The Revolution in Lens Design

Markus Wiederspahn

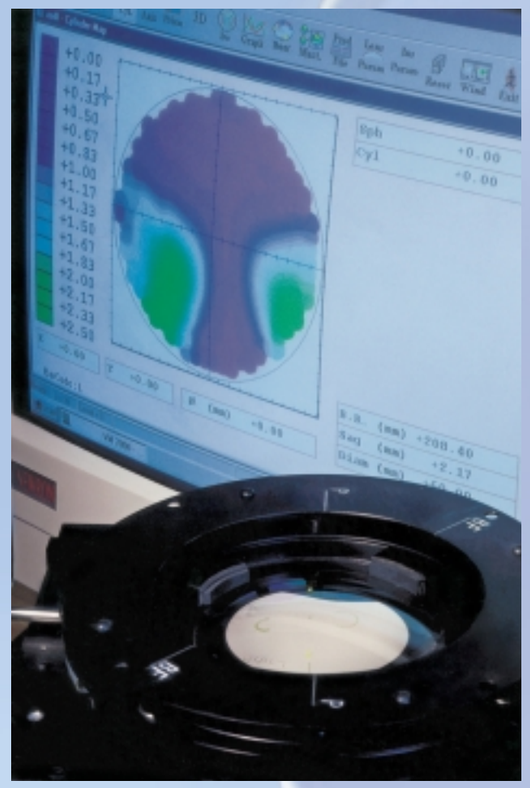
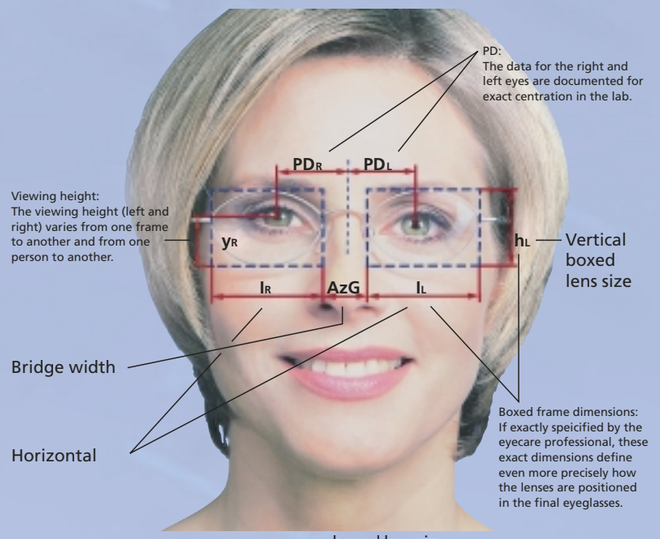


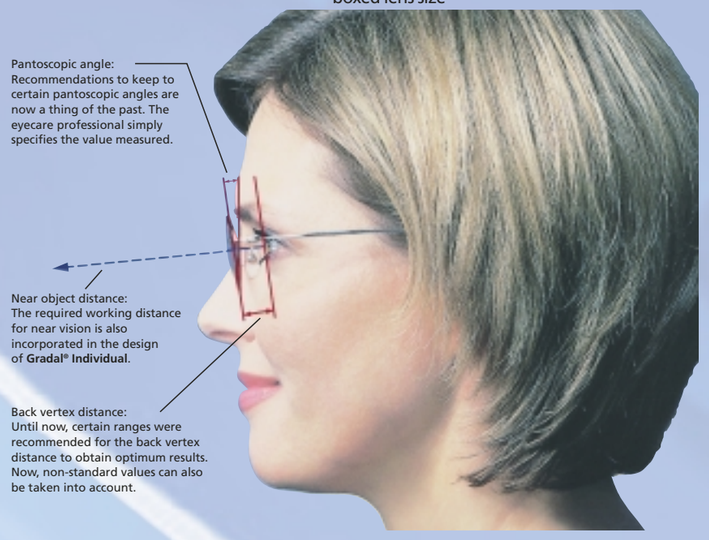
Fig. 1:
Measurement of the progressive surface in the wave front sensor.

Until now, it has not been possible to take the individual parameters of the eyeglass wearer into account, e.g. distance between the eyes, reading distance, fit of the frame in front of the eyes, in the design of progressive lenses. This is all a thing of the past with ***Gradal® Individual*** *– the progressive lens that has truly revolutionized the world of ophthalmic lens design. This innovative development can increase the ranges of vision enjoyed by the wearer by up to 100 % – this means faster adaptation and markedly enhanced wearing comfort. The unique, new concept embodied in* ***Gradal® Individual*** *has been implemented through the use of totally new, state-of-the-art production technology, highly complex mathematical procedures and new methods of quality assurance.*

Focus on perfection

As far back as 1983, Carl Zeiss introduced a progressive lens with the name **Gradal® HS** that set new standards in wearer tolerance and wearing comfort: in the development of the progressive lens design, Carl Zeiss took into account the physiological processes of vision, and of binocular vision in particular. The aim was to ensure that, also in lateral vision, the images obtained by the two eyes





Figs 2a and 2b:
Profile and frontal view of the eyeglass wearer.

should also fuse to form a single impression in the brain – an important requirement for rapid wearer adaptation and the tolerance of progressive lenses.

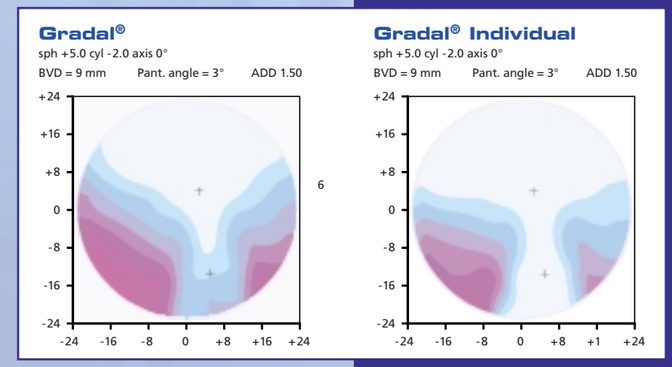
In the past, despite constant enhancement of their properties and the extension of their fields of application and versions, progressive lenses were unable to fully meet the personal requirements of each individual wearer. The reason: instead of exact data on the position of the lenses in front of the eyes, such as interpupillary distance, back vertex distance and pantoscopic angle (the tilt of the eyeglass frame), statistical mean values were used in the computation of the lenses.

Individuality with a capital I

For the very first time, **Gradal® Individual** takes all of this information into account in the progressive lens design. This is also why exact lens fitting is an absolute must. Unlike traditional progressive lenses, the optimization process is now conducted for every individual dioptric power, and not for a whole group of powers.

In the implementation of this design, extensive demands were made on the production process and quality assurance. While the serial production of lens blanks was possible to some extent in the past, the individually computed design must now also be produced as an individual lens. Our cooperation partner in this project, the firm Schneider, Steffenbach, developed special CNC processing machines which turn the extensive set of data into a finished product in a matter of minutes.

A further challenge was posed by the quality control of these unique lenses. In high volume production of progressive lenses, spot checks were still adequate. The totally customized design of **Gradal® Individual**, however, requires fast and at the same time precise measurement of the entire progressive surface. Here, a totally new measuring principle is used in the form of a wave front sensor. Light emitted by a white light source passes through a perforated stop lying in front of the lens and is split up into hundreds of parallel light rays over the entire lens surface. A detector records the deflection of each individual ray through the lens. Using software developed by Carl Zeiss, the lens power in the ray path experienced by the wearer during actual use of the eyeglasses is computed in a few seconds and compared with the nominal values of the surface computation.



in short

For reasons dictated by the laws of physics, progressive lenses display areas in which only blurred vision is possible. These lie beside the progression zone and are only noticed in extreme lateral vision. These zones are shown in various shades in the illustration: the darker the color, the more severe the aberrations. The parameter used for the illustration was the astigmatic error in the respective area of the lens.
The example simulates the power of a standard progressive lens in which the wearer's personal data measured in the fitting procedure have not been incorporated in the lens computation (left). Truly comfortable reading is not possible. On the right, the same lens with an individualized design. Markedly larger, aberration-free ranges of vision (shown in white) are evident along the progression zone and in the near zone in particular. Larger texts can also be read with effortless ease.

"I feel that Gradal® Individual from Carl Zeiss has been tailor-made for me in two different respects.

First, because it was made to meet my own very special requirements and second, because perfect vision at every distance means absolutely everything to me."

Peter Hebeisen, photographer in Paris, France