed)
- › “Grey curtain”/“hazy vision”, distorted vision (with maculopathy or macular oedema)
- › “Flashes of light” and “sooty rain” with on-setting retinal detachment (there is a risk of blindness with retinal detachment – please consult an ophthalmologist quickly!)
- › Sudden and drastic deterioration of visual acuity (due to bleeding into the vitreous humour)

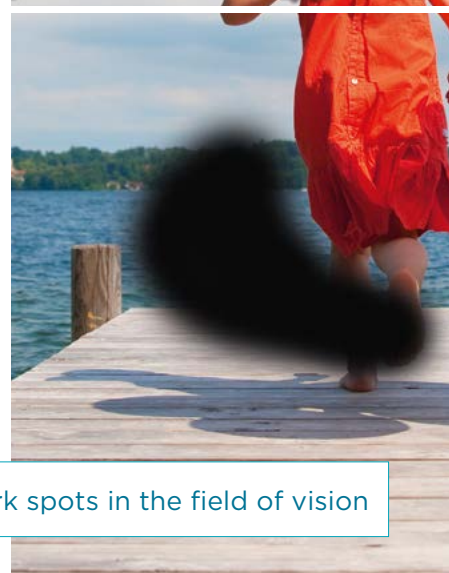
Sooty rain/flushes of light



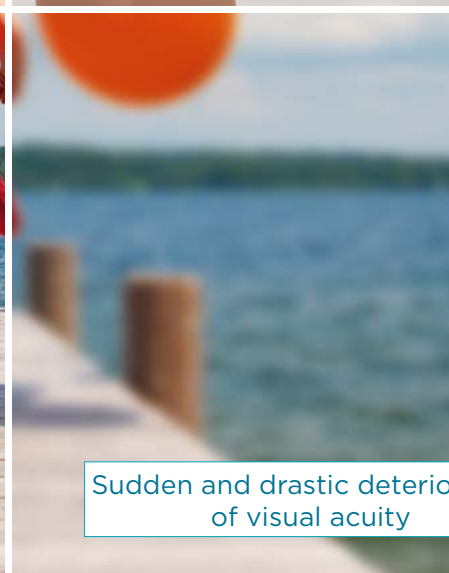
Grey curtain/hazy vision

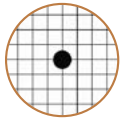


Dark spots in the field of vision



Sudden and drastic deterioration of visual acuity





Simple self-examination

Vision tests for home

Our brain manages to maintain vision for a long time, even when the eyes have already suffered significant damage due to diabetic eye damage such as **proliferative diabetic retinopathy (PDR)** or **diabetic macular oedema (DMO)**. As a result, those affected often don't even notice the onset of vision problems at all – especially since poor vision does not usually appear overnight but instead creeps in slowly. This makes it all the more important to carry out simple vision tests at home in order to detect any visual impairment that may not even be perceptible at an early stage.



**~ 15% of
diabetes patients**
suffer from retinal
damage in the macula
(**maculopathy**) after
15 years of illness.

Self eye exams

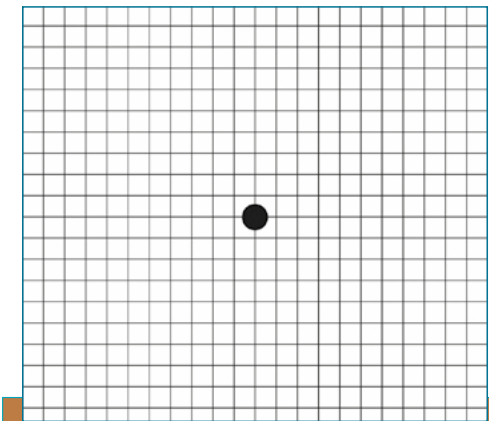
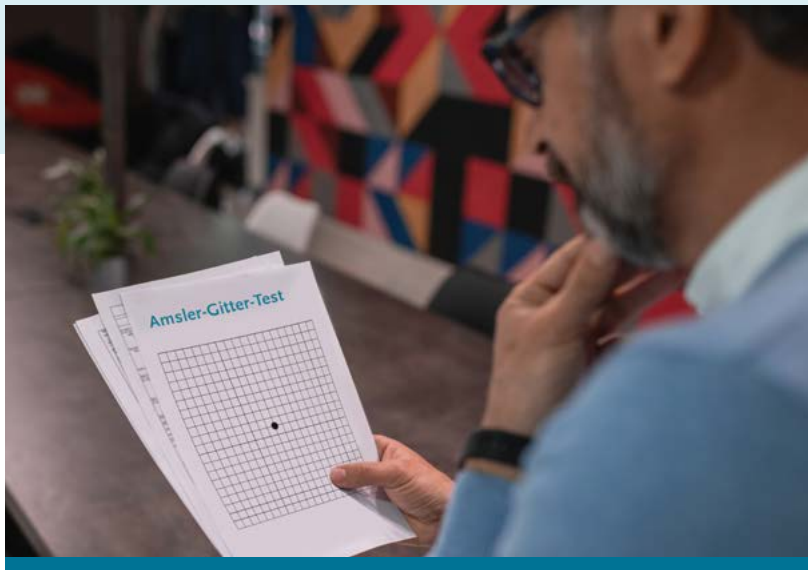
When people with diabetes notice that something is wrong with their eyes, the disease is usually already advanced. A very simple and quick test for at home, the **Amsler Grid Test**, can help to detect the first signs of proliferative diabetic retinopathy (PDR) or macular oedema as early as possible, even between two check-ups with your doctor (see insert sheet). It is best to put up the grid test in a clearly visible place, such as the refrigerator door or bathroom.

The **Amsler Grid Test** is also part of the ACTO vision test, which includes other vision tests. You can get it online at www.acto.de.

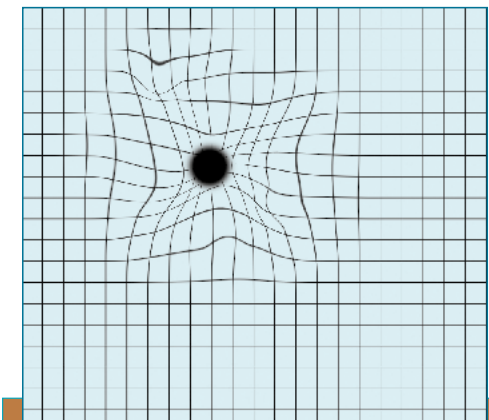
Important: These vision tests do not replace the regular check-ups at the ophthalmologist recommended for diabetes patients! This is because disease-related eye damage may already be present, even if no visual problems have yet become apparent.

Quick test for home: Amsler Grid Test

The function of the macula can be easily checked within your own four walls by using the **Amsler Grid Test** .



Normal vision



Dark spot/distorted vision

The chequered square (Amsler Grid) required for the test and a description have been enclosed with this brochure.

It can be reordered by telephone by ringing +49 (0)911 27312100.



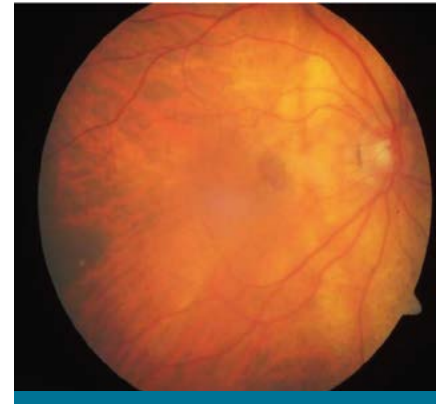
Taking a closer look: eye examinations

An **examination of the ocular fundus (ophthalmoscopy)** once a year is one of the regular check-ups for diabetes patients. This painless examination reveals vascular changes, deposits and bleeding on the retina. As the doctor uses special eye drops to “dilate” the pupil in order to achieve an optimal view of the retina, the eyes will react very sensitively to glare. Patients are therefore not allowed to ride their own bicycle or car for several hours.

Tip: Bring sunglasses to the appointment.

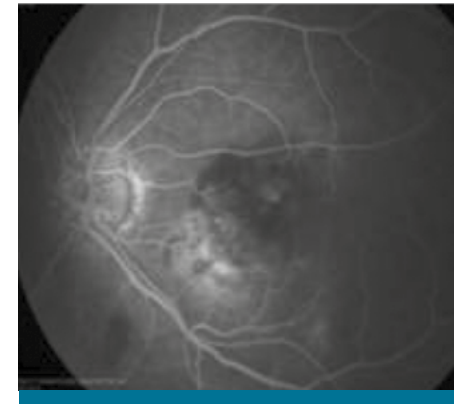
Examinations depending on the course of the disease

If retinopathy is already present, more extensive and often more frequent ophthalmological examinations may be considered. These include, for example, **fluorescence angiography** for imaging the retinal vessels using a yellow dye injected into the arm vein or **optical coherence tomography (OCT)**, which – similar to an ultrasound examination – provides a view of the individual layers of the retina (see images on the right).



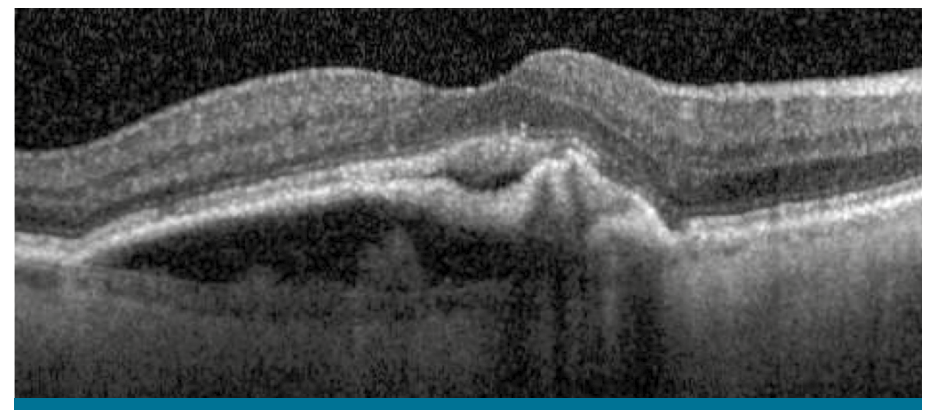
Ophthalmoscopy

Image of the ocular fundus (retina) – direct vision



Fluorescence angiography

Exact image of the retinal vessels – direct view



Optical coherence tomography (OCT)

Image of the layers of the retina – cross-section



Improving vision: options for treating damage to the eyes

Optimally adjusted **blood sugar, blood fat and blood pressure levels** as well as abstaining from smoking form the basis for treating late complications associated with diabetes. The specific treatment of diabetic retinal damage then depends on the stage of the disease. Two treatments in particular can help improve visual function and/or prevent vision loss: **Injection and laser treatments.**

Treatments by injection with growth inhibitors

Especially in cases of impaired visual acuity due to proliferative retinopathy (PDR) or diabetic macular edema (DME), **special eye injections** into the vitreous humour of the eye can improve the symptoms. The “eye injections” carried out under local anaesthetic contain VEGF inhibitors, which inhibit precisely the growth factor that promotes the formation of new blood vessels in the eye as well as vascular permeability and thus oedema.



Virtually painless: Don't be afraid of an eye injection!

Granted: The thought of getting an injection in the eye is unpleasant at first. Thanks to local anaesthesia with special eye drops, you will notice almost nothing – the procedure, which has been established for more than ten years, is considered almost painless and safe. The injections are performed exclusively by specially trained and regularly instructed ophthalmologists in a sterile surgical area of their practice or clinic.





How VEGF inhibitors work

The abbreviation VEGF refers to a growth factor (vascular endothelial growth factor) that promotes the formation of new blood vessels.

If new, leaking vessels form, this can lead to fluid accumulation (oedema) in the eye.

VEGF inhibitors block this growth factor and can lower the risk of unwanted blood vessels and oedemas from developing in the eye.

Some of the damage that has already occurred can possibly be reversed with these substances: pathological vascular growth and the accumulation of fluid can be reduced through treatment, and in an ideal case scenario, vision can even be improved!

Retinal laser therapy

Laser procedures are primarily considered when new, diseased blood vessels in the eye have formed in the peripheral areas of the retina (proliferative retinopathy).

With the concentrated light beam, the doctor can shrink unwanted new blood vessels and block leaking blood vessels and can also destroy retinal cells.

One of the effects of laser therapy is that less VEGF is produced.

In more than half of all cases, this treatment can prevent vision loss from progressing further.



Vision problems lower the quality of life

Some people already feel impaired when at some point in the second half of life there is no way around classic reading glasses. This example gives an idea of the extent to which disease-related visual impairments affect people with diabetes. Because this is about much more than a few illegible lines. With declining eyesight, not only does independence decrease but also the already reduced quality of life of diabetes patients. Driving a car, watching television, going to the cinema or reading – at some point in time, all these things no longer work with advanced eye damage.

Unfortunately still a taboo: daily impairments

The more their eyesight diminishes, the less they are confident in themselves. Some then retreat because they do not want to burden others or have the feeling that they are excluded because of their limitations. Sharing experiences with other patients helps to strengthen self-confidence and to cope better with everyday life (see addresses on pages 50–51).





Useful aids for daily life

Simple everyday things make it easier for diabetes patients to cope with their disease – starting with the right socks, good skin care and suitable visual aids.

› Taking good care

Special skin care products with the active ingredients urea and lactate, with ceramides or carnitine protect the particularly sensitive skin of diabetes patients from drying out and from infection by fungi or bacteria.

TIP: Ask at your chemist's for suitable preparations

› Focus on feet

The feet are a sore spot in people with diabetes (calluses, injuries or pressure sores). Check your feet daily for pressure points or injuries, go for monthly medical foot care and look for suitable (possibly orthopaedic) shoes.

TIP: Use moisturising foot creams

› Keeping sight of things

There are many different types of visual aids (e.g. reading magnifiers) that can be

adapted to the needs of patients.

TIP: Available at the medical supply store or optician

› Dressed to perfection

Special shirts, undergarments and socks with soft cuffs have a disinfecting and healing effect thanks to the incorporated silver or soya fibres.

TIP: Ask at the medical supply store



Eating with pleasure

The times when diabetes patients had to strictly follow diets are fortunately a thing of the past thanks to modern treatment methods. But there are still exceptions: Those who inject a fixed amount of insulin before meals must keep an eye on their carbohydrate intake and calculate it per **bread unit (BU)**. This is the unit of measurement for carbohydrates (i.e. sugar, starch, etc.) in food. One BE corresponds to 12 grams of carbohydrates.

Calories to weight and nutrient ratio

Nowadays, patients with insulin pumps, needs-based individual insulin therapy or purely medicinal treatment do not have to miss out on the good things in life. For them, what counts above all is a diet adapted to their **calorie requirements** in the right **nutrient ratio** and the **loss of excess pounds**. The **glycemic index**, which shows the effects of food on blood sugar, also plays an important role.



Choosing food according to the glycemic index

The lower the **glycemic index (GI)** of a food is, the less insulin the body has to provide.

Here are some examples for an optimal food choice:

- › Whole grain products (whole grain bread and noodles, brown rice, oat flakes), dairy products, eggs, leafy and cabbage vegetables, pulses, apples, pears

However, avoid the following foods with high GI:

- › White flour products, chocolate muesli, corn-flakes, boiled potatoes and products made from them (e.g. dumplings, purées), canned fruits, cocoa drinks, starch/sauce thickener

Questionable choice: Products for diabetes patients

Food for people with diabetes has become the subject of much criticism. This is because they usually not only cost more than other products, but also often contain more calories and fat than comparable standard foods. The fructose added instead of household sugar in many cases is also suspected of promoting overweight.

Professional advice helps

As a diabetes patient, it is imperative that you take advantage of sound nutritional advice – speak with your doctor!



Helpful addresses and websites

› **Deutscher Diabetiker Bund e. V.**

Käthe-Niederkirchner-Straße 16,
10407 Berlin, Germany
Telephone: +49 (0)30 420 824 98-0
info@diabetikerbund.de
www.diabetikerbund.de

› **diabetes.DE – Deutsche Diabetes-Hilfe**

Albrechtstraße 9, 10117 Berlin, Germany
Telephone: +49 (0)30 201 677-0
info@diabetesde.org
www.diabetesde.org

› **Deutscher Blinden- und Sehbehindertenverband e. V. (DBSV)**

Rungestraße 19, 10179 Berlin, Germany
Telephone: +49 (0)30 285 387-0
info@dbsv.de
www.dbsv.org

› **Blickpunkt Auge – Rat und Hilfe bei Sehverlust**

www.blickpunkt-auge.de/kontakt.html

› **PRO RETINA Deutschland e. V.**

Kaiserstraße 1 c, 53113 Bonn, Germany
Office:
Mon–Thur 8.00 a.m. – 4.00 p.m.,
Fri 8.00 a.m. – 2.00 p.m.
Telephone: +49 (0)228 227 217-0
info@pro-retina.de
www.pro-retina.de

› **Stiftung Auge der DOG –**

Deutsche Ophthalmologische Gesellschaft e. V.
Platenstraße 1, 80336 Munich, Germany
Telephone: +49 (0)89 5505 768-28
info@stiftung-auge.de
www.stiftung-auge.de

› **Internet**

www.bewahren-sie-ihr-augenlicht.de
www.augeninfo.de
www.ratgeber-makula.de



**To learn more, please visit:
www.ratgeber-makula.de**



A brochure
is also
available for
download
here:

