

# Colour Vision Deficiency

## What is CVD?

In the human eye there are 7 million receptors at the back of the eye for detecting colour. They are called cones, and there are 3 types, each type detecting a different wavelength (colour) of light. We have cones to detect Red , Green and Blue.

Every colour we see can be perceived by us, by light stimulating the 3 different cone types in our eyes by different amounts. This is the same as how TV's works.

Some people are born with one or more of these cone types missing altogether, or with a reduced number of one cone type. This is called Colour Vision Deficiency (CVD) or more commonly, colour blindness.

If a person has only one type of cone in their eye instead of 3, they are said to be Monochromatic. This is the most severe type of CVD and is fortunately very rare. These people see the world in shades of one colour.

If one cone type is missing (they only have 2 types left), the person is said to be a Dichromat. These people only have 2 cone types to interpret colour with, therefore there are many colours that they will not be able to distinguish between. The colours they have difficulty with will depend on the cone type missing.

Lastly, if only some of one cone type are missing (the person has a reduced number of one type) they are said to be an

Anomalous Trichromat. This is the most common and least severe type of CVD.

The above classifications can let us establish how much difficulty someone will have with deciphering between different colours, but we can further classify it by working out which colours they'll have difficulty with.

If **Red** cones are missing it's called **Protan**.

If **Green** cones are missing it's called **Deutan**.

If **blue** cones are missing it's called **Tritan**.

**Protan** and **Deutan** are the most common types of CVD and they experience difficulty deciphering between very similar groups of colours.

They might have difficulty seeing the difference between;

grey & violet  
green & brown  
green & red  
red & brown  
violet & blue  
orange & yellow

**Tritan** CVD is very rare and these people have difficulty seeing the difference between;

blue & yellow  
navy & black  
yellow & white  
black & violet

## How do I find out if I have a CVD?

It is very easy to find out if someone has a CVD using a simple and quick check at your Opticians. The Optometrist can easily find out whether or not you have a CVD and which colour type it is. To accurately measure the severity of any CVD this would require more extensive tests usually performed by your local hospital via your Optometrist.

## Why do people have CVD?

### **Inherited CVD**

The vast majority of CVD's are inherited. The gene which decides your colour vision is linked to the gene that decides if you're male or female, these are called X and Y chromosomes. Men have 1 X and 1 Y chromosome and women have 2 X chromosomes. The CVD gene is on the X chromosome. Women are less likely to inherit CVD because if they have one faulty X chromosome from one parent, they usually also have a normal X chromosome from their other parent which suppresses the faulty gene.

For a woman to have CVD both her parents therefore must also have it. For men CVD usually skips a generation from grandfather to grandson via the mother.

If one of your parents have a CVD you will have a 50:50 chance of inheriting it.

Approximately 8% of men and  $\frac{1}{2}$ % of women have Protan or Deutan CVD.

Tritan is a much rarer gene but is very dominant. This means that men and women are equally affected.

When CVD is inherited, it stays the same throughout life and each eye is affected equally. It does not affect your clarity of vision.

### **Acquired CVD**

CVD can also be acquired. Some eye conditions can lead to CVD, these include Dystrophies of the eye, Optic Neuritis, Age-related Macular Degeneration, Vascular disorders and Glaucoma.

These CVD's are normally Tritan and their severity varies greatly person to person and day to day. They can also affect your clarity of vision.

### Everyday Colour Vision Problems

The degree to which CVD may affect you day to day depends on its severity, ranging from a disability to an inconvenience. Problems may include;

Selecting coloured goods

Clothes, thread, decorating materials like paint & wallpaper

Judging the ripeness of fruit

Tomatoes and apples

Identifying plants with similarly shaped leaves

Choosing wood stains

Judging when meat is cooked

Judging if young children are sunburned, or if they have pallor due to ill health

Adjusting colours on T.V. strangely

Colour coded maps

British Ordnance Survey maps & Underground maps

Some sports

Difficulty seeing the brown ball in snooker, or identifying different team players

Colour codes

Electrical wiring, coloured numbers and letters in schools to aid learning

Chemistry

The colour of substances and changes of colour in chemical reactions

Diabetics

Difficulty reading coloured scales for glycosuria levels

## **Driving**

Having a CVD does not prohibit you from driving a private vehicle in this country.

However most people with CVD will experience some problems when driving;

Distinguishing road traffic signals

Traffic lights are seen more for their sequence than the colour, which can make driving in foreign countries with different sequences confusing

Confusing street lights with traffic lights,

About 1/3<sup>rd</sup> of people with CVD are insecure driving at night in areas with many street lights

Small sodium street lights confused for red stop lights

Distinguishing between red and green 'cat's-eyes'

Seeing signs with brown backgrounds,

Signs denoting places of historic interest

Slower reaction times to red tail lights and stop lights,

Protans have the most difficulty here and are more likely to have an accident due to this than other drivers, due to their reaction distance being as much as halved.

However, drivers with CVD have been shown to be involved in fewer accidents overall, possibly because they learn to be much more cautious drivers.

In the UK it is recommended that drivers of public service vehicles such as ambulances and buses should have normal colour vision. Some countries also ban Protans in particular from driving heavy goods vehicles, and even private vehicles in Austria and Romania.

### Careers Advice

Most People with CVD are detected at routine school screening by the school nurse. By knowing this at a young age you can influence your child by steering them away from professions which require good colour vision to avoid future disappointment and frustrations. The following is a list of careers which, at the moment, require perfect colour vision;

#### The Armed Forces

This includes Navy, Air Force, Army, Marine services, Pilots, Engineers and vehicle drivers.

Merchant Navy officers and seamen

Customs and excise officers

Civil aviation

This includes Airline pilots, Engineers, Airport technical and maintenance staff, Air traffic controllers.

Railways

This includes Train drivers, Engineers and maintenance staff.

Electrical and Electronic engineers

Hospital laboratory technicians and Pharmacists

Police and Fire service officers

Workers in paint, paper and textile manufacture - or in photography and fine art reproduction

Workers in industrial colour quality assurance.

There are also many professions for which CVD may be a difficulty but not prohibition and may depend on the persons severity of CVD.