

MKH

Measuring and Correcting
Methodology after H.-J. Haase
(**M**ess- und **K**orrektionsmethodik
nach H.-J. Haase)

Guidelines for the
Correction of
Associated Heterophoria



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**Measuring and Correcting
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Associated Heterophoria**

Third Edition

IVBV • June 2005

Preamble

These guidelines are aimed in particular at instructors, who teach the Measuring and Correcting Methodology after H.-J. Haase (MKH) in lectures, seminars and in higher education establishments.

Compliance with these guidelines will guarantee uniform and proficient application of the MKH.

Knowledge of the associated theory and sufficient experience are required to understand these guidelines.

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(International Association for Binocular Fullcorrection)**

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Preface to first edition

Over the years, several instructors have developed various approaches and recommendations of their own for the use of the Polatest vision testing instrument in binocular correction.

A considerable number of these instructors have kindly discussed their ideas in detail with me. This has resulted in some additions or modifications to my original recommendations. Other new suggestions were recognized as unsuitable and were discarded.

However, some other instructors did not even attempt to consult me at all or persisted with their ideas despite previous discussion with me. Confusing contradictions which sometimes resulted from this prompted the IVBV to plan uniform guidelines for the MKH.

Several experienced MKH practitioners jointly commenced their work on the compilation of these guidelines in September 1992. The two initial discussions took place in Hamburg in order to give me an opportunity to directly contribute my opinions and to recount my own recent personal experience.

The guidelines resulting from a total of six extensive meetings of the IVBV working group concisely summarise the essentials of my methodology. I very much welcome the fact that rules have now been formulated, the consistent observance of which should be seen as indispensable and obligatory for the practical application of the MKH.

I am extremely grateful to the working group for providing me with an opportunity to participate in this undertaking.

Hamburg, April 1995

Hans-Joachim Haase

Preface to second edition

I was delighted at the success of the first edition of the guidelines for the correction of associated heterophoria. Discussions held on certain points of the guidelines and questions arising on subjects not dealt with before have led to a further revision and addition to these guidelines. For instance, the important chapter on the application of the near tests has been added.

I can once again confirm that the use of my methodology is correctly described in these extended guidelines. I would therefore be very grateful if all users accepted these IVBV guidelines as binding and hope that the scientific advisory committee of the IVBV will continue its endeavours to enhance the guidelines in the future.

Hamburg, March 1997

Hans-Joachim Haase

Preface to third edition

Some additions and improvements to the correction of associated heterophoria seemed to make a new edition necessary. With it the often expressed users' wish was met to choose the bound version at hand for better handling.

We hope that also this third edition of the guidelines shall find a prevailing application to the advantage of people with associated heterophoria.

Berlin, April 2005

Scientific advisory committee of the IVBV

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Preliminary remarks

Structure and goals of the IVBV

The International Association for Binocular Fullcorrection ("Internationale Vereinigung für Binokulare Vollkorrektion") is an association registered in Switzerland, in which members of different professional groups work together on an interdisciplinary basis towards the goal of achieving optimum vision. These include optometrists, ophthalmic opticians, ophthalmologists, orthoptists, teachers, school psychologists, speech and dyslexia therapists and others.

Unimpaired binocular vision is an important prerequisite for optimum vision. As long ago as the mid-1950s, this awareness led Hans-Joachim Haase to think about new measuring techniques, making him a pioneer in the field of binocular fullcorrection. Today, the methodology developed in this context is known as MKH (Measuring and Correcting Methodology after H.-J. Haase).

For many decades, the success of the MKH has shown that in most cases only the prismatic fullcorrection of existing associated heterophorias led to unimpaired binocular vision. It is therefore the declared goal of the IVBV to propagate the MKH and to incorporate new scientific knowledge in its ongoing development.

This goal is pursued not only by means of the annual congresses held by the IVBV, but also by various regional events which anyone interested is cordially invited to attend.

The IVBV's aim in publishing these guidelines is to promote the uniform and correct application of the MKH.

Annotation to associated heterophoria

The result of any measurement depends upon the prevailing measurement conditions. Already Ogle et al. differentiated between dissociated and associated heterophoria, where "dissociated" referred to measurements under eliminated fusion and "associated" referred to measurements in the presence of fusion stimuli¹. Therefore it would be correct to mention the applied measurement procedure with every result of measurement (example: "dissociated heterophoria, measured with Maddox rod test" or "associated heterophoria, measured with Mallett fixation disparity unit").

The MKH exclusively applies tests with fusion stimuli and therefore belongs to the procedures for measuring associated heterophoria. For a simple designation, more understandable to persons affected, in German scientific language the term "Winkelfehlsichtigkeit" (literally translated: angle visual defect) was introduced for "associated heterophoria, measured with MKH". The term is abbreviated WF.

As there is not yet an official translation into English for the German term "Winkelfehlsichtigkeit" the abbreviation WF is used in these guidelines in the meaning of "associated heterophoria, measured with MKH".

¹ Ogle, Kenneth N.; Martens, Theodore G.; Dyer, John A.: *Oculomotor Imbalance in Binocular Vision and Fixation Disparity*. Lea & Febiger, Philadelphia 1967, 43/45

Always correction – Always fullcorrection?

The goal of the IVBV is the promotion of MKH, being the currently best procedure for the determination of binocular corrections.

However, the word **fullcorrection** (Vollkorrektur) in the name of the IVBV does not imply the dogmatic postulation of correcting **every** WF **fully**.

It is rather a question of separate decision in every individual case whether a correction seems promising, considering the result of the measurement as well as any existing strain and visual discomfort. When a correction is to take place the binocular **fullcorrection** will be the rule. However, in certain isolated cases a specific undercorrection may prove useful, though bicentral image formation in the eyes' position of rest is only guaranteed by binocular fullcorrection.

Tolerance to binocular corrections

Binocular correction on the basis of one of the still used measurement procedures (as Maddox rod test, Schober test or von Graefe's method) are known to be mostly not well tolerated.

However, a **fullcorrection** of associated heterophoria, which was determined according to the MKH guidelines, is mostly well tolerated as it was determined under largely natural visual conditions (namely in the presence of fusion stimuli).

Undercorrection of WF may lead to intolerance if the correction value is situated between those values, which were measured using the individual MKH tests.

Overcorrection of WF would lead to unaccustomed fusional stress and would therefore prejudice the tolerance more than any undercorrection. But with correct application of MKH overcorrection is impossible.

Guidelines for the Correction of Associated Heterophoria

1 Equipment

1.1 Test room

In the test room there should be sufficiently bright and constant lighting conditions by means of an artificial illumination. A simple experiment permits a rough assessment of the lighting conditions:

With the lighting undimmed, first look at a test field with optotypes for two minutes and then at a bright surface beside the test. If afterimages of the test field are seen, the lighting of the test room is not strong enough.

In the area surrounding the test field perceived by the patient during refraction there must be no fusion stimuli in the form of objects or structures which might catch her or his eye. Light sources must be positioned so that no reflections are produced on the test surface.

The patient can view the tests either directly or via a mirror with a silver-plated surface.

To keep the influence of accommodation to a minimum, the test distance should be 5 metres at least, but preferably 6 metres.

1.2 Vision testing instrument

To perform the MKH, the visual conditions must be as natural as possible.

The essential prerequisites include:

- adequate illumination of the test field,
- sufficiently large test field frame,
- dark test types presented with adequate contrast against a bright surround,
- simultaneous display of the test components for both eyes,
- complete extinguishing of the test components assigned to the other eye,
- equal brightness for the two eyes,
- test types of the same colour for both eyes (no anaglyphic separation).

Performance of the MKH requires the following tests:

- cross test [K],
- pointer test [Z],
- double pointer test [DZ],
- rectangle test [H],
- stereo triangle test [St]²,
- stereo-balance test [V]²,
- differentiated stereo test [Dx]³.

Further tests are:

- reduced stereo triangle test²,
- reduced stereo-balance test²,
- random dot hand test [RH],
- random dot step test [RS],
- Cowen test [C].

² see section 6.2 Comment on the angle of stereopsis, page 42

³ x = number of rows, for example: five rows [D5], six rows [D6], nine rows [D9]

The existing tests should initially be used in the following test sequence:

K, Z, DZ, H, St, V, Dx, RH, RS, C.

It must be possible to switch between the two types of presentation (normal and inverse), i.e. it must be feasible for the visual impressions of the right and left eyes to be interchanged.

1.3 Trial frame

A trial frame with analysers is vital for performing the MKH. The analysers must be sufficiently large for use in distance and near. It is advantageous when both sides of the trial frame are separately adjustable in their height.

The measurement of associated heterophoria using lorgnette-type analysers cannot be recommended.

The major grave drawbacks of a phoropter are:

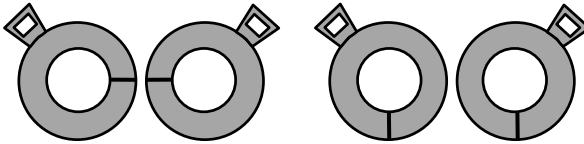
- unnatural head and body posture (particularly during near refraction),
- changing visual points with head movements,
- stimulus to psychic accommodation,
- no possibility of allowing the patient to walk around with the determined correction.

1.4 Trial lenses

Prismatic trial lenses in the following steps and number are recommended for efficient performance of the procedure:

- to 2.0^{Δ} in steps of 0.25^{Δ} ,
- to 5.0^{Δ} in steps of 0.5^{Δ} ,
- to 10.0^{Δ} in steps of 1.0^{Δ} ,
- above this in any step whatever.

These trial lenses should be available in pairs in at least two base settings relative to the handle:



To ensure that as few trial lenses as possible are required in the trial frame, the gradation of the spherical and cylindrical trial lenses should also be as fine as possible.

All trial lenses should have a high quality antireflection (AR) coating.

Rotary prisms are not suitable for prismatic fine adjustment, as this must be performed in discrete steps in some tests⁴. Furthermore, a sensible symmetric distribution of the prismatic power is not always possible.

⁴ see section 6.3, page 43 and section 6.4, page 48

2 Advising the patient

2.1 Preliminary consultation

Prior to the refraction procedure, it is advisable to

- acquire information on visual aids worn to date,
- ascertain the dioptric power and centration of these visual aids,
- inquire about any existing visual problems.

An experienced practitioner will ensure already during the preliminary consultation that he understands his patient's visual problems.

To be able to assess the connection between the problems described and binocular vision, he will pay special attention to the following:

- headaches,
- annoying sensitivity to light,
- becoming tired quickly when performing demanding visual tasks,
- difficulties when changing the direction of gaze and/or visual distance,
- problems with near vision,
- fixation difficulties,
- unsteadiness in visual perception,
- difficulties estimating distances and speeds,
- occasional diplopia,
- problems with reading and writing, especially in children.

Medical examinations should also be recommended additionally or beforehand, especially if disturbances are present that cannot be explained by visual defects.

2.2 Explanation of correction values

In practice, it has proven to be beneficial to provide a short, understandable explanation of the monocular and binocular processes of vision, making appropriate reference to the correction values obtained. Less time is required at this stage than for subsequent explanations.

Here, special mention should be made of how the prismatic correction is meant to affect existing visual problems.

In large associated heterophoria in particular, the points to be emphasised are the change in eye position, the appearance and weight of the spectacles and the possibility of special phenomena occurring in perception such as macropsia, micropsia and chromostereopsis.

Sample lenses, sample spectacles or sketches can prove to be helpful here.

If necessary, the possibility of increasing correction values and the consequences should be pointed out.

2.3 Dispensing the spectacles

When dispensing the spectacles, it is recommended to discuss again the sense and purpose of the correction with the patient, and for first-time corrections in particular.

As a result of the detailed explanations provided during the preliminary consultation, the changes concerning cosmetic appearance and perception can now be handled with greater ease.

Other important points to remember for the practitioner are the need to make an appointment for a follow-up examination and to stress that he will also be available to answer any questions outside the context of this appointment.

In particular should the patient understand that a renewed appearance of symptoms is a common indication of necessary repeated correction.

3 Principles of refraction

A complete refraction procedure consists of monocular testing and binocular testing (measurement of associated heterophoria).

Order of a complete refraction procedure:

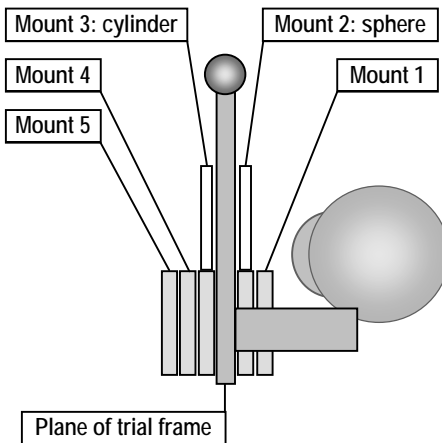
1. Monocular testing for distance,
2. associated heterophoria measurement using distance tests,
3. determining the near addition for associated heterophoria measurement using the near tests,
4. measuring associated heterophoria using the near tests and
5. determining the final addition.

3.1 Monocular testing for distance

The occluder should be black.

A reflecting or transparent or brightcoloured occluder does not always sufficiently exclude the covered eye from the visual process. This can lead to impairments in visual differentiation (especially in amblyopia).

Order of the trial lenses in the trial frame (the trial lens mounts are numbered starting from the back):



Final criterion:

Gradual spherical fine adjustment using smallest possible, comfortably legible black optotypes with a bright surround (under no circumstances red-green).

Leave the patient enough time to relax from existing positive or negative accommodation.

Refractive balance in binocular vision should not be performed under any circumstances after completion of monocular testing.

3.2 Associated heterophoria measurement using distance tests

The measurement of associated heterophoria is only sensible after the refractive correction has been carefully determined.

Prior to commencement of associated heterophoria measurement, all data obtained in monocular testing (including acuity and trial frame settings) must be recorded to be able, for example, to correct any accidental alteration of the cylinder axes.

During associated heterophoria measurement it is particularly important to give the patient the feeling that his replies, even if they have been made with some uncertainty, are always correct and significant, and that his visual problems are understood.

The patient needs enough time to grasp and describe the many unusual visual impressions he is experiencing.

3.3 Determining the near addition for associated heterophoria measurement using the near tests

The near addition for associated heterophoria measurement using the near tests must be determined for 40 cm, as the binocular tests are designed for this distance.

As a rule, the near addition can be determined binocularly.

With different near point distances for the two eyes, the near addition must be determined monocularly.

This is particularly the case with anisometropia from approximately 2 D upwards.

3.4 Associated heterophoria measurement using the near tests

Irrespective of the patient's age, the associated heterophoria measurement must be continued on the near tests.

Even if the patient's visual complaints are restricted to near vision, the associated heterophoria measurement on the distance tests must precede that on the near tests.

Associated heterophoria measurement on the near tests is therefore commenced with the prismatic correction determined beforehand on the distance tests.

3.5 Determining the final addition

As the near addition used during the associated heterophoria measurement on the near tests was determined for 40 cm, the final addition must now be adapted to the situation during actual use of the spectacles.

3.6 Documentation of measurement result and details for manufacturing the spectacles

Besides documentation of the measurement procedure to be used for future checking measurements the following parameters, necessary for manufacturing the spectacles, are to be given in order to ensure that the spectacles correspond to the results of the refraction procedure:

- Correction values R/L:
sph; cyl, A; pr_{hor} , B; pr_{vert} , B; Add; (Npr_{hor} , B; Npr_{vert} , B)⁵.
- Near testing distance (see also section 9.2, page 66).
- Major working distance (if different from above).
- Monocular visual acuity with correction for distance.
- Monocular centre distances⁶.
- Difference in height of the monocular centration points:
 $\Delta y = y_R - y_L$ (that means: Δy is rated positive if the right centration point is higher than the left one).
- Vertex distance R/L.
- Arrangement of the trial lenses with regard to sequence and bevel of prisms (to the front or to the back).

The pantoscopic angle of the trial frame is to be chosen such that the visual axes are perpendicular to the plane of frame when looking at the centre of the test area.

For the dispenser of the spectacles the following additional tasks arise:

- Thorough anatomical frame fitting so that vertex distance and pantoscopic angle reach the values recommended by the spectacle lens manufacturer for the specific type of lens as accurately as possible. If these values cannot be reached due to anatomical reasons a change of type of lens or a special making is to be considered.

⁵ if different from the prism for distance vision

⁶ distances between optical centre of lens R/L and bridge of trial frame

- Record the individual values for vertex distance and pantoscopic angle.
- Determine the position of the visual point for distance R/L without correction (horizontal and vertical).
- If the monocular centre distances of the trial frame differ from the monocular pupillary distances:
calculate the prismatic side effect of the refractively correcting trial lenses (apply Prentice-formula $P = d \cdot S'$) and include it in the determined prismatic correction.
- Calculate the shift of the visual points which is due to the prismatic effect. For that purpose the position of the visual points without correction will be shifted 0.25 mm per prism dioptre against the prism base setting (**formula-case**).
- Decide on the coordinates of the centration points:
 - horizontally: z_R, z_L (alternatively: x_R, x_L)
 - vertically: y_R, y_L (in consideration of the posture of head and body in the major application situation, for instance with spectacles for screen work).
- Convert the sphero-cylindrical power if there is a relevant difference between the vertex distance with the trial frame on the one hand and the spectacles on the other.
- Central chief ray and front surface of the spectacle lens shall be perpendicular to each other. If this cannot be achieved due to anatomical or technical reasons, the resulting angle between front surface of the spectacle lens and the frontoparallel plane should be conveyed to the manufacturer for calculating the spectacle lens.
- The use of prismatic lenses made of higher refracting material may lead to unsatisfactory visual acuity, particularly with
 - higher refractive powers,
 - higher prismatic powers,
 - unequal acuity R/L,
 - larger anisometropia.

3.7 Choice of lenses and frame

In the selection of the spectacle lenses the power of the lens plays a decisive part with regard to the refractive and prismatic power.

Conversion and/or arrangements with the lens manufacturer are often necessary to achieve the same correction power with the spectacles as existed beforehand in the measurement situation. For that the procedure when inserting prismatic trial lenses (pupil centre case of lens centring or formula-case – see page 26 – or special case, that is specification of all details in the order of the trial lenses) are to be recorded and reported to the manufacturer (see section 3.6, page 25).

Weight and edge thickness of spectacle lenses can be calculated using modern lens consultation programs.

Lens material with refractive index 1.5 provides the best quality in image formation. Material with refractive index 1.6 is still well tolerated, here it is important to evaluate pros and cons of cosmetics, weight and aberrations. Material with refractive index over 1.6 should only be used in specific exceptional cases.

The selection of the frame can decisively influence the total weight of the spectacles. Here the material plays a part (for instance titan compared with monel) as well as shape and size of the spectacle lens shape with reference to the prismatic power.

The frame fit may be changed considerably after lenses with higher prismatic powers base-in have been inserted. Therefore the position of the facette (and the fitting of the pads of metal frames) has to be principally clarified before ordering the lenses, otherwise vertex distance, height of visual point and face form angle differ. Later changes of frame fit which have not been considered when ordering the lenses may lead to a correction power different from that intended.

With progressive-power lenses the major visual direction requires particular attention if the spectacles are intended for a certain workplace and if higher prismatic corrections are necessary.

Prismatic lenses should at least be simply AR coated to avoid distracting reflections. When visual tasks of high contrast have to be performed, prismatic lenses without AR coating lead to secondary images which disturb the perception. Especially when there are difficulties in reading and writing the highest possible contrast is to be achieved through the appropriate choice of AR coated lenses. The polishing of flat facettes for rimless spectacles is unfavourable as additional light reflections may impair the perception.

If the wearing period will probably be short a simple quality of the lenses may be considered from expense reasons evaluating the entire consequences.

With higher vertical prisms there must be considered that the lenses do not touch forehead, cheek and eyelashes. Should the situation arise a change of the pantoscopic angle must be taken into account in the calculation of the lenses.

A rhombic shape is perfectly suited for prismatic corrections (particularly for children). It is pointed towards the main base directions and there arise aesthetic and functional advantages compared with oval and rectangular lens shapes. In addition the high lens shape ensures better field of fixation for visual tasks in school, as when looking from the exercise book to the board.

The firm fit contributes a lot to the success of a correction. Spectacles with prismatic corrections must not change their fit "on their own", that is it must be possible to clean a pair of spectacles without its getting out of shape.

Pads and bridges as well as tips and drop ends should be so designed that they may be well fitted to the rules of art – and they should be fitted in that way.

4 General rules for the MKH

As long as the final goal of the correction is not yet reached trial measuring steps shall be carried out. The procedure in changing the measuring prisms depend upon the individual tests and will there be described.

Overcorrection must be avoided at every phase of determining WF, as the resultant image location on the retina triggers unaccustomed fusion stimuli. These can considerably impair the further course of measurement and hence jeopardise the result.

In case of doubt smaller correction steps are to be used to avoid overcorrection.

The prismatic trial lenses should be distributed as evenly as possible with regard to their number, power and base setting in front of the two eyes.

Oblique base settings of the trial prisms are to be avoided.

In the event of conflicting perceptions on different tests with the same type of presentation (e.g. exo-perception on the cross test and eso-perception on the pointer test), an attempt should be made to clarify the situation by using the other type of presentation.

If normal and inverse presentation of the same test result in conflicting perceptions, it is not possible to derive a correction step directly from this. The next correction step must then be performed on the other tests taking into account the course followed by the MKH so far. It is proven to be correct if no further conflicting perception occurs.

If displacements (deviations from alignment of binocular test details as seen without polarizing filters) of different magnitude are perceived with normal and inverse presentation of the same test, the larger one of the two should generally be corrected. Whether this step was correct is checked on the other tests and subsequently in the reverse running (re-presentation of the tests).

5 Rules for K, Z, DZ and H

5.1 Common rules

If the patient has difficulty assessing a test in the type of presentation initially selected, it should be checked whether he can assess it better in the other type of presentation.

Three uniform question criteria apply for the use of these tests:

1. simultaneity and completeness (simultaneous vision),
2. intensity of blackness (contrast equality),
3. position and image steadiness (symmetry in position and time).

Re 1.: To check for absolute inhibitions (exclusions), the patient is asked whether the test components assigned to the individual eyes are perceived simultaneously and completely.

Re 2.: To check for relative inhibitions (suppressions), the patient is asked whether the test components assigned to the individual eyes are constantly seen in the same shade of black. (Details see respective test description.)

Re 3.: To check what oculocentric directions the retinal points have on which the test components assigned to the individual eyes are imaged, the patient is asked what position these test components adopt relative to each other.

Common goal of correction for these tests:

Perception of steady zero test position (alignment) with the weakest possible prism in both types of presentation. If this goal cannot be achieved, the best possible symmetry must be strived for, that is oscillation or jumping of the test detail seen unsteadily on both sides of alignment, equally far and equally often and long regarding position and time.

5.2 Cross test

Symbol: K

Purpose

Correction of motor-compensated associated heterophoria components and/or FD I.

Guidelines for explanation and use of the test

Present the cross monocularly without analysers to the eye last refracted, i.e. leave the occluder in the trial frame.⁷

Then insert the analysers.

Possible formulation of question:

„What remains of the cross?“

The choice of words in the reply (e.g. horizontal, flat, in lying position; dash, bar, line, minus sign) is helpful for the further questioning technique. The term used by the patient should continue to be used.

Now remove the occluder.

No central fusion stimulus should be present in the use of the cross test. Therefore, the patient should be asked to do the following (repeatedly, if necessary):

„Please always keep your eyes on the centre of the test.“

A particularly long time should be left for the cross test to allow a fusion tonus which may have existed for a long time to relax as far as possible.

Now proceed with the three uniform questioning criteria (simultaneous vision, contrast equality and symmetry).

⁷ It will be removed, however, if for instance statements are to be made concerning the binocular visual acuity or the stereo-acuity before determining the associated heterophoria. But due to the recurring motor fusion in the course of this, the measurement on the cross test may then require more time.

In refractive balance⁸, contrast is normally also equal in both eyes, often even with monocular amblyopia.

Despite refractive balance, however, different contrast may be perceived if fixation disparity is present, caused by inhibitions or deviating refraction at the disparate image location. Occlusion of the eye seeing more contrast does not alone indicate fixation disparity with any certainty as a possible cause, as the different contrast can also be caused by refractive imbalance⁹.

If contrast imbalance is experienced at this point, never change spherical values. Changes to the refractive values on binocular tests are never advisable!

Size of the first correction step:

- horizontal 1.0^Δ,
- vertical 0.5^Δ.

The effect of every correction step, i.e. the change in perception, determines the next prismatic trial lens.

In the event of doubt, smaller correction steps are always safer, as no overcorrection must take place.

With simultaneous excursion of approximately the same magnitude in the horizontal and in the vertical, it is of no significance what direction is corrected first.

With clearly different excursions, the larger of the two should be corrected first. If the excursion also decreases in the other direction at the same time during this process, reduce the excursion in both directions alternately in small steps after approximate matching of the two components.

If both directions are corrected simultaneously, no prismatic trial lenses with oblique base settings must be used.

⁸ State of isometropia in an uncorrected pair of eyes or of equally exact monocular correction of the two eyes.

⁹ State of anisometropia in an uncorrected pair of eyes or of unequally exact monocular correction of the two eyes.

In addition, inhibitions could be better judged from the use of the test in both types of presentation. For example, the vertical extension of inhibitions is only recognisable when the vertical cross-bar is presented to the eye affected.

5.3 Pointer test

Symbol: Z

Purpose

Correction of the horizontal portion of the first subtype of FD II and of motor portions which have not yet relaxed on the cross test.

Recognition of cyclophoria and anamorphic image distortion.

Guidelines for explanation and use of the test

The pointer test must be used before the double pointer test and, due to its simplicity, should not be replaced by the latter.

The pointer test must be used in both types of presentation.

Reason: If the switch in the oculo-centric direction in FD II has occurred just to the image locations of the pointer tips and no more, a deviation from alignment will only be perceived if the scales are imaged in the deviating eye.

Present the pointer test monocularly, i.e. present each eye briefly and separately with its respective test component.

Possible formulation:

„You see one pointer at the top and one pointer at the bottom.“

And correspondingly:

„You see a scale at the top and a scale at the bottom.“

The patient's attention can also be drawn to the circle.

Ask first whether the pointer and the scales are seen simultaneously. You can also inquire whether they display the same contrast in order to assess the extension of inhibitions.

Ask the patient to describe the position of the upper and the lower pointer separately.

Possible formulation of question:

„Is the upper pointer pointing to the centre of the scale or to the left or right?“

Here, the patient should not initially be requested to look at the circle, as this represents a strong fusion stimulus in every case, even if it is not looked at.

Size of the first correction step:

- 0.25^{Δ} ,
- possibly 0.5^{Δ} .

The effect of each correction step on the patient's perception determines the size of the next step.

On the pointer test, no changes must be made with vertical prisms!

Once symmetry has been achieved, the patient is asked whether he can still assess the pointer positions when looking at the circle. If he can, it should be checked whether further correction steps are required.

Many patients are not able to make this assessment, however, as details to be assessed are looked at directly in natural vision. Under no circumstances should you intimidate the patient by demanding too much of him!

A distinction between cyclophoria and anamorphic image distortion is only possible on the double pointer test.

5.4 Double pointer test

Symbol: DZ

Purpose

Correction of the horizontal and vertical portion of the first subtype of FD II and of motor portions which have not yet relaxed so far.

Differentiation between cyclophoria and anamorphic image distortion.

Guidelines for explanation and use of the test

The double pointer test must also be used in both types of presentation. The same reason applies as that given for the pointer test.

It is not necessary to present the double pointer test monocularly. It suffices to draw the patient's attention to the additional pointers and scales on the right and left.

Possible formulation of question:

„Do you now see additional pointers and scales on the right and left?“

Ask first whether the pointer and the scales are seen simultaneously. You can also inquire whether they display the same contrast in order to assess the extension of inhibitions.

You can ask the patient to give the positions of the four pointers in any order.

Size of the first correction step:

- 0.25^{Δ} ,
- possibly 0.5^{Δ} .

The effect of each correction step on the patient's perception determines the size of the next step.

5.5 Rectangle test

Symbol: H

Purpose

Correction of the vertical portion of the first subtype of FD II and of motor portions which have not yet relaxed so far.

Recognition of aniseikonia in the vertical and estimation of its magnitude.

Guidelines for explanation and use of the test

Present the rectangle test monocularly.

Possible formulations:

„You see a half of a rectangle on the right / left.“

„You see a square bracket on the right / left.“

Ask first whether both halves of the rectangle are seen simultaneously.

Then ask whether the patient sees a gap at the top and bottom between both halves of the rectangle.

If the gaps are not seen, the type of presentation can be changed and/or the patient can be asked to concentrate his gaze on the fixation circle. If the gaps are not seen under any circumstances no correction steps must be carried out on the rectangle test.

You can also inquire whether both halves of the rectangle display the same contrast in order to assess the extension of inhibitions.

Ask the patient to describe the positions of both halves of the rectangle relative to each other separately for top and bottom.

Particularly if both halves of the rectangle are seen in different sizes (aniseikonia), ask about their symmetry and correct for symmetry.

Size of the first correction step:

- 0.25^{Δ} ,
- possibly 0.5^{Δ} .

The effect of each correction step on the patient's perception determines the size of the next step.

On the rectangle test, no changes must be made with horizontal prisms!

Many patients are unable to look at the fixation circle and at the same time assess the position of both halves of the rectangle relative to each other, as details to be assessed are looked at directly in natural vision. Once again, under no circumstances should you intimidate the patient by demanding too much of him!

The **horizontal rectangle test** triggers vertically acting orthofugal fusion stimuli which may have falsifying effects on horizontal vergence behaviour. Therefore, this test is generally unsuitable for the correction of horizontal portions of associated heterophoria. But it can be used for the assessment of an aniseikonia in the horizontal direction.

The rectangle test should possibly be used in both types of presentation.

Reason: Correspondingly as for the cross test.

6 Rules for stereo tests

6.1 Common rules

Every stereo test must be used in both types of presentation.

Reason:

In the setting of the eyes to the test distance, the normal presentation of stereo tests results in retinal image formation of the stereo objects with crossed lateral disparity (resulting in the perception "in forward direction"), and inverse presentation results in images with uncrossed lateral disparity (resulting in the perception "in backward direction").

Correction steps are only possible if information is available about perception in both types of presentation.

6.2 Comment on the angle of stereopsis

The angle of stereopsis is the ratio of the stereoscopic parallax (stereo parallax) of the stereopsis test shape in the presented stereo test to the fixation point distance (testing distance).

In programmable electronic vision testing devices the stereoscopic parallax can be changed. Thereby any intended angle of stereopsis can be realized for every testing distance.

In mechanical vision testing devices with fixed stereoscopic parallax the angle of stereopsis depends upon the testing distance.

For documentation the symbols for stereo triangle tests and stereo-balance tests may be completed by adding the angle of stereopsis. This is indispensable for the reduced test types, for example: **St6.3'** and **V9'**.

The new detail of a number with a line as symbol for minute of arc must not be mistaken for the former number without line, denoting the stereoscopic parallax in millimetre.

The table shows how the angle of stereopsis depends upon testing distance and stereoscopic parallax:

angle of stereopsis in minutes of arc		testing distance		
		5 m	5.5 m	6 m
stereo parallax	20 mm	13.75'	12.50'	11.46'
	11 mm	7.56'	6.88'	6.30'

For instance, at a testing distance of 6 metre the former designation **St11** (stereo triangle test with stereo parallax 11 mm) corresponds to the new designation **St6.3'** (stereo triangle test with angle of stereopsis 6.3 minutes of arc).

6.3 Stereo triangle tests

Symbol: St¹⁰

Terms used

► **Stereo delay:**

Generic term for spontaneous delay and secondary delay.

► **Spontaneous delay:**

Time difference between the change in the type of presentation and the correct identification of the stereo object in front of or behind the fixation object.

► **Secondary delay:**

Time difference between the first correct identification of the stereo object in front of or behind the fixation object and the perception of the final, larger stereoscopic depth of field ("moving along" of the triangles).

► **Stereo alternation test:**

Switch between the two types of presentation to check stereo delay.

Purpose

Correction of the second subtype of FD II.

Clarification of the following questions:

1. Is stereo vision present on this test?
2. Is the position of the triangles (in front of or behind the fixation point) correctly assigned to the respective type of presentation (normal/inverse)?
3. Is there spontaneous delay?
4. Is there secondary delay?
5. Is the correct stereoscopic depth of field attained?

¹⁰ see section 6.2 Comment on the angle of stereopsis, page 42

Guidelines for explanation and use of the test

On the basis of how the MKH has proceeded until now, a decision is made whether to start the stereo triangle test with or without explanations. In both cases, you must convey to the patient that the fixation point appears to be at a fixed distance, while the triangles may seem to be at different distances (in front of or behind the fixation point).

If the stereo triangle test is presented without an explanation, the patient should describe the visual impression he receives.

If the stereo triangle test is presented with an explanation, the following approach is recommended:

Question:

„There is a black dot in the middle. What do you see above this dot?“

Possible answers:

„One triangle.“, „Two triangles.“

Question:

„What do you see below this dot?“

Possible answers:

„One triangle.“, „Two triangles.“

Question:

„Do you see the triangles in front of or behind the dot?“

If there is some hesitation in giving a reply, continue to ask:

„... or are the triangles and the dot the same distance away?“

Question (after correct reply by patient):

„Are the triangles very far in front of the dot?“, while switching to the other type of presentation, if possible unnoticed.

The reply shows whether the reaction to the switch in the direction of lateral disparity is spontaneous and correct.

If diplopia (of the triangles or the dot) occurs in both types of presentation, limited Panum's areas are present. Then a reduced stereo triangle test (stereo triangle test with a smaller angle of stereopsis¹¹) can be used in the same way.

If diplopia (of the triangles or the dot) occurs in only one type of presentation, correction steps should be taken in accordance with the table given below, e.g. correction with base-in prism for diplopia of the triangles in normal presentation.

A check is made for delays by performing the stereo alternation test several times. Here, the patient can be questioned and corrected firstly for an existing spontaneous delay and then for an existing secondary delay.

If stereo delays are perceived, the following rules for correction apply:

1. If prisms are already contained in the trial frame as a result of the MKH process so far, the prismatic correction steps are initially performed to increase the prism in the existing base settings.
2. If no prisms are present in the trial frame as a result of the MKH process so far, the following rules of correction are initially applied:

Perception in stereo triangle test	Base setting
Major stereo delay in normal presentation	In
Major stereo delay in inverse presentation	Out
Same stereo delay in both types of presentation	Up or down

¹¹ e.g. St7'; see section 6.2 Comment on the angle of stereopsis, page 42

These rules of correction only apply if the patient is looking at the fixation point. His attention must be constantly drawn to this requirement.

Possible formulation:

„Please always keep your eyes on the dot.“

If neither approach leads to improved test perception, i.e. to a reduction in stereo delay, a check is also made with the base settings not used so far in both types of presentation.

If a stereo delay is present in both types of presentation, but is clearly different, the horizontal portion of associated heterophoria should be corrected first.

Size of the first correction step:

- **0.25^Δ to be inserted.**

If this step results in the stereo delay being

- eliminated:
leave the trial prism inserted and quit the stereo triangle test,
- only reduced:
also leave the trial prism inserted and repeat the first correction step,
- neither eliminated nor reduced:
increase the trial prism by further 0.25^Δ and continue correspondingly until approximately 1.5^Δ.

A spontaneously expressed improvement in the patient's depth perception with a prismatic trial lens is not a measuring criterion. Therefore this trial lens has to be removed if an existing stereo delay is not eliminated or reduced as well.

The following rule always applies:

Only if an existing stereo delay is eliminated or clearly reduced should the prismatic change be incorporated in the correction.

Testing of the stereoscopic depth of field (only possible in a forward direction) provides an indication of the current quality of the processing of laterally disparate image formation.

If the perceived stereoscopic depth of field is too small, this does not provide any indication of the direction or size of further correction steps.

The following reasons may explain an overly small depth of field:

1. Fullcorrection has not yet been achieved.
2. Despite fullcorrection, total sensory adaptation back to the original condition has not (yet) taken place.

Improvements to the stereoscopic depth of field after further correction steps performed on other tests confirm their correctness. If improvements do not occur immediately, they are possible after the prismatic fullcorrection has been worn for some time.

6.4 Stereo-balance tests

Symbol: V¹²

Terms used

▶ **"Valence":**

Relationship between the two eyes in stereoscopic directional perception.

▶ **Prevalence:**

Dominance of one eye in stereoscopic directional perception.

▶ **Equivalence:**

Equality of the two eyes in stereoscopic directional perception in either crossed or uncrossed lateral disparity.

▶ **Stereo visual balance (stereo-balance):**

Simultaneous presence of equivalence in crossed as well as in uncrossed lateral disparity.

Purpose

Correction of the third to sixth subtype of FD II.

Checking for stereo-balance by clarifying whether the stereo objects (triangles) are perceived in the spatially correct horizontal position relative to the fixation object (dot with scales) in both types of presentation.

¹² see section 6.2 Comment on the angle of stereopsis, page 42

Goal of correction

Establishing stereo-balance.

If a perceived misalignment cannot be completely eliminated the best possible symmetry shall be achieved with the weakest prism.

This means:

The perceived distance of the upper and lower triangles from the scale centre should be

1. as small and equal as possible in either of the two types of presentation and
2. as equal as possible in both types of presentation.

Guidelines for explanation and use of the test

First of all, the patient can be told that the aim of this test is not to assess three-dimensional vision. The significance of the measuring scales should always be explained to him. If necessary, the maximum possible lateral displacement of the triangles (to the end of the scales) can be demonstrated by occluding briefly one eye of the patient at a time.

With limited Panum's areas, it is possible that the triangles or the dot are seen double. An appropriate question should therefore be asked to ensure that no diplopia is present.

If diplopia is present, it must be clarified whether the triangles (or the dot) are seen double in both types of presentation. In this case, a reduced stereo-balance test (stereo-balance test with a smaller angle of stereopsis¹³) – or stereo triangle test as an alternative – can be used to roughly estimate the "valence".

The patient should be asked to give the position of the triangles on both the top and bottom in both types of presentation.

To ascertain small differences between the top and bottom triangle positions, the patient should be asked whether the tips of the triangles are pointing exactly at each other.

To ascertain small (residual) deviations from the scale centre, rapid changing of the type of presentation used may prove to be helpful.

With the perception of prevalence, the following rules of correction should be followed:

1. If prisms are already contained in the trial frame as a result of the MKH process so far, the prismatic correction steps are initially performed to increase the prism in the existing base settings.

¹³ e.g. V9'; see section 6.2 Comment on the angle of stereopsis, page 42

2. If no prisms are present in the trial frame as a result of the MKH process so far, the following rules of correction are initially applied:

Perception in stereo-balance test	Base setting
Major prevalence in normal presentation	In
Major prevalence in inverse presentation	Out
Same prevalence in both types of presentation	Up or down

These rules of corrections apply only if the patient is looking at the fixation point. Unlike the stereo triangle test, however, this is normally the case here, so that no comment to this effect is required.

If neither approach leads to improved test perception, i.e. to a reduction in prevalence, a check is also made with the base settings not used so far in both types of presentation.

If prevalence is present in both types of presentation, but is clearly different, the horizontal portion of associated heterophoria should be corrected first.

Size of the first correction step:

- 0.25^{Δ} to be held up.

If this step results in

- achieving equivalence in both types of presentation:
insert the prismatic trial lens and quit the stereo-balance test,
- only reducing the prevalence:
also insert the prismatic trial lens and repeat the first correction step,
- leaving the prevalence unchanged or reducing it just temporarily (namely in the first moment of holding up the trial lens):
absolutely remove the prismatic trial lens and hold up another one which is 0.25^{Δ} stronger.

Further steps must correspondingly be taken using the next stronger trial lens at a time, approximately 1.5^{Δ} being the maximum in steps of 0.25^{Δ} .

If a larger prevalence or even diplopia occurs:

Take further measuring steps on a trial basis (in both types of presentation with the base settings not used so far).

If this does not lead to any improvement:

Quit the stereo-balance test for the moment.

A spontaneously expressed improvement in the patient's depth perception with a prismatic trial lens is not a measuring criterion. Therefore this trial lens has to be removed if an existing prevalence is not eliminated or reduced as well.

The following rule always applies:

Only if an existing prevalence is eliminated or clearly reduced should the prismatic change be incorporated in the correction.

6.5 Differentiated stereo tests

Symbol: Dx¹⁴

Purpose

Correction of FD II.

Testing of stereoscopic visual acuity in both types of presentation.

Testing of spontaneous delay by rapid stereo alternation test.

Guidelines for explanation and use of the test

When the test is presented, the patient is asked to start by looking at the upper row.

Possible formulation of question (for D5):

„There are five crosses in the top row. Do they all appear at the same distance from you?“

Proceed in the same way row by row in both types of presentation.

As this test makes very exacting demands on stereoscopic vision, an only initial lack of stereoscopic depth perception provides no indication of correction steps.

Possibilities of making it easier to assess the test:

- have the patient look at the test types separately one after another,
- change the type of presentation,
- point out that one test type may appear to be in a forward or backward direction,
- point out that one test type appears in a forward direction (in normal presentation) or that it appears in a backward direction (in inverse presentation).

¹⁴ x = number of rows

If stereoscopic depth perception is not achieved for all rows in both types of presentation, the following rules of correction should be followed:

1. If prisms are already contained in the trial frame as a result of the MKH process so far, the prismatic correction steps are initially performed to increase the prism in the existing base settings.
2. If no prisms are present in the trial frame as a result of the MKH process so far, the following rules of correction are initially applied:

Perception in differentiated stereo test	Base setting
Minor stereoscopic visual acuity in normal presentation	In
Minor stereoscopic visual acuity in inverse presentation	Out
Same stereoscopic visual acuity in both types of presentation	Up or down

If neither approach leads to improved test perception, i.e. to improved stereoscopic visual acuity, a check is also made with the base settings not used so far in both types of presentation.

Subsequently, a check is made for spontaneous delay by a rapid stereo alternation test. This is performed using the test types (lines) with the smallest stereoscopic parallax that led to certain stereoscopic depth perception in both types of presentation.

Delayed stereoscopic depth perception evident only at the beginning must not be assessed as spontaneous delay.

If spontaneous delay is established, the following rules of correction should be followed:

1. If prisms are already contained in the trial frame as a result of the MKH process so far, the prismatic correction steps are initially performed to increase the prism in the existing base settings.
2. If no prisms are present in the trial frame as a result of the MKH process so far, the following rules of correction are initially applied:

Perception in differentiated stereo test	Base setting
Major spontaneous delay in normal presentation	In
Major spontaneous delay in inverse presentation	Out
Same spontaneous delay in both types of presentation	Up or down

If neither approach leads to improved test perception, i.e. to a reduction in spontaneous delay, a check is also made with the base settings not used so far in both types of presentation.

Size of correction steps:

- 0.25^{Δ} ,
- with absence of a reaction 0.5^{Δ} .

6.6 Random dot tests in general

Unlike all other binocular tests, the form of the test components in the random dot tests is not discernible monocularly. Not until appropriate utilisation of laterally disparate image formation has been achieved is it possible to identify the stereo objects (random dot stereopsis).

Random dot tests are not presented monocularly.

6.7 Random dot hand test

Symbol: RH

Purpose

Testing for random dot stereopsis.

Guidelines for explanation and use of the test

Possible formulation of question:

„Can you recognise anything in this test?“

Regardless of the reply, no correction steps are performed in this test.

If the answer is no, the test can be presented again after correction steps have been performed on other tests.

6.8 Random dot step test

Symbol: RS

Purpose

Correction of FD II.

Testing for random dot stereopsis.

Testing for stereoscopic visual acuity in both types of presentation.

Testing for spontaneous delay by rapid stereo alternation test.

Guidelines for explanation and use of the test

The correction is performed in the same way as in the differentiated stereo tests.

Size of correction steps:

- 0.25^{Δ} ,
- with absence of a reaction 0.5^{Δ} .

7 Reverse running (Re-presentation of the tests)

7.1 Purpose

- Recognising whether fusion tonus has relaxed and determining the appropriate correction prism.
- Recognising the effect of previous correction steps on inhibitions and on the adjustment status of the associated heterophoria.
- Distinguishing between the third to sixth subtype of FD II. This differentiation is only possible if stereo-balance is present.

This can provide an indication of the following:

- the tolerance of the correction established so far,
- the necessity for tolerance tests,
- the need for an adaptation session when the prescription is dispensed,
- the need for further measurements and when they should be performed,
- appropriate undercorrection, should it be necessary.

7.2 Guidelines for performance

Starting with the last test in which prismatic changes have been determined, single or all tests should be presented again.

- With perception of alignment or symmetry of all tests presented in the reverse running, the prismatic correction is not changed. If stereo-balance was achieved beforehand by increasing the prism in the stereo-balance test, FD II of the third subtype is present.
- With perception of undercorrection, fusion tonus has now relaxed. Correction is then performed in accordance with the guidelines for the test concerned.
- With perception of overcorrection, the prismatic correction must not be changed under any circumstances.

If stereo-balance was achieved beforehand by increasing the prism on the stereo-balance test, perception of overcorrection only on the cross test indicates FD II of the fourth or fifth subtype.

Perception of overcorrection both on the cross test and on the pointer and double pointer test and/or rectangle test indicates FD II of the sixth subtype.

The effect of the last prismatic change on all other tests must be checked in every case.

8 Testing for binocular balance

8.1 Purpose of testing

Binocular balance is present if the focusing point distance is the same for both eyes.

Testing for this is necessary because changes to the farpoint refraction are possible during the associated heterophoria measurement.

Binocular balance is present when stereo-balance has been achieved on the stereo-balance test and contrast equality on the cross test.

If there is no contrast equality on the cross test, the Cowen test can additionally be used.

8.2 Cowen test

Symbol: C

Purpose

After use of the associated heterophoria tests, the Cowen test serves to check binocular balance as a supplement to the cross test.

If binocular imbalance is suspected, the Cowen test is only used to ascertain in which direction the spherical correction value should be tested monocularly on optotypes.

Guidelines for explanation and use of the test

As red-green tests produce coloured afterimages which can have a disturbing effect on the subsequent tests, the Cowen test should be presented for as short a time as possible.

Possible formulation of question:

„Do you see two rings on the top and two rings on the bottom? Are the two upper rings the same shade of black?“

If the patient hesitates with his reply, continue to ask:

„... or does the ring in the red area or the one in the green area appear to be blacker?“

Proceed in the same way for the two bottom rings.

Assuming the same focusing wavelength for the two eyes, binocular balance is present if:

- both rings in the red field are perceived as being blacker than those in the green field (binocular red dominance),
- all four rings are perceived as being the same shade of black,
- both rings in the green field are perceived as being blacker than those in the red field (binocular green dominance).

As the focusing wavelength in distance vision usually lies in the long-wave range, binocular balance is most frequently indicated by binocular red dominance.

If the result obtained on the Cowen test suggests the possible need for a refractive change, the sphere must be checked on optotypes in monocular vision. This guarantees that refraction is performed for the fovea centre. For this purpose, high prismatic values should be removed from the trial frame, with the latter being reset to pupil centre centration, if necessary.

Changes to the refractive correction always require a rechecking on the associated heterophoria tests. If this rechecking leads to further prismatic correction steps, the testing for binocular balance must also be repeated.

Spherical correction values must never be changed in binocular vision, but solely in monocular vision. The MKH therefore rules out the possibility of testing for binocular balance in the conventional way.

9 Guidelines for near testing

9.1 Purpose of near testing

Near testing is used to check and, if necessary, change the prismatic correction determined on the distance tests. Furthermore, it is also decided whether the prismatic correction for near should deviate from that for distance.

Usually, the measuring and correction steps on the near tests are no different to those on the distance tests. Therefore only special features of associated heterophoria measurement in the near tests will be given in this section.

9.2 General rules

Associated heterophoria measurement on the near tests is commenced with the prismatic correction determined beforehand on the distance tests.

The near vision testing instrument is presented at a distance of 40 cm. If necessary, a suitable near addition should be used.

The tests are presented in the same order as for distance, starting with the cross test for near vision.

If different measured values are obtained for near and distance, different prismatic correction values are not advisable with a few exceptions.

Reason:

By the wearing of the prismatic correction determined on the distance tests, experience has shown that the sensomotor system becomes stabilised to such an extent that a subsequent check provides the same measuring results for distance and near.

If the prismatic correction obtained on the near tests differs from that determined beforehand on the distance tests, it must be subsequently rechecked on the distance tests. No deterioration should occur in the stereo-balance test in particular, i.e. no new or greater prevalence.

If the prismatic correction obtained on the near tests is confirmed on the distance tests, it should be prescribed for both near and distance.

If it is not confirmed, a check must be made to establish whether the prismatic correction determined on the distance tests is tolerable for long periods of reading.

In the event of intolerance, it is decided in each individual case whether different prismatic corrections are required for distance and near.

9.3 Cross test for near

Symbol: K/N

The following cases may be experienced when this test is presented:

- Spontaneous **alignment perception and contrast equality**

In this case, the associated heterophoria measurement can be terminated, as the other near tests will not provide any further information on possible correction.

- Spontaneous **alignment perception, but contrast inequality**

and/or other inhibition phenomena

In this case, near testing is continued on the other near tests. In anisometropia, binocular balance should be checked beforehand on the Cowen test for near.

- **Exo-perception**

This can have the following causes:

1. Inhibitions still present prevent the full effect of the fusional stimuli for near, leading to too little convergence for the testing distance.
This results in an exo-position, regardless of the direction of an associated heterophoria determined beforehand on the distance tests, even if it has already been fully corrected.
2. Fusional tonus has relaxed, revealing motor portions of an associated exophoria.
3. The associated heterophoria in near vision deviates from that in distance vision in the exo direction.

In the event of exo-perception, the following procedure is performed irrespective of the cause not known beforehand:

Firstly, an attempt is made to achieve alignment perception of the test by increasing the testing distance.

- If this is successful and the alignment perception remains when the distance of 40 cm is slowly approached again, the testing is continued on the other near tests.
- If this is not successful, an attempt is made to achieve alignment or at least reduced exo-perception by increasing the prismatic correction (horizontal and/or vertical) determined on the distance tests. This is often accomplished with only a slight increase in the correction if this successfully resolves the inhibitions, because in most cases, inhibition-induced exo-perception (up to test field diplopia) is caused by only a small, still uncorrected portion of the associated heterophoria. Incidentally, this is one of the reasons for the many so-called "physiological near exophoriae" measured in procedures other than MKH.

If increasing the prismatic correction results neither in alignment perception nor in reduced exo-perception, an attempt is made to achieve this by

- reducing the base-out prisms in the case of associated esophoria (with or without vertical associated heterophoria) determined on the distance tests,
- prismatic trial lenses with a horizontal base setting (base-in first) in the case of vertical associated heterophoria determined on the distance tests.

- **Eso-perception**

In this case, the procedure is dependent on the direction of the associated heterophoria determined beforehand on the distance tests:

- In the case of associated esophoria (with or without vertical associated heterophoria) determined on the distance tests, the prismatic correction is increased in the horizontal direction, as fusional tonus has relaxed. This increase can also be performed on the cross test for distance.
- In the case of associated exophoria (with or without vertical associated heterophoria) determined on the distance tests, the prismatic correction is not changed here and checked on the other near tests. Associated exophoria with eso-perception in near vision is very rare.
- In the case of vertical associated heterophoria determined on the distance tests, an attempt is made to achieve alignment perception or at least reduced eso-perception by using prismatic trial lenses with a horizontal base setting (base-out first). Vertical associated heterophoria with eso-perception in near vision is very rare, too.

- **Displacement perception in the vertical**

In this case, irrespective of a horizontal associated heterophoria determined on the distance tests, an attempt is made to achieve alignment perception or at least reduced displacement perception by

- increasing the vertical prism in the case of vertical associated heterophoria already determined on the distance tests,
- inserting a vertical prism with the appropriate base setting in the case of vertical associated heterophoria not yet determined on the distance tests.

In anisometropia, it must be guaranteed that the vertical displacement perception is not caused by an incorrect viewing height.

If a change in the prismatic correction determined on the distance tests has led to alignment perception or to reduced displacement perception on the K/N, the changed correction can be checked on the distance tests before use of the other near tests.

9.4 Further WF-tests for near

If further near tests are used after the cross test for near, the same rules apply as for the corresponding distance tests.

As there is no stereo triangle test for near vision, the stereo-balance test is used as an alternative to test for delays.

Every change to the prismatic correction on a near test can be checked on the corresponding distance test before the next near test is used.

9.5 Cowen test for near

Symbol: C/N

A check for binocular balance is especially recommended in anisometropia. It should be performed in accordance with the rules of the Cowen test for distance.

As the focusing wavelength in near vision is often shifted towards shorter wavelengths, binocular balance is generally evident through binocular green dominance or by the fact that all four rings are perceived in the same shade of black.

Appendix

Symbols

Symbol	Meaning
MKH	Measuring and Correction Methodology after H.-J. Haase
IVBV	International Association for Binocular Fullcorrection
WF	Winkelfehlsichtigkeit (associated heterophoria)
FD	Fixation disparity
FD I / II	Fixation disparity of the first / second type
K	Cross test
Z	Pointer test
DZ	Double pointer test
H	Rectangle test (vertical)
St ¹⁵	Stereo triangle test
V ¹⁵	Stereo-balance test
Dx ¹⁶	Differentiated stereo test
RH	Random dot hand test
RS	Random dot step test
C	Cowen test (red-green colour test)
.../N	Symbol / Designation for near ¹⁷ Example: WF/N, K/N, C/N

¹⁵ see section 6.2 Comment on the angle of stereopsis, page 42

¹⁶ x = number of rows

¹⁷ Symbols without the designation /N refer to distance.

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Further literature and literature in English can be taken from the website of the IVBV: www.ivbv.org.

Scientific advisory committee

The scientific advisory committee of the IVBV came out from the "IVBV working group instructors" that elaborated the first edition of the guidelines on hand.

The scientific advisory committee is responsible for the permanent development of the guidelines.

The current members of the committee can be taken from the website of the IVBV: www.ivbv.org.

The committee will be pleased about any suggestion and constructive criticism. Please send it in writing to the IVBV.

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These Guidelines for the Correction of Associated Heterophoria, published by the IVBV (International Association for Binocular Fullcorrection), are out for the first time in the form on hand.

The guidelines are meant for all persons active in eye examination, who use the MKH (Measuring and Correcting Methodology after H.-J. Haase).

May the application of these guidelines continue to prove a valuable aid for the benefit of people with associated heterophoria.