

Information

From the LowVision Specialists



Guidelines for the fitting
of telescopic systems

About a successful fitting

Eye care professionals dispensing telescopic spectacles must ensure they have successfully fitted and tested them with the visually impaired person beforehand.

The fitting

of telescopic spectacles takes place over several steps:

- Anamnesis
- Refraction and visual acuity testing
- Choice of the telescopic system
- Optical and anatomical fitting
- Dispensing and familiarisation

A detailed anamnesis significantly eases the fitting of any magnifying visual aid and prevents wrong fittings or fittings which ignore the requirements of the patient. It also is the basis for the choice of the magnifying visual aid. Considerable instinct and sensitivity is demanded from the eye care professional.

This brochure mainly describes the optical and anatomical fitting of telescopic spectacles.



The differences between Galilei and Kepler systems

The systems primarily differ in terms of their design. While Galilei systems consist of a converging and a diverging lens and create an upright image, Kepler systems are made from two positive lenses and use prisms to reverse the inverted image and to shorten the system.

The specific advantages of the different systems are described on the following page.



The differences between Galilei and Kepler systems



937185 1,8x
Field of view 23°; 13 g



937215 2,1x
Field of view 20°; 15 g



937255 2,5x
Field of view 18°; 20 g



937275 2,7x
Field of view 13°; 30 g



931935 **Kepler 3x9**
Magnification 3x, field of view 12,5°, objective Ø 9 mm

931945 **Kepler 4x10**
Magnification 4x, field of view 10,0°, objective Ø 10 mm

931955 **Kepler 4x12**
Magnification 4x, field of view 12,5°, objective Ø 12 mm

932165 **Kepler 6x16**
Magnification 6x, field of view 10°, objective Ø 16 mm, black metal housing

■ Advantages of Galilei systems

- Light and unobtrusive
- Good contrast vision
- Large field of view
- Easy to use
- Exact centration

■ Advantages of Kepler systems

- Better image quality
- Higher telescopic magnifications possible
- Longer working distance
- Well-defined and evenly illuminated field of view
- Can be used for different distances by focusing

The right choice of the system

Amongst others the following criteria have to be considered when choosing the system for a user:

- Kind of visual impairment
- Residual visual acuity
- Remaining field of view
- Transparency of the ocular media
- Binocular or monocular vision
- Ability of the visually impaired person to use the visual aid

Following the determination of the data listed below, which are conditions for the successful fitting of a visual aid, it now is up to the fitting eye care professional to choose the optimum aid for the visually impaired person and to test this aid with them. However, the final decision which specific visual aid is suitable can only be made by the visually impaired person themselves on basis of a thorough consultation and intensive testing.

Conditions for the successful fitting of a visual aid

Determination of the following data:

- Distance visual acuity
- Visual acuity requirement
- Magnification requirement
- Reading ability
- Light requirement





The calculations at specific viewing distances

Galilei and Kepler systems in general are initially designed for infinity. For use at finite distances the systems have to be adjusted accordingly. Most Kepler systems can be focused on the viewing distance by turning the objective lens in a different position. As Galilei systems apart from a few exceptions are fixed focus systems an accommodation compensation lens is normally used on the ocular side or an appropriate front cap lens.

- Option 1
Calculation of the accommodation compensation

Accommodation compensation

$$\Delta A = \frac{\Gamma_{\text{System}}^2}{a_E} = \frac{\text{System magnification}^2}{\text{Viewing distance}}$$

This accommodation compensation is then offset against the distance correction.



■ Option 2
Adjustment of the viewing distance
with a front cap lens

It is possible to combine a basic front cap lens for the 'intermediate' viewing distance with a flip-up front cap lens as a magnifying lens for an additional 'reading' distance. This combined front cap lens has two viewing distances. The first lens adjusts the system to a medium viewing distance (2.0 m, 1.52 m or 1.0 m). This for example corresponds to the TV distance. With an easy flip mechanism the second lens can be added in front of the system. The system is now set up for near vision.

Front cap lens Basic (D)	Intermediate viewing distance (m)
0,50 D	2,00 m
0,66 D	1,52 m
1,00 D	1,00 m

$$\text{Viewing distance} = \frac{1}{D}$$



Front cap lens

Basic

938055 +0,50

938065 +0,66

938105 +1,00



The calculations of the total magnification

In order to use the system for near vision the object distance is shortened. With Kepler systems this is done by turning the objective lens in a different position or also the way done with Galilei systems by the addition of a magnifying front lens. These ways telescopic spectacles become telescopic magnifying spectacles. The total magnification with a magnifying front lens is calculated as follows:

Example calculation:

Magnification of the system: 2.10x
Magnification of the front cap lens: 1.25x

$$\Gamma'_{\text{total}} = 2.1 \times 1.25 = 2.625$$

Example calculation:

5 D front cap lens

$$\Gamma'_{\text{front cap lens}} = \frac{5D}{4D} = 1.25$$

Total magnification

$$\begin{aligned}\Gamma'_{\text{total}} &= \Gamma'_{\text{system}} \times \Gamma'_{\text{front cap lens}} \\ &= \text{system magnification} \times \text{front cap lens magnification}\end{aligned}$$

Magnification of the front cap lens

$$\Gamma'_{\text{front cap lens}} = \frac{D}{4D}$$

Consequently the viewing distance with telescopic magnifying spectacles is longer by the factor of the telescopic system magnification in comparison with microscopic magnifying spectacles of the same magnification.



The optical fitting of the telescopic spectacles

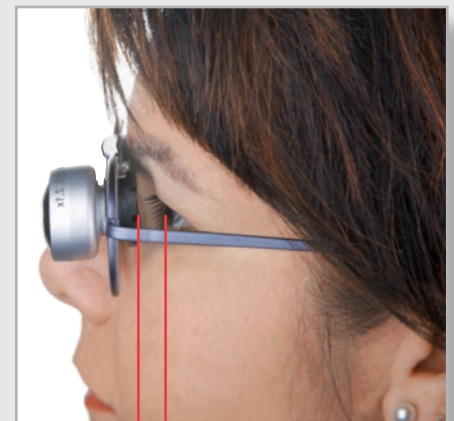
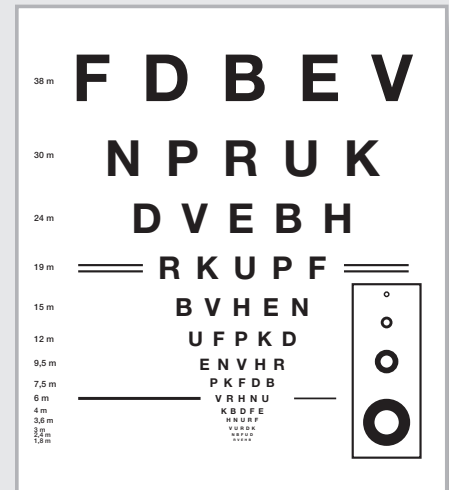
■ 1. Eye test at the viewing distance

First of all it is advisable to position the visually impaired person at the same distance from the eye test chart at which they will watch TV with the system (or at the regular viewing distance with the system). On the eye test chart they will be provided those optotypes which they are barely but still able to recognise at this distance with the earlier determined distance correction but without a magnifying visual aid.

■ 2. Fitting with the trial frame

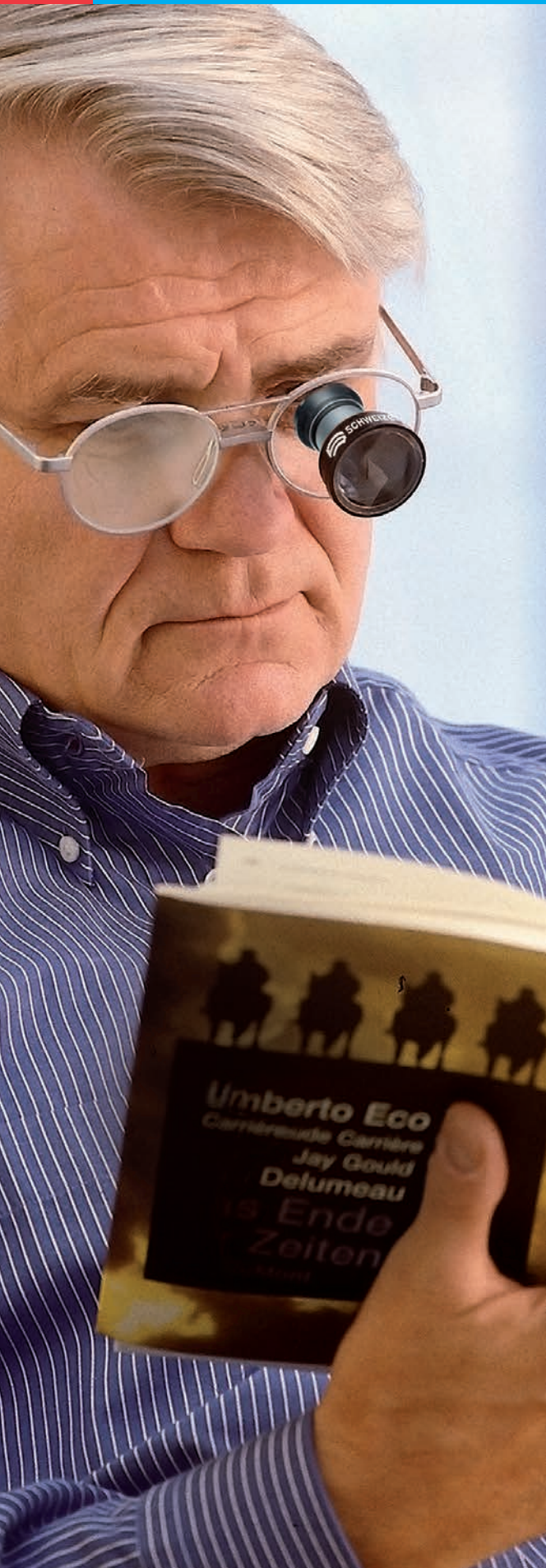
Depending on the achieved visual acuity, magnification requirement and field of view a telescopic system will now be added (monocular on the better eye). With Galilei systems (unless already adjusted to the shorter distance) the accommodation compensation has to be added on the ocular side in the trial frame. A Kepler system has to be focused on the viewing distance. Important are an exact centration and the Corneal Vertex Distance (CVD) to be as short as possible.

With this magnifying system an increase in visual acuity by about the factor of the system magnification can be expected. At this point a check of the earlier determined distance correction makes sense. As the visually impaired person now can recognise more visual acuity levels it is possible for them to give more precise responses. The additional trial lenses are added behind the system on the ocular side.



CVD as short as possible!





The optical fitting of the telescopic spectacles (continued)

■ 3. Eye test at the reading distance

With an added magnifying front lens it is possible to test the near vision reading right away. The power of the front lens depends on the determined magnification requirement for near vision and the 'total magnification' formula described before. With focusable systems the close distance can be set by turning the objective lens in the appropriate position.

■ 4. Testing the second eye

Insofar as the conditions are met, the same testing procedure is applied to the second eye. The examination of the binocular visual improvement for the distance vision is carried out with two telescope systems positioned in parallel under consideration of the same rules as those applying to the monocular test.

Please note:

The magnification (for both near and distance vision) generally has to be chosen as low as possible because the viewing distance, the field of view and the depth of focus decrease rapidly with increasing magnification.

The mechanical fitting of the telescopic spectacles

The mechanical fitting is at least as important as the choice and the optical fitting of the telescopic system.

It is carried out in three steps:

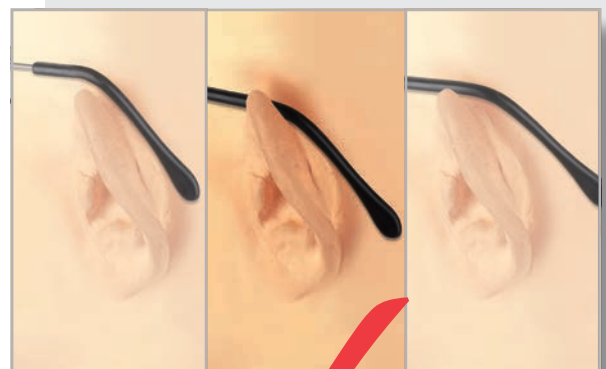
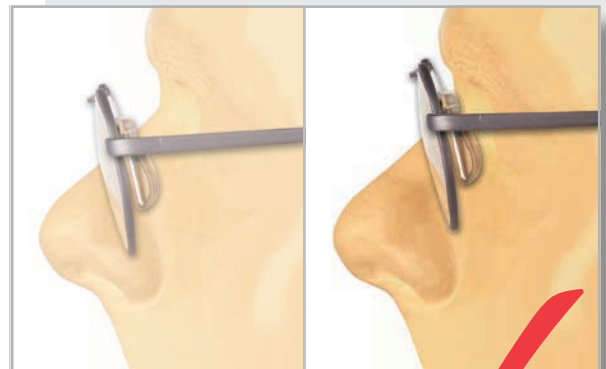
1. Choice of a suitable frame
2. Anatomic adjustment of the frame
3. Determination of the visual points

■ Choice of a suitable frame

When choosing the frame it is of utmost importance to ensure a good fit especially in the nasal area.

Medical requirements for telescope frames:

- The frame has to be adjustable to the anatomic conditions of the patient (fit, pantoscopic angle, temple length, visual points, etc.) in a way that ensures a comfortable firm hold and that also the optical correction requirements can be fulfilled in combination with the mounted optics.
- The material of the frame must not emit any toxic substances and has to be skin-friendly.
- The frame has to be designed in such a way that its shape remains unchanged after the adjustment.





935806 Titanium telescope frame
Titanium grey colour, matt, size 50-18-145



935576 Titanium telescope frame female model
Titanium grey colour, matt, size 51-19-145



935626 Titanium telescope frame male model
Titanium grey colour, pearlescent, size 50-19-145

The mechanical fitting of the telescopic spectacles (continued)

■ Choice of a suitable frame (continued)

The frame must not impose any risk of injury and all of its edges and/or surfaces must be rounded off.

Technical requirements for telescope frames:

- Compliance with current standards, laws and regulations
- Secure hold of the lenses
- Adjustable temple length
- The frame including all bridges, joints, etc. has to be designed in such a way that any strain during the adjustment and the correct use does not lead to damages of the spectacles
- Contact surfaces in the nasal area have to be adjustable and must not fall below the following values:
with a total weight of < 25 g at least 250 mm²
with a total weight of > 25 g at least 300 mm²

Note:

SCHWEIZER frames are available in numerous different designs, colours and frame sizes.

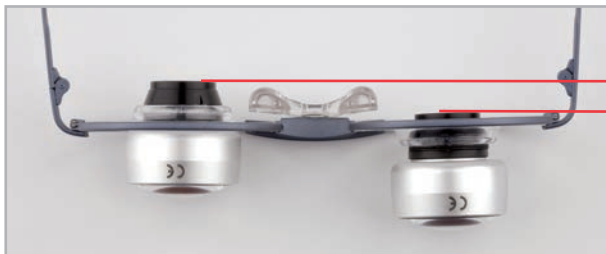
■ Anatomic adjustment of the frame

■ Shortest possible Corneal Vertex Distance (CVD)

Same as during the testing procedure the CVD has to be as short as possible. As a result the user can take the best possible advantage of the field of view of the system.

The system should be as close as possible to the eye but without the eyelashes touching the lens. Therefore SCHWEIZER offers different mounting lenses for the assembly of telescopic spectacles to ensure the optimum position of the system in front of the eye.

Already with the mounting lens it is possible to vary the CVD by up to 8,5 mm.



Change of
the CVD by
8,5mm!



932765 Standard mounting lens with mounting slot

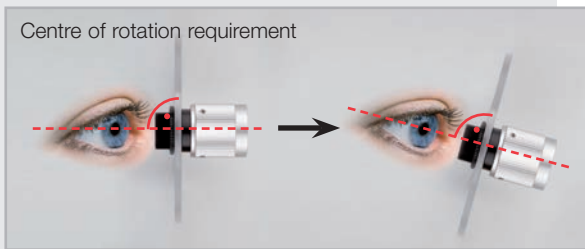
3 mm thickness, CR39, Ø 80 mm,
pack of 2 pieces



933265 Mounting lens inclusive adapter for back correction lens 15 mm

Without convergence for adjustment of the CVD,
pack of 2 pieces

The mechanical fitting of the telescopic spectacles (continued)



■ Anatomic adjustment of the frame (continued)

■ Pantoscopic angle and centre of rotation

The appropriate pantoscopic angle is the basis for a comfortable posture of the head and the body.

The centre of rotation requirement has to be fulfilled, this means the major visual direction and the optical axis of the system have to overlap. In order to achieve this with a head posture which is as relaxed as possible it is necessary to adjust the pantoscopic angle to the principle visual task. The frame plane is set in a way that it is positioned in a right angle to the major visual direction.

If the telescopic spectacle is primarily used for watching television and if the user leans back in an armchair when watching television, maybe even putting their feet up, a greater pantoscopic angle is required than if they sit up with a straight posture on a chair in front of the television set.

■ Adjustment tip from SCHWEIZER

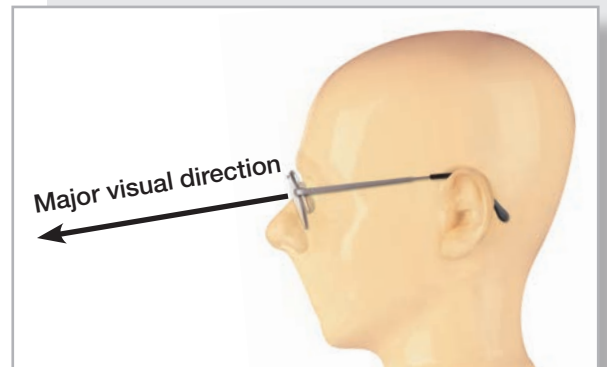
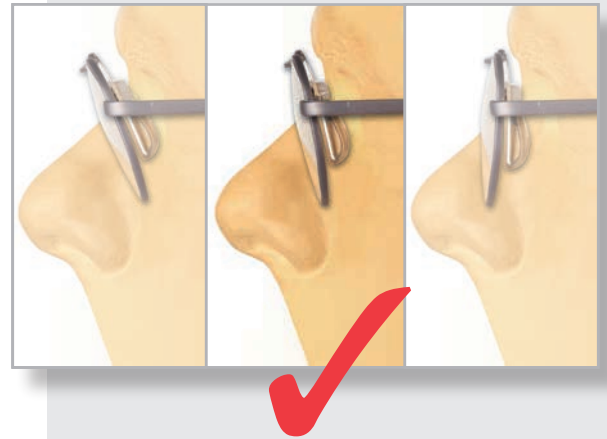
The habits and desires should be ascertained in detail. It for example is important to find out at which height the television set stands.

The same also applies if the system is primarily used for near vision. If the visually impaired person reads at a reading stand they require a smaller pantoscopic angle than they do when reading in a writing posture leaning over the table without a reading stand.

If the system is used for near vision and for distance vision an appropriate compromise should be made.

■ Correct adjustment of the pantoscopic angle of the frame

The visually impaired person has to take the appropriate sitting position and the eye care professional controls from the side the pantoscopic angle. The pantoscopic angle has to be corrected until the frame plane is vertical to the major visual direction. In actual use the optical axis of the system is in a right angle to the frame plane.

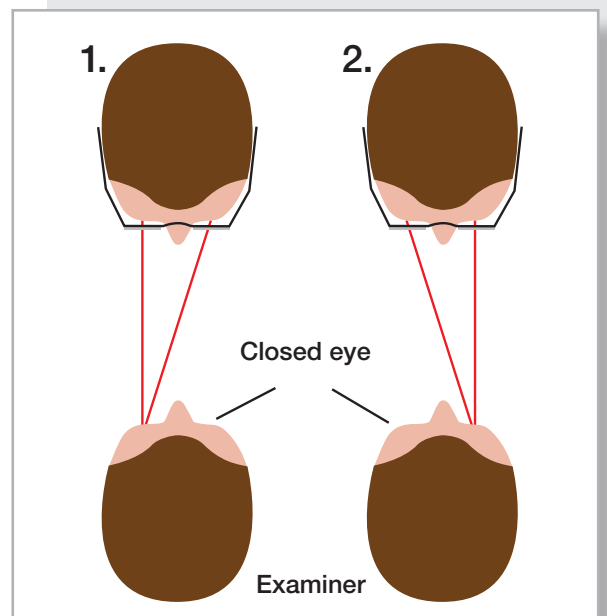


■ Determination of the visual points

For the determination of the horizontal and vertical visual points there normally is applied the Viktorin's method.

In this process the eyes of the test person and the eyes of the examiner face each other. The test person first looks into the examiner's left eye followed by their right eye.

The respective visual points are marked on the lens, checked again and are corrected if necessary.



The mechanical fitting of the telescopic spectacles (continued)

■ Determination of the visual points (continued)

■ Eccentric fixation with head movement – Interpupillary distance measurement

If it already is noticed during the monocular refraction that the patient turns their head in one direction for fixation an eccentric fixation with head movement is evident.

During the interpupillary distance measurement the patient should look at the eye care professional in a way that they can see the face or eyes of the eye care professional as good as possible. The visual points have to be marked in this position.

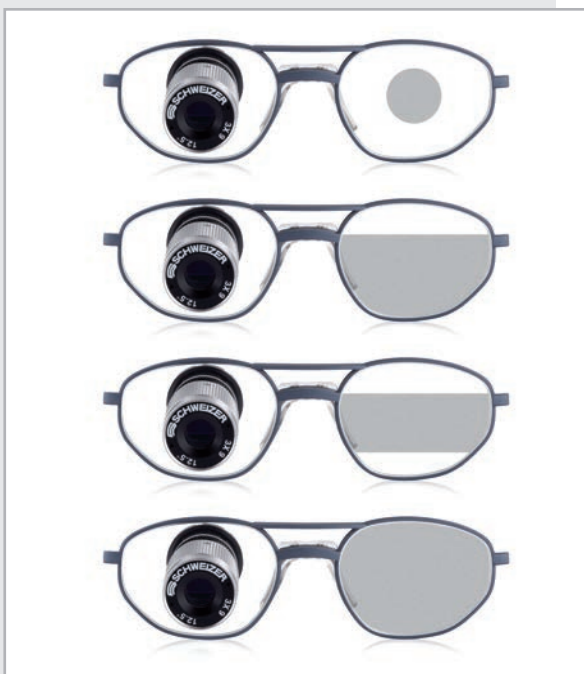
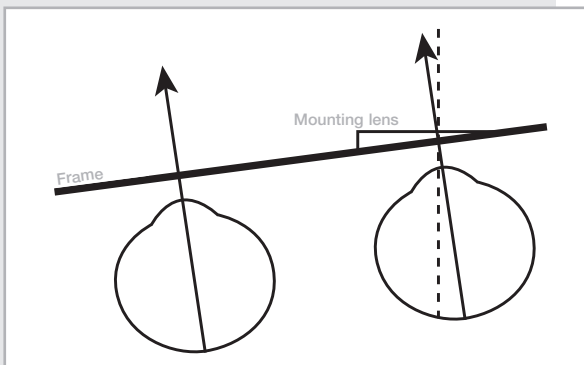
In order to fulfil the centre of rotation requirement in this case, there will be used mounting lenses with convergence for 330 mm with the raised side in the direction of the head movement.

■ Ocluded or tinted mounting lenses

In monocular telescopic spectacles the other eye is occluded. For this purpose there are available different options. The full lens can be occluded, partial areas can be left clear or only the pupil can be covered.

In the case of a high glare sensitivity it can make sense to tint the mounting lenses and possibly to add a tinted side protection.

Tinted mounting lenses also ease the fixation through the system and the contrast through the system seems to increase as well.



The dispensing of the telescopic spectacles

When dispensing the telescopic spectacles the fit of the frame is controlled and the adjustment of the system is checked as these have to be tuned exactly.

■ Checking the centration

For checking the centration of Galilei systems a penlight is used from the side shining between the system and the eye. By looking through the system from the front it now is possible to check the central position.

With Kepler systems the penlight is used from the front shining through the system. From the side there is then visible the exit pupil light dot. This light dot has to overlap the pupil of the eye.

■ Adjustment tip from SCHWEIZER

Control of the shortest possible CVD

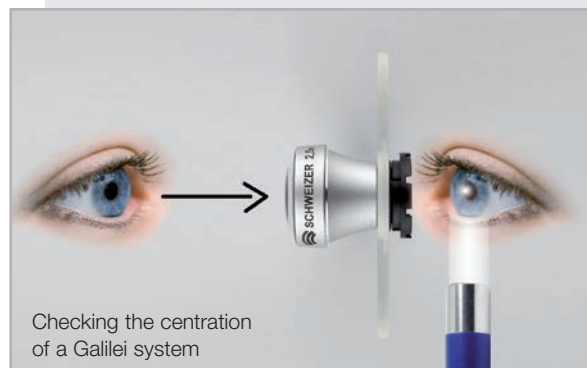
As a general rule the system has to be adjusted as close as possible to the eye.

On systems with a real exit pupil such as all Kepler systems it is necessary that the exit pupil of the system overlaps the entrance pupil of the eye to see the telescopic image without vignetting.

By lifting the telescopic spectacles slightly it is possible to check whether the CVD is adjusted correctly.

At the correct CVD a slight lifting does not change the position of the visible area. A further lifting creates the impression that the full visible area suddenly is becoming darker. If the user claims that the image is getting darker from below and thus the visible area is moving upwards the CVD is too long.

In the rare case that the CVD is too short the visible area moves downwards upon lifting and the image is getting darker from above.



The familiarisation

The familiarisation with the new visual aid takes place at the reading stand.

The reading stand enables reading in a relaxed posture and makes it easier to maintain the shorter distance.

As the whole text is at the same distance from the eye the optimum sharpness is available to the user over the entire area of the text.

If the reading material is on a flat table the upper part will lack sharpness as it already is outside of the system's focal length. The written material will only be clear in the lower part.

The advantage of a reading stand is easily demonstrated by just folding the reading stand away once. If not before the user will now experience its advantages.

The familiarisation naturally takes place with a light of the initially determined light temperature.

To practice the exact reading distance it is necessary for the person to move very close to the reading material (they should 'smell the print'), before then slowly moving their head backwards until they find the optimum sharpness.

When reading with telescopic systems it often is more pleasant not to move the head but to move the written material on the reading stand a little. This avoids the movement of the image which takes place when turning the head.



The conclusion

With telescopic spectacles a visually impaired person can be assisted with both their near and distance vision. For many people concerned this combination represents the ideal solution for satisfying some of their individual basic visual requirements and also enables them to participate in social life.

The eye care professional can make use of a wide range of options for choosing the most optimum solution for the person concerned. It is the case, however, that this one aid alone will rarely be enough for the visually impaired person. It is up to the eye care professional to offer them something adequate for their additional visual requirements and tasks.



The Author

Andreas Schaufler is a trained optician who has been working at SCHWEIZER since 1997. He has played a leading role in the development of the corporate identity and the brand image. Through his work he has made a significant contribution to the acceptance and today's wide level of interest in the subject of LowVision. In 2001 Andreas Schaufler completed an extra-occupational study course at the Bavarian Academy of Advertising and Marketing and is now Head of the Marketing Department at SCHWEIZER. He is the author of several professional papers on LowVision.

This document in English language was translated from the original German version.



Do you have questions ...

... about our products or do you need further information?

Please give us a call, we have the right specialists for you!

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