

Rigid gas permeable contact lenses

appenzeller
kontaktlinsen®
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i-MATRIX

Scleral lenses



Corneal damage, keratoconus,
keratoplasty? Still fits.

info@appenzeller-kontaktlinsen.ch
www.appenzeller-kontaktlinsen.ch



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Content

Introduction

- 4 i-MATRIX Scleral lenses from Appenzeller Kontaktlinsen

Indications and design

- 4 Indication**
- 5 Ocular surface protection
- 5 Design**
- 5 1st Zone: Central Clearance Zone (CCZ)
- 5 2nd Zone: Limbal Clearance Zone (LCZ)
- 5 3rd Zone: Scleral Landing Zone (SLZ)

Fitting and Assessment

- 6 Design Variations
- 6 Materials
- 6 Fitting set
- 7 Choosing the first diagnostic lens
- 7 Lens insertion
- 8 Assessment of the lens (Fluorescein-Overview, Central Clearance, Limbal Clearance, Landing zone, Over-refraction)

Lens dispense and follow-up

- 12 Handling
- 12 Follow-up procedure
- 13 Fitting record
- 14 Follow-up record

Care regime

- 15 Cleaning
- 15 Rinsing
- 15 Disinfection and storage

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Introduction

State-of-the-art scleral lenses are highly oxygen permeable due to the materials used. The large diameter practically causes no foreign body sensation and therefore provides a high initial comfort. Coupled with perfect optics, scleral lenses usually give the patient a new visual experience and increased quality of life.

Nevertheless, the fitting of a scleral lens cannot be compared with that of a rigid gas-permeable or soft lens. It is important that both the contact lens specialist and the patient are trained accordingly.

They are a real alternative to soft or RGP lenses, especially for irregular corneas. Because the lens doesn't move on the eye, no dust can get under it, nor can it get lost whilst in the eye.

As the name suggests, scleral lenses sit on the sclera only and bridge the cornea as well as the limbus. The resulting «cavity» between the eye and the lens is a reservoir of fluid which is already filled with saline solution when the lens is put in the eye and remains so throughout the day.





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Indications



Corneal perforation in acute rosacea



Scleral-therapeutic lens in acute rosacea



Stevens-Johnson syndrome

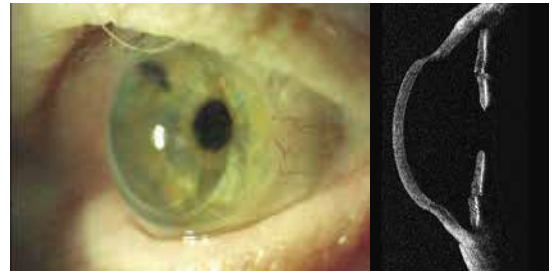


Stevens-Johnson syndrome

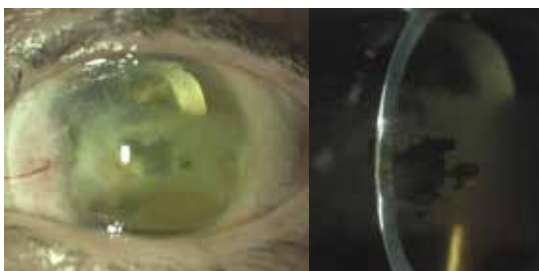
Images: Ralf Beuschel - Uni-Klinik Basel



Keratoplasty



Bulging graft



Trauma



Keratoconus Grade IV RE
Section OCT 0°-180°



Keratoglobus Section
OCT 0°-180°

Figure: Appenzeller Kontaktlinsen

→ Indication

- Primary corneal ectasia
 - Keratoconus
 - Keratoglobus
 - Pellucid marginal cornea degeneration
- Corneal ectasia after refractive surgery:
 - Lasik
 - Photorefractive keratectomy (PRK)
 - Radial keratotomy (RK)
- Corneal graft
- Corneal trauma
- Corneal scar after corneal infection like Herpes Simplex
- Corneal degeneration or dystrophy

Ocular surface protection

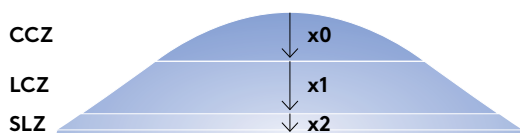
- Pronounced sicca syndrome
- Sjögren's syndrome
- Stevens-Johnson syndrome
- Eyelid coloboma

Further fields of application can also be various water sports or dynamic sports up to clay pigeon shooting.

→ Design

The back surface consists of 3 zones:

- 1st Central Clearance Zone (CCZ)
- 2nd Limbal Clearance Zone (LCZ)
- 3rd Scleral Landing Zone (SLZ)



1st Zone: Central Clearance Zone (CCZ)

The Central Clearance Zone (CCZ) is characterised by its base curve (BC), its central sagittal height (x_0) and its diameter. The standard diameter of the CCZ is 10.0 mm and doesn't vary neither with the total diameter of the scleral lens nor with the base curve (BC). The sagittal height x_0 is responsible for the clearance of the central cornea. If the clearance is too big, the base curve needs flattening, which will reduce the sagittal height. If the clearance is too small, the sagittal height x_0 must be increased through a steeper base curve (BC).

2nd Zone: Limbal Clearance Zone (LCZ)

The Limbal Clearance Zone (LCZ) is the connection between the CCZ and the Scleral Landing zone (SLZ). It is defined by a tangent, following the central base curve, the diameter of the limbal zone and the corresponding sagittal height (x_1). The tangent can be modified in 1° steps, each corresponding to a change of the sagittal height x_1 of $25\mu\text{m}$. The LCZ should relieve the peripheral cornea and vault the limbus. If the lens touches the limbus in this area, the sagittal height x_1 must be increased. A reduction of the sagittal height x_1 is only necessary in very rare exceptional cases.

3rd Zone: Scleral Landing Zone (SLZ)

The Scleral Landing Zone (SLZ) is the heart of the i-MATRIX scleral lens. It is also characterised by a tangent following the LCZ and the corresponding sagittal height x_2 . As with the LCZ, the angle of the tangent can be changed in 1° steps and corresponds to a modification of the sagittal height of $25\mu\text{m}$. The SLZ should sit on the sclera with a regular pressure distribution. Since this area of the ocular globe can have a toric shape, the i-MATRIX ST takes this into account.



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Fitting and assessment

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Choosing total diameter

∅ Cornea (HVID)	∅ CL (Dt)
Small	Small
Medium	Medium
Large	Large

Choosing base curve

Indication	Description	Base curve
Indications related to irregularities of the cornea	Ectasia of the cornea (keratoconus, PMD), intacs, ectasia after surgery, keratoplasty, trauma	Start with BC 7.3 (Medium). A) If the CL touches a large area, switch to BC 6.7 (Steep). B) In case of excessive clearance of the CL (≥ 600 µ), switch to BC 7.9 (Flat).
Indications related to Dry Eye	Pronounced Sjögren's syndrome, Stevens-Johnson syndrome, Sjögren's syndrome, etc.	Start with BC 7.9 (Flat). If the CL touches a large area, switch to BC 7.3 (Medium).

Rotationally symmetric				Scleral toric low		Scleral toric medium	
∅	Small	Medium	Large	∅	Medium	∅	Medium
Steep	6.7	6.7	6.7	Steep	6.7	Steep	6.7
Medium	7.3	7.3	7.3	Medium	7.3	Medium	7.3
Flat	7.9	7.9	7.9	Flat	7.9	Flat	7.9

Guide for choosing the first diagnostic lens of the fitting set

→ Design variations

Product name	Description
i-MATRIX	Spherical
i-MATRIX ST	Scleral Toric
i-MATRIX ST VT	Scleral Toric-Front Toric
i-MATRIX VPT	Front Toric Prismatic

→ Materials

In order to safely wear the scleral lens all day long, the best possible oxygen supply to the cornea should be provided. We therefore manufacture our scleral lenses in highly oxygen permeable materials like: Optimum Extra (Dk 100), Optimum Extreme (Dk 125) or Boston XO (Dk 100).

→ Fitting set

The fitting of a scleral lens is not comparable to that of a corneal lens. For example, each manufacturer has their own design and also their own fitting philosophy. For that reason we recommend attending a seminar to learn the appropriate technique. We can also provide you with a fitting set on loan for your fittings.

This set consists of 9 spherical lenses: 3 each in the diameters small, medium and large, for small, medium and large corneas with the base curves: 6.70 mm, 7.30 mm and 7.90 mm. Also 6 scleral toric lenses: 3 each with 2 different toricities, with the diameter for a medium-sized cornea and with the base curves 6.70 mm, 7.30 mm and 7.90 mm.



Step 1

- Fully fill the scleral lens



Step 2

- Add fluorescein



Step 3

- The patient's face is completely parallel to a horizontal surface
- Patient holds their lower eyelid
- Contact lens specialist holds the upper eyelid
- Insert the scleral lens

→ Choosing the first diagnostic lens

Step 1: Choosing the diameter (ØT)

Correlated to the corneal diameter (HVID)

Step 2: Choosing the base curve (BC)

The base curve is determined by the indication for the fitting, NOT by the central corneal radii. The corneo-scleral profile is also taken into account, especially for indications related to irregular corneas. The more pronounced the CSP the steeper the BC is chosen. (First diagnostic lens usually BC 7.30. In case of a large touch in the centre, change to BC 6.70 mm).

For indications related to Dry Eye, a BC of 7.90 mm is selected as first diagnostic lens

→ Lens insertion

The scleral lens is fully filled with unbuffered saline solution, with added fluorescein and inserted into the patient's eye with the help of a hollow sucker. The patient bends their head forward so that neither fluid is lost nor an air bubble can be formed under the lens.



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Fitting and assessment

→ Assessment of the lens

The assessment of the inserted lens is done in several steps, under different lighting conditions and without eye movements. Also, the lens should not move on the eye, but sit tightly without interrupting the blood flow of the conjunctival vessels in the scleral zone.

Fluorescein-Overview

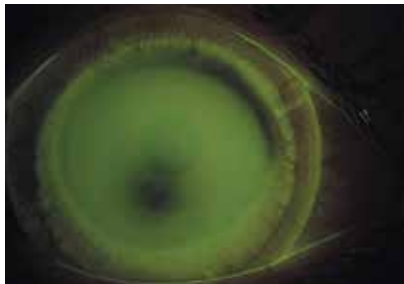
The overall view is used to instantly determine whether the scleral lens is inserted without an air bubble. In addition, a first impression of the total diameter and the central clearance can be gained. In case of an air bubble, the lens has to be reinserted with fluorescein.

Central Clearance

The central clearance is evaluated in 2 steps:

1. Overview

Here it is only a matter of determining whether the lens is touching centrally or not.



Example of insufficient clearance

In case of an apical touch, immediately change to the next steepest lens. A further assessment of the lens with regards to the clearance or the scleral landing is not necessary.



Example of adequate clearance and appropriate diameter

2. Evaluation of the clearance in optical section

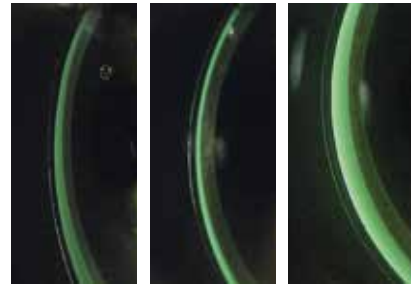
The apex is crucial for the evaluation in the optic section. In case of primary corneal ectasia or after refractive surgery and transplants, the highest point of the cornea is not necessarily in the centre.

Ideally, the scleral lens should have a clearance at the apex of about 300 µm at the end of the day. Studies show that the clearance decreases by approximately 100 µm during the course of the day. This is to be taken into account when fitting.

The estimation of the clearance is done in comparison to the centre thickness of the scleral lens (0.35 mm = 350 µm) and in relation to the corneal thickness.

In case of insufficient or excessive clearance, the following rule of thumb can be used: A change of the base curve (BC) of 0.10 mm corresponds to a change in sagittal height of 100 µm.

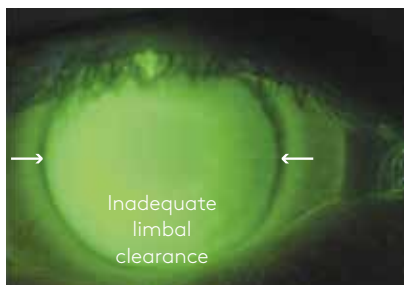
- Flatter BC → lower sagittal height ≈ less clearance
- Steeper BC → higher sagittal height ≈ more clearance



Left: ideal clearance
Middle: insufficient clearance
Right: excessive clearance

Limbal Clearance

The i-MATRIX scleral lens must bridge the peripheral cornea and limbus. This is achieved by choosing the appropriate diameter in relation to the horizontal cornea diameter in the first place. If a touch should occur after several hours of wear, the sagittal height x_1 can be increased.



Example of an inadequate limbal clearance despite appropriate selection of the diameter with x_1 standard.



Example of an adequate limbal clearance $x_1 + 0.10$. Increase of the sagittal height of the LCZ by $100 \mu\text{m}$

In the optic section the limbal clearance can and should also be assessed.



Example of an ideal limbal clearance in the optic section

Landing zone

The assessment of the scleral landing zone is the most important and most difficult part of the fitting. Do not assess this during lateral or vertical eye movements. If a lens is too flat in the scleral region it can cause decentration and the assessment is no longer appropriate.

The goal is to achieve an even pressure distribution of the scleral zone on the conjunctiva and the underlying sclera. The final lens should fit tight enough so there is no obvious movement during blinking or push-up. The blood vessels must not be constricted and cause blanching, neither at the edge nor in the mid-periphery. On the other hand, a certain mobility of the vessels underneath the outer area of the scleral zone is desired.

A shadow formation at the edge of the scleral lens, a visible protruding of the edge or even air bubbles must be avoided at all costs. These are indicators of too flat a scleral zone.



Shadow formation nasally – scleral landing zone too flat

To make this assessment, it is essential to physically manipulate the eye. To do so, the conjunctiva is moved slightly with the help of the eyelid. If the blood vessels can be moved up to the limbus, the scleral landing zone is too flat. In order to estimate the amount by which the sagittal height should be increased, we recommend to work with continuous, light pressure on the eyeball next to the edge of the scleral lens. Observed is the lifting of the scleral edge or the breaking up of the tear film underneath the scleral zone.

A systematic approach is helpful for the assessment and recording of the adjustment.



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Fitting and assessment



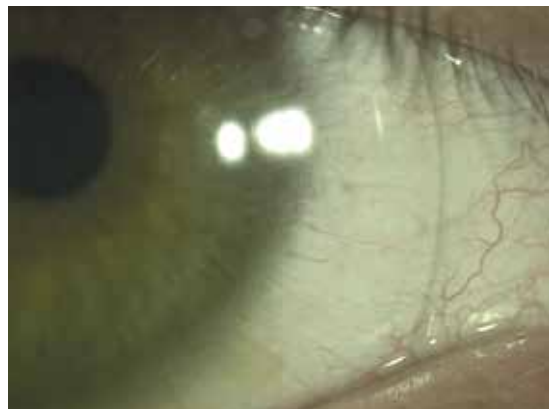
1. Overview
Optimal scleral landing zone



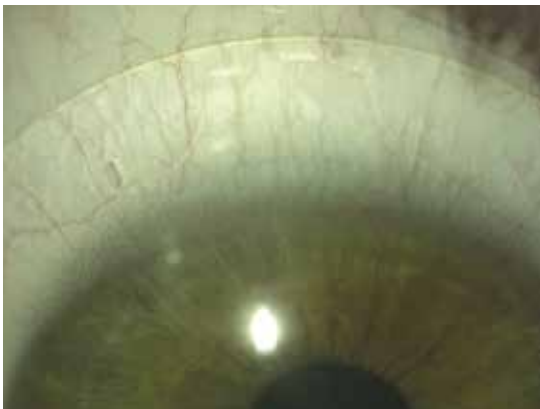
2. Temporal area 7-8 o'clock
Optimal scleral landing zone



3. Inferior area
Optimal scleral landing zone



4. Nasal area 4-5 o'clock
Optimal scleral landing zone



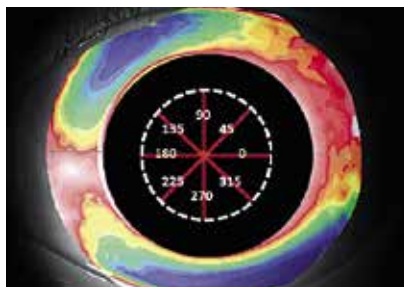
5. Superior area 10-2 o'clock
Optimal scleral landing zone



Shadow formation and visible protruding of the edge

Basically, it should be noted that conjunctival hyperaemias do not indicate too steep a fitting, as with a corneal lens, but too flat a fitting of the scleral landing zone. In the assessment of the scleral landing zone, a difference in the mobility of the vessels is often noted, or even a slight sticking of the lens edge.

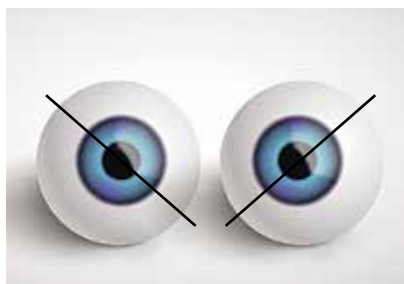
Studies show that not only does the cornea often present toricity, but also the sclera. However, corneal and scleral toricities are not necessarily in the same axis.



Toricity of the sclera (right eye)
© M. Ritzmann

The blue coloured areas represent the flat regions and the red coloured areas the steep regions of the anterior eye.

Deduced from this, different to the corneal toricity, the flatter meridian in the right eye is more likely around 120–150°, and 30–60° in the left eye.



If a scleral lens with a toric scleral landing zone is fitted, it will therefore also stabilise in these axial positions.

The following examples with a spheric scleral lens in the eye instantly indicate the fitting of a scleral toric lens.



Air bubble formation superior with light pressure on the eyeball → Solution ST 0.3



Spherical i-MATRIX – obviously showing air bubble formation in the inferior region → Solution ST 0.60



Spherical i-MATRIX – central air bubble, inferior protrusion, leakage of the saline solution → Solution ST 0.90

Over-refraction

A refraction over the scleral lens is only being done when the lens in the eye is showing a central clearance of approximately 200 to 600 microns, which the final lens should have.

An over-refraction over an excessive bridging diagnostic scleral lens (> 600 µm) leads to an inaccurate calculation of the final prescription lens due to the thick tear lens.



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Lens dispense and follow-up



Application devices «Max» (left) and «Moritz».



Removal with sucker without hole

When dispensing the scleral lens, the patient must be instructed on insertion and removal of the lens. For insertion, we recommend the use of an application device. For this purpose, a ring «Max» or a stand with fixation light «Moritz» are available.

For the removal of the scleral lens, a sucker without a hole is placed in the lower area of the lens, perpendicular to its curvature.

The follow-up of a well-fitted scleral lens should take place about 10-14 days after the dispense of the lens. During this period, the patient may make observations that were not obvious during fitting or dispensing, such as clouding of the fluid between the cornea and the scleral lens after several hours of wear. This indicates a so-called post-lens clouding. It is thought that if the scleral zone is fitted too flat, mucins are flushed out of the goblet cells of the conjunctiva and cloud the fluid under the scleral lens.

Usually the follow-up is carried out in the evening after a wearing period of about 8 hours. The assessment of the lens at this time allows an evaluation of the central and limbal clearance as well as the scleral landing zone that is present at the end of the day.

Procedure for the follow-up

1. Measuring visual acuity and over-refraction
2. Stabilisation (only toric scleral lenses)
3. General overview (Limbal and conjunctival hyperaemia)
4. Central clearance
5. Limbal clearance
6. Scleral landing zone without fluorescein and with fluorescein
7. Removal of the scleral lens and examination of the anterior eye with fluorescein

After removing the scleral lens, an impression of the edge of the scleral lens can always be observed – similar to that after wearing tight-fitting jewellery. This is completely normal.

It is important that the scleral lens is not removed to assess the clearance. The application of fluorescein makes it possible to determine whether and where the scleral landing zone is fitted too flat. At this «leaky» point, the fluorescein is sucked under the lens.

→ Fitting record

Surname _____ First name _____
Date of birth _____ Phone _____

Medical history

OD _____
OS _____

Visus sc

OD _____ OS _____

Refraction

	Sph	Cyl	Axis	Add	VA
OD					
OS					

Examination of the anterior eye

	OD	OS
Cornea		
Conjunctiva (bulbar)		

Diagnostic lens

	SN No	BC	Sph	Ø	ST	X1	X2
OD							
OS							

Assessment

	OD	OS
		Centration
		CCZ
		LCZ
		SLZ flat
		SLZ steep
		Limbal hyperaemia
		Bulbar hyperaemia

Over-refraction

	Sph	Cyl	Axis	Add	VA	Stabilisation
OD						
OS						

Scleral lens order

	BC	Sph	Cyl	A	Ø	ST	X1	X2
OD								
OS								



→ Follow-up record

Surname	First name
Date of birth	Phone

Subjective

OD
OS

Over-refraction

	Sph	Cyl	Axis	Add	VA	Stabilisation
OD						
OS						

Assessment

OD	OS
	Centration
	CCZ
	LCZ
	SLZ flat
	SLZ steep
	Limbal hyperaemia
	Bulbar hyperaemia

Result

OD
OS

Scleral lens order if necessary

	BC	Sph	Cyl	A	Ø	ST	X1	X2
OD								
OS								



Scleral lenses are made of the same highly oxygen permeable materials as corneal lenses. Therefore the same care products can be used. However, it should be noted that many patients who need scleral lenses have very sensitive eyes. For this reason, we recommend the use of a peroxide system so that no preservatives get to the eye. We recommend the following care products:

1. Cleaning Daily

Appenzeller Kontaktlinsen® Reiniger

Alcohol-based cleaner for daily care of the scleral lenses

2. Rinsing Daily

Appenzeller Kontaktlinsen® Saline or Polyrinse or B. Braun

For rinsing after cleaning the scleral lens

3. Disinfection and storage Daily

Appenzeller Kontaktlinsen® Peroxyd + «Scleralcase»

Disinfection and neutralisation: 1 hour

The disinfection can be carried out very simply, quickly and a 100% efficiently. Use the «Scleralcase» with the large baskets and fill it up to the mark.

Appenzeller Kontaktlinsen® All-in-One RGP

Disinfectant

Alternatively, for those who do not opt for the peroxide system, the All-in-One RGP solution can be used.



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Appenzeller Kontaktlinsen AG
Hauptstrasse 22
CH-9042 Speicher AR
Telephone +41 71 344 20 00

Appenzeller Kontaktlinsen AG
Kemptener Strasse 8
D-88131 Lindau
Telephone +49 69 332 962 31

Appenzeller Kontaktlinsen AG
Postfach 29
A-6973 Höchst
Telephone +43 72 088 16 97

info@appenzeller-kontaktlinsen.ch www.appenzeller-kontaktlinsen.ch

Rigid gas permeable
contact lenses

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10 Reasons Why to choose Appenzeller Kontaktlinsen

→ Fitting success

We do everything we can to understand your wishes and ideas. So that your fitting is a complete success – for you and your patients.

→ Open ears

Our Professional Services team advises you competently, personally and patiently. They will answer every question and make sure you get the right contact lens in any case.

→ Price advantage

We offer you favourable terms of payment. You can get extra benefits if you pay in advance. We will happily let you know about the current conditions on request.

→ Technological advantage

We put a great deal of effort into Research & Development to ensure that our contact lenses always meet the latest technological possibilities.

→ Custom made

Each contact lens is individually made to order for you, so that it matches your specifications a 100%.

→ Guarantee scheme

We take responsibility for our work so you can rely on us and our contact lenses with guarantee. Guarantee period:

- i-SOFT 3-monthly lenses: 1 month
- 6-monthly lenses: 2 months
- 12-monthly lenses: 3 months

Broken lens: Return us the lens within the guarantee period and we will replace it. We will credit it on your next invoice accordingly. The date on the delivery note is decisive for the guarantee period.

→ Swiss made

We demand the highest standards of the manufacturing quality of our contact lenses, so that they match your equally high expectations of Swiss made.

→ Right to exchange

We send out our contact lenses with or without the right to exchange, so you can make the best choice for your needs. The option "with right to exchange" gives you financial security: you can order a different lens later. If you do so within the exchange period, you pay only a small excess. The date on the delivery note is decisive for the deadline.

- Soft contact lenses:
 - i-SOFT 3-monthly lenses: 1 month
 - 6-monthly lenses: 2 months
 - 12-monthly lenses: 3 months
- Rigid gas-permeable lenses: 3 months

→ Long-term vision

We strive for a lasting business relationship with you, so that you can also count on us in the long term.

→ Reproducibility

We help you keeping your patients satisfied by ensuring that you receive the same lens as before with your repeat order.