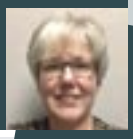

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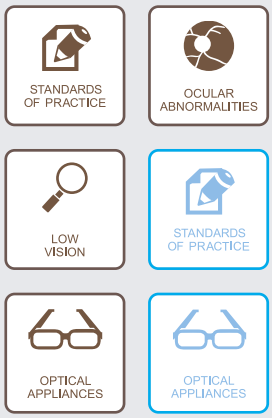

This CET has been approved for 1 point by the GOC. It is open to all FBDO members, and associate member optometrists. The multiple-choice questions (MCQs) for this month's CET are available **online only**, to comply with the GOC's Good Practice Guidance for this type of CET. Insert your answers to the six MCQs online at www.abdo.org.uk. After member login, go into the secure membership portal and CET Online will be found on the L menu. **Questions will be presented in random order**. Please ensure that your email address and GOC number are up-to-date. The pass mark is 60 per cent. The answers will appear in the May 2020 issue of Dispensing Optics. The closing date is 10 April 2020.

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Bioptic basics for beginners Part 2

By Abi Grute BSc (Hons), MCOptom, BSc(Hons), FBDO (Hons), LVA (Hons) SLD Cert Ed

This article is the second in a two-part series that provides an overview of the optical properties, availability, fitting process and training in the use of bioptic telescopes (BTs) to aid central vision magnification.

In article one (*Dispensing Optics*, December 2019), the optical principles of telescopic design, factors that may influence the choice and successful use of such devices, were discussed. This second article will detail some of the aids that are currently available in the UK, how to fit bioptics and how to train users to make the best use of their devices.

The optics of BTs involving the use of technology is outside the scope of this article.

AVAILABILITY IN THE UK

Having reviewed the user's requirements, it is then necessary to consider what type of aid is best suited to their needs. This means it is necessary to consider if the telescope will be Galilean or Keplerian in design, the distance at which the aid is to be used, the level of magnification required, how it will be mounted, if ametropic correction is necessary, and if it will be monocular in design.

In the UK, there appear to be fewer suppliers of BTs than in some other countries, and **Table 1** sets out some of the units that are currently available and their properties.

It should be appreciated that the selection of BT power, whether for distance or near use, is established by the normal magnification reckoning of: estimated magnification = actual acuity/desired acuity – with due regard to user contrast sensitivity noted in **Table 2** of part one of this article.

Anecdotal opinion gives rise to the idea that most practitioners feel that a gain of three lines of acuity is an acceptable result, coupled with the minimum magnification necessary at the required working distance, if it is sufficient to achieve the desired goal.

FITTING BIOPTIC TELESCOPES

There are many parallels to be drawn between dispensing progressive power lenses and BTs. Both types of corrective device require accurate horizontal and vertical centration, careful consideration of the pantoscopic angle, and must be glazed into well-fitting, securely adjusted spectacle frames.

Before taking any measurements, the pantoscopic angle must be carefully adjusted and recorded. The frame should have a complete fitting before further measurements are taken, and the vertex distance should also be noted.

If fitting a 'through the lens' type of device, the BT may protrude as much as 6mm from the back plane of the front.

For this reason, it may be important to carefully control the vertex distance at which spectacles are fitted. Frames with pads on arms may well need the pad arm loop widened in order to provide more room for the BT, depending upon how the frame fits relative to the user's brow.

Horizontal centration will be dependent upon whether the device is to be used binocularly or monocularly for distance, intermediate or near tasks. Extra care must be given to consider the effect of any heterophoria or heterotropia on monocular and binocular centration measurements. Horizontal centration for distance use should be measured in the usual way.

If the field of intended use is for intermediate or near, the manufacturer will be able to provide details of the working distance. It is important to establish exactly where the working distance is measured from, i.e. from the objective lens

SUPPLIER	PRODUCT	TELESCOPE TYPE	DESCRIPTION	MAG	FIELD OF USE	*FIELD OF VIEW	FOCUSING RANGE
Associated Optical	Ocutech SightScope	Galilean fixed focus	Clip on monocular or binocular. Reading caps available	1.7x 2.2x	∞	26° 18°	Fixed
Lemon Chase	Design for Life Vision	Galilean fixed focus	Front surface mounted, monocular or binocular. Reading caps available	2.2x	∞	12°	Fixed
Lemon Chase	Design for Vision	Galilean fixed focus	Front surface mounted, monocular or binocular. Reading caps available	2.2x	∞	16°	Fixed
Zeiss	Zeiss G2 Bioptic	Galilean fixed focus	Front surface mounted BT	2x	∞	10°	Fixed
Associated Optical	VES Mini**	Keplerian adjustable focus	Through the lens, lens mounted	3x	∞ to 18cm	15°	Adjustable
Edward Optical	BITA	Galilean adjustable focus	Through the lens, lens mounted. Reading caps available	2.5x 3x 3.3x 4x 5x 6x	∞ to 36cm ∞ to 60cm	10.5° 9° 9° 8.5° 7° 6.5°	Adjustable
Associated Optical	VES Explorer**	Keplerian adjustable focus	Through the lens, bridge mounted	3x 4x	∞ to 18cm ∞ to 23cm	15° 12.5°	Adjustable
Associated Optical	VES Sport II**	Keplerian adjustable focus	Through the lens, bridge mounted	3x 4x 5x	∞ to 23cm ∞ to 25cm ∞ to 30cm	12.5° 10.5° 9.6°	Adjustable
Associated Optical	VES K**	Keplerian adjustable focus	Through the lens bridge mounted	3x 4x	∞ to 18cm ∞ to 23cm	14° 12.5°	Adjustable

All models should be checked with supplier as specification are subject to change. *Note all measurements for field of view are assuming distance use. **All VES models have some amount of ametropia correction by adjusting telescope length, eyepiece caps are also available for some models

Table 1. Currently available bioptic telescopes and their properties

to the object, the eyepiece lens to the object, or the exit pupil to the object.

It is then necessary to consider if the device is to be mounted on the spectacle lens or through the spectacle lens, in order to place the ruler in the plane of the eyepiece lens when measuring. Centration should then be measured with the user fixating an object of appropriate size at the exact working distance of the telescope: this will be a lot closer than a 'standard reading position'.

A very easy method of checking whether the centration is correct is to ask the user to describe the shape of the field of view through the aid. If the device produces a circular field of view, the user should see a complete circle when viewing through each eyepiece. If a partial circle is seen, or if the user has to laterally alter their head position to view an object directly ahead, then centration is incorrect.

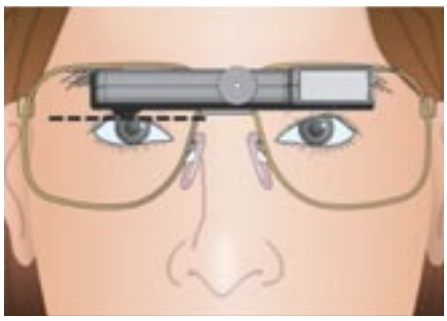

Figure 1. Schematic illustration of the vertical fitting height of Bioptic device

Manufacturers of BTs often recommend that the BT is mounted so the bottom of the eyepiece lens coincides with the top of the pupil with at least a 3mm surround of spectacle lens to ensure stability of fixing[1] (**Figure 1**).

If the telescope is to be mounted to the front surface of the lens, more translation movement will be needed to access the telescope, which will be perpendicular to the spectacle lens, as the distance between the ocular centre of rotation and the exit pupil will be greater.

If the telescope is to be mounted through the lens and suspended from the brow bar of the spectacles, it is generally mounted at an angle of 10° to the horizontal plane, and remains independent

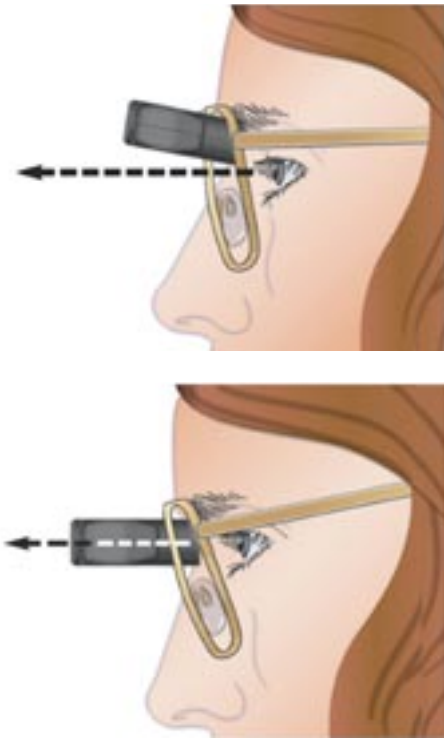

Figure 2. Schematic illustration of the relationship between telescope viewing axis and telescope mounting angle

of the pantoscopic angle (**Figure 2**). As the BT eyepiece is closer than the vertex distance of the spectacles, manufacturers suggest that a 10° inclination of the head should align the visual axis of the telescope with the line of sight. Obviously, the pantoscopic angle should still be adjusted before BT mounting height is measured.

If the BT is to be mounted through the lens and held directly by the spectacle lens, consideration must be given to the pantoscopic angle and the mounting angle of the telescope. The mounting angle of this type of lens tends to be controlled by the manufacturer.

It is suggested by the inventor of the Ocutech range of lens-mounted BTs that the telescopes are at a 10° angle from the horizontal, and the final mounting angle of the telescope is the sum of the angle made by the telescope to the horizontal and the pantoscopic angle. In this example, with a 12° pantoscopic angle means the telescope is mounted at an angle of 22°[2] in order to ensure that the user gains maximum field of view through a BT.

In addition to the centration distance and telescope mounting angle, it is necessary to consider the vertex distance and exit pupil position of the devices to ensure maximum field of view. When using Galilean aids, the largest field of view is achieved with shortest vertex distance for reasons discussed in part one of this article.

When fitting Keplerian aids, it is useful to know the distance from the eyepiece lens to the exit pupil. This will allow a final vertex distance to be estimated. For example, if the eyepiece lens protrudes 6mm behind the back plane of the spectacles and the exit pupil lies 10mm behind the eyepiece lens, the starting vertex distance would be 13mm if an arbitrary entrance pupil position of the eye were taken as 3mm from the corneal apex. The relationship between these measurements is shown in **Figure 3**.

The author's experience is that this empirical approach to fitting remains a valuable starting point and that there is often merit in experimenting with the final fitting height and mounting position of the BT in order to meet the individual needs of the user. There is no reason that some types of monocular BTs, particularly lower power Galilean devices, cannot be mounted at the lower edge of the pupil or in the temporal periphery of the spectacle lens. With practice, it is also possible to mount the BT to coincide with the user's preferred retinal locus used in eccentric viewing.

VISUAL REHABILITATION

Visual rehabilitation is a crucial part of supporting visually impaired patients to gain the most from their residual vision and any aids that are supplied[3]. Descriptions of visual rehabilitation widely vary but many appear to agree that rehabilitation must involve some elements of training – not only to maximise use of remaining vision, but also in using any visual aids that are provided.

It seems that there is no clear consensus on how much training is required to achieve full visual potential, with studies quoting improved results with approximately five hours[4] – or as much as six hours of training with some with additional exercises to practise at home[5].

To the best of the author's knowledge, there are no formally agreed training programmes for users of BTs, however, there are some basic principles that are helpful in training any user to use any type of low vision optical device.

Training sessions are best undertaken little and often. Ten to 15 minutes repeated several times throughout the day are often less frustrating and tiring than one longer session. This is particularly easily achieved when a user is wearing a BT.

Brighter environmental conditions are more likely to produce higher contrast images that are easier to view. Practise is best undertaken in a quiet environment when the user is not tired or stressed, starting with simple tasks that are stationary. Motivation is often helped by setting short-term targets in order to reach the user's ultimate goal, using analogies to help them understand that it takes a fair degree of patience, practise and effort to become proficient with the device.

It is the author's experience that it is most helpful to explain the process of training and the target for each session before the user begins the session. This is because once the user is concentrating on the visual effects of the device, they may not retain or follow instructions.

Telescope training is often broken into a variety of stages and the same process and steps appear to work very well with BT devices. It should be appreciated that the training should take

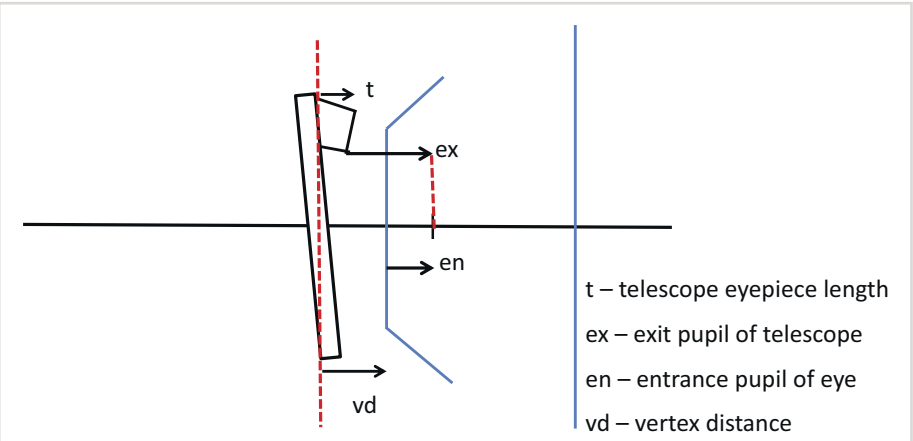

Figure 3 Side view of mounted aid to show relationship between spectacle vertex distance, eyepiece length, exit pupil and entrance pupil

place at the appropriate distance for the focal length or range of the aid. Give the user the experience of just handling the device, understanding its features and any focusing mechanisms.

PATIENT TRAINING STEPS

Localisation and translation is the first step in using a telescope. It is the process of being able to locate an object in the field of view and then move the chin to ensure the image is translated to the field of view of the telescope. This should be trained with the user comfortably seated viewing a stationery object. Home exercises can be given so this practise may be continued at home. For example, finding a clock, the television, a picture etc.

Focusing must be trained if the telescope has an adjustable focus. This is most readily done by encouraging the user to localise and translate an object, the trainer then puts the device out of focus and then encourages the user to adjust the mechanism of the telescope to bring the image into focus. Remember that the telescope may have a limited range of focus, so the user must be made aware of the range available. Once this has been mastered, they should then be encouraged to focus on objects at different distances.

Spotting is the combination of the skills outlined above, and is the consolidation of ensuring that the user can effectively align the optical axis of the telescope with visual axis of the eye and view the object clearly.

Tracing is the following of stationary lines in the visual environment, for example, lines of print or pathways. This should be undertaken whilst the user is seated because this action can be very disorientating to begin with, remembering that the magnified image moves much faster than the non-magnified image.

Tracking is similar to tracing but involves following a target that is moving rather than stationary. This can take a large amount of practise and it appears to be most easily done by viewing moving objects on computer screens for near objects, and slow moving far distant objects to begin with.

Scanning is most readily appreciated by considering it as a skill to locate an unseen object in the visual field by using the BT to find it. It is akin to a technique that allows the user to form a 'mind map' of the environment by scanning the scene in a methodical method from left to right, moving down the view a little each time.

Final instruction should be given to the care and need for regular adjustments in order to keep the device in good working order, and delivering maximum benefit to the user.

CONCLUSION

Whilst this type of low vision device is by no means common, those with an interest in low vision and visual enablement may well benefit from enhancing their scope of practice to incorporate bioptic telescopic devices.

The use of such devices is not limited to those with age-related macular degeneration and diabetic retinopathy. 'The author's own experience is that they can be useful for most types of conditions that involve central vision loss, such as optic atrophy, Stargardt's disease and myopic degeneration.

It may take a little more time to train users how to get the most from their aid, and not everybody is suitable or successful with such aids, but the feedback from those that are makes this type of dispense entirely worthwhile.

ACKNOWLEDGEMENTS

The author wishes to thank Ian Hughes of Associated Optical and Dr Henry Greene for their help, and Ocutech and Zeiss for the use of their images in this article.

ABI GRUTE has worked in optics for more than 30 years, mostly as a dispensing optician in independent practice. After more than five years as an ABDO College lecturer, she left to head the training and development department of a large independent optical group. In 2011, she went on to study optometry at City University. She has sat as an ABDO board member, General Optical Council Fitness to Practise Committee member, distance learning course author, CET review panel member and Worshipful Company of Spectacle Makers (WCSM) principal examiner. In 2018, she was awarded the WSCM Outstanding Service Medal in recognition of her service to the Education Committee. Abi continues to serve as an ABDO practical examiner and principal examiner for optics in the ABDO Low Vision Honours course.

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