Understanding Vision Oct 16, 2017

What is the eye's center of rotation?

A special point in the eye plays a big role in the production of ZEISS eyeglass lenses.

Did you know that a special point in the eye – its center of rotation – plays a key role at ZEISS in the optimization of precision eyeglass lenses? This can be very important to 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 an eyeglass 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 center 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 eyeglass lenses in 1970 and has been constantly enhanced and optimized 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!

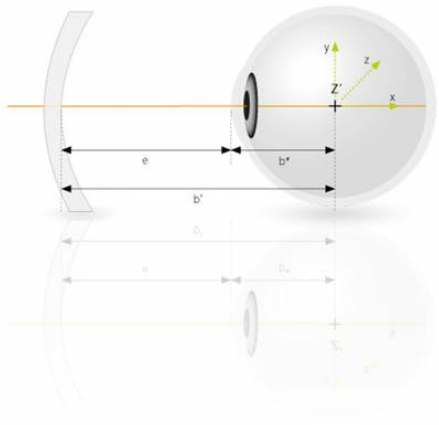
The eye's center of rotation indicates at what point the eye rotates behind the lens during the visual process!

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

The incorporation of the eye's center of rotation in the lens design is of special significance for wearers who need high prescription lenses. It optimizes vision and makes it more natural and more comfortable. This point is even more 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 puzzle that determines how comfortably the wearer's eyes can glide between the various viewing ranges for near, intermediate and far vision.

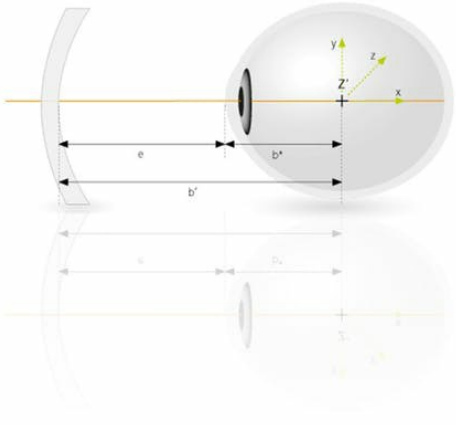
ZEISS constantly rechecks the calculation of the algorithm with the aid of data from a large number of eye examinations. This is all supported by the medical expertise and experience of colleagues from Carl Zeiss Meditec AG. It varies within a small range of just a few millimeters and is calculated for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



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

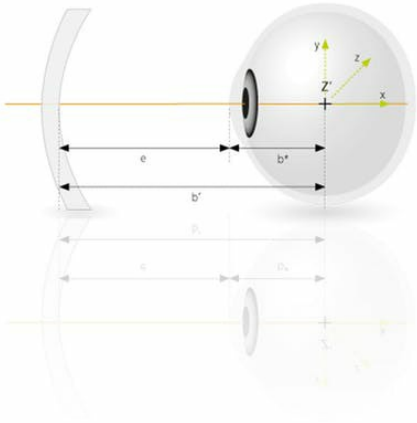
Z' = eye's center of rotation
e = corneal back vertex distance
b' = vertex-center of rotation distance
b* = cornea-center of rotation distance

Change in the position of the eye's center of rotation in nearsighted eyes:



Near-sightedness, or myopia, usually results if the eyeball is too "long." A deviation of as little as 1 millimeter can result in myopia of around 3 diopters. This means the eye turns differently around its center of rotation and therefore also sees differently through the lens.

Change in the position of the eye's center of rotation in farsighted eyes:



In far-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 center of rotation and therefore also sees differently through the lens.

The eye's center 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. At the center 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 center 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).

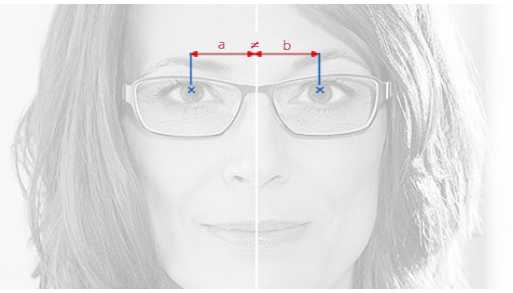
The center of rotation therefore depends on the type of visual defect present and applies to each individual eye. Thus it will not change for the individual eye in the presence of "associated phoria" – an image positional error attributable to a deviation of the two visual axes from each other that requires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

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

Single PD | Reading distance | Viewing height | Frame tilt | Back vertex distance | Wrap angle



Single PD

The single PD is the exact distance from the center of each pupil to the centre of the frame. Accurate measurement of this parameter often reveals that a wearer's face is asymmetrical.

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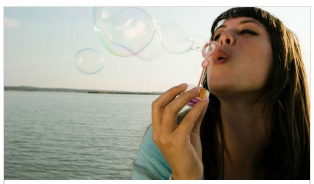

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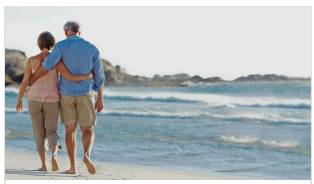

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