



Stargardt's disease (fundus flavimaculatus)

Stargardt's disease (also called Stargardt's macular degeneration or Stargardt's macular dystrophy) is a rare inherited eye condition which affects the central area of the retina called the macula. It is also sometimes called fundus flavimaculatus. It affects about 1 in 10,000 people.

Stargardt's disease is sometimes called a juvenile macular dystrophy since it tends to first appear between the ages of 10 to 20 although visual impairment may not be apparent until as late as ages 30 to 40.

Stargardt's disease causes parts of the macula to stop working, leading to problems with central vision, detailed vision and sometimes with colour perception.

How the eye works

Light passes through the cornea at the front of your eye, and is focused by the lens onto your retina. The retina is a delicate tissue that lines the inside of your eye. The retina converts the light into electrical signals that travel along the optic nerve to your brain. The brain interprets these signals to "see" the world around you.

Light from the object you are looking at directly is focused onto a tiny area of the retina called the macula at the back of the eye. The macula is about 4mm across and is responsible for detailed central vision and most colour vision. It provides the vision you need to read, recognise faces, drive a car, see colours clearly, and any other activity that requires detailed, fine vision. The rest of the retina gives you side vision (peripheral vision).

The genetic cause of Stargardt's disease

It is now clear that Stargardt's disease is caused by a faulty gene (a 'mutation'). The first gene mutation responsible for Stargardt's disease was discovered in 1997. Since then several other gene mutations have been discovered that can cause the disease.

Genetic inheritance

Genes are basically the body's set of instructions on how the body should develop. We all inherit two sets of genes, one set from each of our parents, and we each pass on one of those sets of genes to our children. These sets of genes 'lie' in pairs (one from each parent) and they determine our traits - the many things which make us individuals, such as hair or eye colour, or whether we get certain genetic conditions. There are two ways a trait can be passed through genes to children - by a dominant pattern or a recessive pattern.

Difference between dominant and recessive traits

A dominant trait only needs to be inherited from one parent. With this type of inheritance, only one copy of the gene is needed. When a dominant gene from one parent is paired with a recessive gene from the other parent, the dominant gene 'switches on' the trait. It is 'dominant' over the other (recessive) gene inherited from the other parent and the child will have that dominant trait.

With recessive traits, two copies of the gene are needed, meaning both parents have to carry and pass on a copy of the recessive gene. When this happens, the recessive trait will be 'switched on' and the child will have that recessive trait.

How Stargardt's disease fits into these patterns

Stargardt's disease has a recessive pattern of inheritance in 90% of cases. This is most commonly due to a mutation in the ABCA4 gene. When two people who carry the faulty Stargardt's disease gene have a child then that child may have Stargardt's disease.

Usually people who carry the Stargardt's disease gene do not have the disease since a 'normal' copy of the gene from their other parent has switched off the 'faulty' gene. This means that Stargardt's often occurs in families that have no history of the disease in the past. This also means it is highly unlikely that someone with Stargardt's disease will pass on the disease unless their partner also has the disease or is a carrier of the 'faulty' gene.

Recently, a rare dominant version of Stargardt's has also been identified in the ELOVL4 gene.

Tests are available to determine which gene mutation is causing the disease. People with Stargardt's may also wish to be entered onto the Australian Inherited Retinal Disease Register and DNA Bank - phone (08) 9346 2866, located at Sir Charles Gairdner Hospital in Perth .

Changes to the eye with Stargardt's disease

The 'normal' version of the most common Stargardt's gene provides instructions to make certain proteins in the retina that are involved in the removal of toxic waste products. However, in someone with Stargardt's disease, the 'faulty' Stargardt's gene gives incorrect instructions which prevent the protein from removing these toxic substances. These toxic substances gradually build up, damaging and eventually killing cells in the macula.

There are two main findings on the retina of people with Stargardt's disease. First, there is often an oval-shaped lesion, often referred to as 'beaten bronze' in appearance, around the macula. This lesion tends to deteriorate over time and causes changes in the way the cells of the macula are able to work. This leads to a loss of visual acuity, meaning people's vision becomes less sharp.

The second change involves yellowish flecks which surround this lesion. Sometimes people have just these flecks without the macular lesion. These people used to be diagnosed with fundus flavimaculatus. However, some researchers believe that these

two problems, the macular lesion and the yellow flecks, are both caused by the gene which causes Stargardt's disease and therefore are different versions of the same genetic problem. It has also been suggested that fundus flavimaculatus and Stargardt's disease vary in age of onset and severity where fundus flavimaculatus may appear in the 20's and 30's and vision may be more severely affected.

Effect on vision with Stargardt's disease

Stargardt's disease mainly affects the macula and hence central vision. At first Stargardt's disease will make the central vision unclear and then sometimes distorted or blurred. As the disease progresses, a blank patch may appear in the centre of vision.

Stargardt's disease does not affect other parts of the retina so does not normally affect peripheral or side vision. Since we use our peripheral vision when we are moving around, most people with Stargardt's disease can manage to move about on their own, albeit with some difficulty.

Stargardt's disease can also cause problems such as glare and difficulties adapting to changing light conditions.

Stargardt's disease does not appear to have any effect on general health. Life expectancy is normal.

Treatments for Stargardt's disease

There is currently no treatment for Stargardt's disease.

Researchers have reported that exposure to ultraviolet light may cause further retinal damage. It is therefore recommended that wearing sunglasses with UV protection that conforms to Australian Standards and a hat with a wide brim can protect individuals from the sun's damaging ultraviolet rays.

In rare cases, new, leaky blood vessels can form under the retina, leading to sudden and significant vision loss. This is known as neovascularisation. Neovascularisation can be treated with the use of injections of an anti-VEGF agent, usually with considerable success.

In general, the same dietary recommendations that are made for the age-related form of macular degeneration apply to people with Stargardt's disease. Eat a healthy, balanced diet, including fish two to three times a week, include leafy greens daily, a handful of nuts a week, and include low glycemic index ("Low GI") carbohydrates in preference to high GI carbohydrates whenever possible. A supplement containing lutein and zeaxanthin may also be considered, in consultation with your eye specialist. Minimise the amount of fats and oils in the diet, exercise regularly and maintain a healthy weight.

There is no specific evidence that supplements based on the Age-related Eye Disease Studies (AREDS and AREDS2), which are commonly recommended for age-related macular degeneration, are of any benefit for Stargardt's disease.

Research has shown that supplementation with excessive amounts of vitamin A

should be avoided in Stargardt's disease as gene mutations may lead to abnormal synthesis of the vitamin in the eye, resulting in increased loss of vision. The normal recommended dietary allowance of vitamin A should not be exceeded.

Future developments

Significant research is taking place in this area, with several new drug candidates showing promise. In particular, several new "gene therapy" treatments are being developed which will hopefully enable the insertion of the 'correct' genes which can negate the effect of the faulty genes.

In addition, a substantial amount of research is taking place with stem cell therapy; human stem cell studies with Stargardt's disease have recently commenced. It is hoped that stem cell treatment may ultimately be able to replace damaged retinal cells.

Managing vision loss

Although the long term progression of the disease is variable, unfortunately most people with Stargardt's disease eventually develop very poor vision, which may be categorised as 'legal' blindness. Note however that Stargardt's disease does not cause total or 'black' blindness as peripheral vision is still maintained.

When managing vision loss, a key priority is maintaining quality of life and independence. Contacting a low vision organisation can be helpful as they can work with you to assess your individual needs and determine which aids and technologies can help. There are many excellent solutions to help people live well with low vision.

Contact Macular Disease Foundation Australia to discuss your low vision needs and to receive free information on low vision.



Our focus is your vision

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