What is the eye's centre of rotation?

A special point in the eye plays more than a secondary role in the production of ZEISS spectacle lenses.

Did you know that a special point in the eye – its centre of rotation – plays a key role at ZEISS in the optimisation of precision spectacle lenses? This can be of decisive importance in determining the visual comfort offered to the wearer with his or her new lenses.

Many individual parameters or measuring points are important when fitting lenses into a spectacle frame. They determine how natural the wearer's vision will be and how fast he or she can adapt to their new lenses. These parameters include, for example, the back vertex distance, the distance between the pupils, the viewing height, the tilt of the lenses in the frame, and the wrap or curvature of the frame. However, there is one point in the eye that is not directly measured by your optician. The eye's centre of rotation is a further parameter that is taken into account in the production of ZEISS precision lenses.

At ZEISS this value is calculated using a complex algorithm. It was first incorporated in the production of spectacle lenses in 1970 and has been constantly enhanced and optimised in ZEISS lens designs ever since. This is only possible by collecting a large volume of datasets from wearers – more than 500,000 in all!

The eye's centre of rotation indicates at what point the eye rotates behind the lens during the visual process!

Why is the eye's centre of rotation particularly important for the wearer?

The incorporation of the eye's centre of rotation in the lens design is of special significance for wearers who need high prescription lenses. It optimises vision and makes it more natural and more
comfortable. This point is additionally important for the production of progressive lenses. And it is an absolute must for the production of progressive lenses using freeform technology at ZEISS. It is one of the pieces of the jigsaw that determines how comfortably the wearer's eyes can glide between the various viewing ranges for near, intermediate and far vision.

ZEISS constantly rechecks the calculation of the algorithm with the aid of data from a large number of eye examinations. This is all supported by the medical expertise and experience of colleagues from Carl Zeiss Meditec AG. It varies within a small range of millimetre dimensions and is calculated for each individual wearer’s prescription.

Centre of rotation (Z') for eyes with normal vision
As its name suggests, the eye’s centre of rotation is right in the middle of the eye.

\[ Z' = \text{eye’s centre of rotation} \]
\[ e = \text{corneal back vertex distance} \]
\[ b' = \text{vertex-centre of rotation distance} \]
\[ b^* = \text{cornea-centre of rotation distance} \]

Change in the position of the eye’s centre of rotation in shortsighted eyes:

Short-sightedness, or myopia, usually results if the eyeball is too "long". A deviation of as little as 1 millimetre can result in myopia of around 3 dioptres. This means the eye turns differently around its centre of rotation and therefore also views differently through the lens.

Change in the position of the eye’s centre of rotation in longsighted eyes:
In long-sightedness, or hyperopia, the eyeball is too "short" and images a distant object behind the retina. A blurred image is the result. Once again, this means the eye turns differently around its centre of rotation and therefore also views differently through the lens.

**The eye’s centre of rotation also plays an important role in astigmatism.**

The astigmatic eye images the world in two focal lines which are located at different distances either both in front of or both behind the retina, or one in front of and one behind the retina in each case. At the centre between the two focal lines the image is blurred and does not have any preferred direction: the term "mean sphere" is used to describe this. This mean value is used to calculate the eye’s centre of rotation that is then incorporated in the calculation of toric lenses (lenses with different optical power and focal length in two orientations perpendicular to each other).

The centre of rotation therefore depends on the type of visual defect present and applies to each individual eye. Thus, it will not change, for the individual eye in the presence of associated phoria – an image positional error attributable to a deviation of the two visual axes from each other that requires considerable effort from the person affected in order to avoid double images. Prismatic lenses can correct associated phoria and therefore enhance visual comfort.

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**The ZEISS Online Vision Check**

How well do you see contrast and color? Check your vision quickly and simply here!

Start Eyesight Test Now!

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**At a glance:**

Did you know that in addition to the quality and accuracy of lens design calculation, the exact values measured during refraction and centration are also of decisive importance? Up to 40% of visual performance can be lost due to inaccurate centration. Further information…
Your glasses fitted to you

My Vision Profile
Determine your personal visual habits now and find your individualised lens solution.

Check Your Vision Profile Now!

Find a ZEISS Optician Near You

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