Information Guide

Synoptophore (Major Amblyoscope)
Synoptophore (sin-op-to-phore) Greek: syn = with, ops = eye, phoros = bearing

**Introduction**
This information has been designed for eye care professionals and is intended as a quick and easy companion, not as a formal teaching aid.

As each assessment is highly individual the proficient use of the Synoptophore comes from experience and skill in interpreting the patient responses correctly.

**History**
The Synoptophore design has undergone many changes over the years. In 1838 Sir Charles Wheatstone constructed the first stereoscope. In the early 20th century Claud Worth produced the Amblyoscope, to evaluate and stimulate binocular vision. To determine the extent of simultaneous perception and measure the area of suppression M.C. Maddox first developed slides to be used in these early devices.

Initially based on these instruments the Synoptophore (Major Amblyoscope) has evolved from measuring angles of deviation, treating binocular anomalies and has utilised pleoptics since Clement Clarke’s first patent in 1929.

**3 models available**

**2001 model**
The 2001 is the most comprehensive model in the range. All standard measurements and treatments are possible, and the model boasts an automatic flashing unit allowing each eye to be stimulated alternately or simultaneously. A removable pair of Haidinger’s Brushes motor units are provided as standard, allowing users to employ pleoptic techniques to assess and treat eccentric fixation and abnormal retinal correspondance.

**2002 model**
The 2002 model combines all the features of the 2001, with the exception of the Haidinger’s Brushes. It is ideal for the assessment and treatment of patients needing orthoptic care or management.

**2003**
The 2003 model provides all the standard measurements and treatments including the manual flashing switches and independent dimming rheostats.
Basic principles

The eye-pieces consist of +6.50 DS collimating lenses, which require the patient to relax their accommodation, as if looking into the infinite distance. A plane, silvered, mirror reflects 90° along the two, cylindrical-conical, optical tubes. These tubes pivot horizontally, vertically and torsionally on their supports so that the two presented images may be moved in relation to each other. At the end of the tubes there is a light source, which evenly illuminates the transparencies, as a plastic screen diffuses light from the lamp bulbs.

As the Synoptophore is adjusted, to produce the required measurements, a series of alternately sized slides as well as various scales are required.

The scales on the Synoptophore, to measure the displacement, are degrees and Prism Dioptres (Δ).

As shown in the picture above

\[ 1\Delta = 100 \times \tan(\degree) \]

Therefore \( 1\degree = 1.75\ \Delta \)
Basic operation

All grades of Binocular Single Vision (BSV) can be assessed on the Synoptophore.

Simultaneous Perception (SP):
The first grade of BSV, Simultaneous perception (red binding), is tested using two dissimilar pictures, such as a lion and a cage. The tubes are objectively (by the examiner) and subjectively (by the patient) adjusted so that either the lion is perceived to be inside the cage or one image is suppressed.

Ideally foveal size pictures should be used, but the target size should be appropriate to the patient’s visual acuity (VA).

<table>
<thead>
<tr>
<th>Slide size</th>
<th>Angle subtended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foveal</td>
<td>1°</td>
</tr>
<tr>
<td>Macular</td>
<td>1° -3°</td>
</tr>
<tr>
<td>Paramacular</td>
<td>3° - 5°</td>
</tr>
<tr>
<td>Peripheral</td>
<td>&gt; 5°</td>
</tr>
</tbody>
</table>

Each slide size has been calculated to subtend a different angle at the nodal point of the eye.
• The patient should be seated at the Synoptophore
• The inter-pupillary distance (IPD) should be adjusted so the lines on the eyepiece line-up with the corneal reflections
• The smaller picture, i.e. the lion, should be placed in the slide holder in front of the fixing eye, whilst the larger picture should be placed in front of the fellow eye.

Objective – By alternatively switching off the lights illuminating the slides an alternate cover test is performed. The patient’s eyes are dissociated and as the single illuminated picture is projected onto each fovea alternately a re-fixation movement occurs. The direction of the eye movement is examined and the tube before the non fixing eye is adjusted until no eye movement is seen, or reversal of movement is noticed. The measurement is then read off the scale in degrees. This can be repeated for vertical deviations using however measurements should be read off the scale in prism dioptres (Δ).

NB: If the fixation is poor the corneal reflections alone may be used to assess the angle of deviation.

Subjective – The patient pulls/pushes the handle controlling the non-fixing eye’s tube until the two images are superimposed. If this is difficult or not possible suppression may be present and a larger target should be introduced, however, if superimposition is not achieved with peripheral slides then the patient has no potential BSV.

TIP: It is worthwhile asking questions about the pictures to stimulate the patient’s attention i.e. “does the lion look hungry?”

Near – To calculate the amount of deviation at near the process can be replicated with -3.00 DS lenses placed in the eye-piece’s lens holder This induces 3.00 DS of accommodation, simulating near viewing.
Sensory (SF) and Motor Fusion (MF)

To assess the second grade of BSV, sensory fusion (green slides), two similar pictures each with an incomplete “control” (i.e. rabbit’s tail and a bunch of flowers) are presented to the patient. One tube is locked, at zero, and the patient is instructed to move the image, as with SP, and create a composite image of the rabbit holding a bunch of flowers. It is important to question the patient about the “controls” to prove sensory fusion or assess for the presence of suppression. Yet again, if this is difficult for the patient, larger slides may be beneficial.

The position sensory fusion was achieved is read off the scale and the range of motor fusion is then tested by locking the columns at this corrected angle and converging/diverging the tubes until either control disappears or the image splits into two. The vergences may then be read off the scale in degrees.

NB: When testing motor fusion the images may become de-focused or alter in size before fusion fails.

TIP: Observing the corneal reflections is beneficial when assessing fusion, as it will indicate when suppression occurs.
Stereopsis

A gross qualitative stereopsis (yellow slides) assessment can be obtained using two images of the same object, hypothetically taken from slightly different angles, to indicate depth perception. The slides are inserted into the slide holders with the controls of each slide positioned towards or away from the subject. The patient is then required to describe the apparent effect i.e. a swing moving towards or away from them. The test should be repeated, with the slide controls changing position, to ensure the stereoscopic effect is authentic and the patient is not guessing.

Retinal Correspondence

Whilst assessing simultaneous perception retinal correspondence may also be examined. When the objective and subjective angles are equal normal retinal correspondence (NRC) is present, however, should the objective and subjective differ an “angle of anomaly” is present. If this equals the objective angle abnormal retinal correspondence (ARC) is “harmonious”, if the objective angle is larger than the angle of anomaly ARC is “unharmonious”.

NB: Retinal correspondence can also be determined on the Synoptophore using special Bielchowsky after image test slides and high intensity lamps.

<table>
<thead>
<tr>
<th>Example report</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective angle</strong></td>
</tr>
<tr>
<td><strong>Subjective angle</strong></td>
</tr>
<tr>
<td><strong>Fusion at subj.</strong></td>
</tr>
<tr>
<td><strong>Stereopsis at subj.</strong></td>
</tr>
</tbody>
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Stereopsis
The variety of movements the Synoptophore allows permits several other tests to be undertaken. Some of the most prevalent are AC/A ratio, plotting the area and density of suppression scotomas, assessing 9 positions of gaze and the subjective measure of torsion.

**Accommodative convergence to accommodation ratio (AC/A ratio)**

The gradient method is most often used, when accommodation, minus without accommodation is divided by the change in accommodation. This can be assessed on the Synoptophore by adjusting the IPD to the patient, placing foveal SP slides into the slide holders and measuring the objective angle ($\Delta$), then repeating with -3.00DS (or a lower power).

i.e. $+18\Delta - +9\Delta / 3$DS = 3:1

The Graphic method however plots comparisons of normal convergence against the subjective angle, as minus lenses of increasing power (usually -1.00DS to -4.00DS) are used. As the test is standardised (fixation distance, illumination etc) Accommodative Convergence is the only variable affecting the deviation.

**Suppression**

The area of suppression may be mapped out by initially recording the angle at which the image is suppressed, then as the tube is rotated horizontally or vertically record when both pictures are again apparent and subtract one from the other.

As the rheostat controls the illumination presented to the fixing eye lowering the illumination until simultaneous perception is achievable gives an estimate of the density of suppression. This is not however recommended for dense suppression.

**TIP:** In dense suppression it may be required to press the slide ejection lever or tap the light housing to draw attention to the image.
9 Positions of gaze

In complex ocular motility cases, all 9 cardinal positions of gaze can be subjectively measured along with unilateral ductions with repeatable, standardised conditions.

The subjective measurement can be performed fixing either eye in the primary position, when the central lock is released on lateral versions and using the elevation and depression controls up to +/- 30° vertically.

Using an appropriate size slide, the arm of the Synoptophore may be progressively moved from zero degrees into the defective position of gaze, whilst the patient maintains fixation. When either the patient responds or it becomes apparent the eyes have stopped following the fixation target a duction measurement is recorded, in degrees.

**TIP:** It may be useful to hold the patient’s head whilst testing inconcomitant deviations.
Torsion

Maddox slides (white binding) can aid the assessment of 9 positions of gaze. Horizontal and vertical deviations are assessed in the normal way. However, with the cross before the fixing eye the examiner may rotate the torsion control until the patient is satisfied that it superimposes in the centre of the green surround and all lines should run parallel.

Further information

For further information on the Synoptophore, please telephone (01279) 456255 or email synoptophore@haag-streit-uk.com.
**Common terms**

**Angle alpha** – The angle between optical axis and the visual axis. A positive angle, (corneal reflection placed nasally) causes pseudo divergent squint; negative angle (corneal reflections placed temporally) causes pseudo-convergent squint.

**Angle gamma** – The angle between the optical axis and the fixation axis.

**Angle kappa** – The angle between the mid-pupillarly line and visual axis.

**Angle of anomaly** – The difference between objective and subjective angles of deviation.

**Motor fusion** – The ability to maintain sensory fusion through a range of vergence, which may be horizontal, vertical or cyclovergence.

**Sensory fusion** – The ability to perceive two similar images, one formed on each retina, and interpret them as one.

**Simultaneous perception** – The ability to perceive simultaneously two images, one formed on each retina.

**Stereopsis** – The perception of relative depth of objects on the basis of binocular disparity.

**Synoptophore (Major Amblyoscope)** – Equipment which can be used to assess the angle of deviation and binocular potential at a theoretical distance fixation.

**Superimposition** – The simultaneous perception of the two images formed on corresponding areas, with the projection of these images to the same point in space. This may occur whether retinal correspondence is normal or abnormal. If fusion is absent two similar images are seen as separate but superimposed and no fusion range is demonstrable.