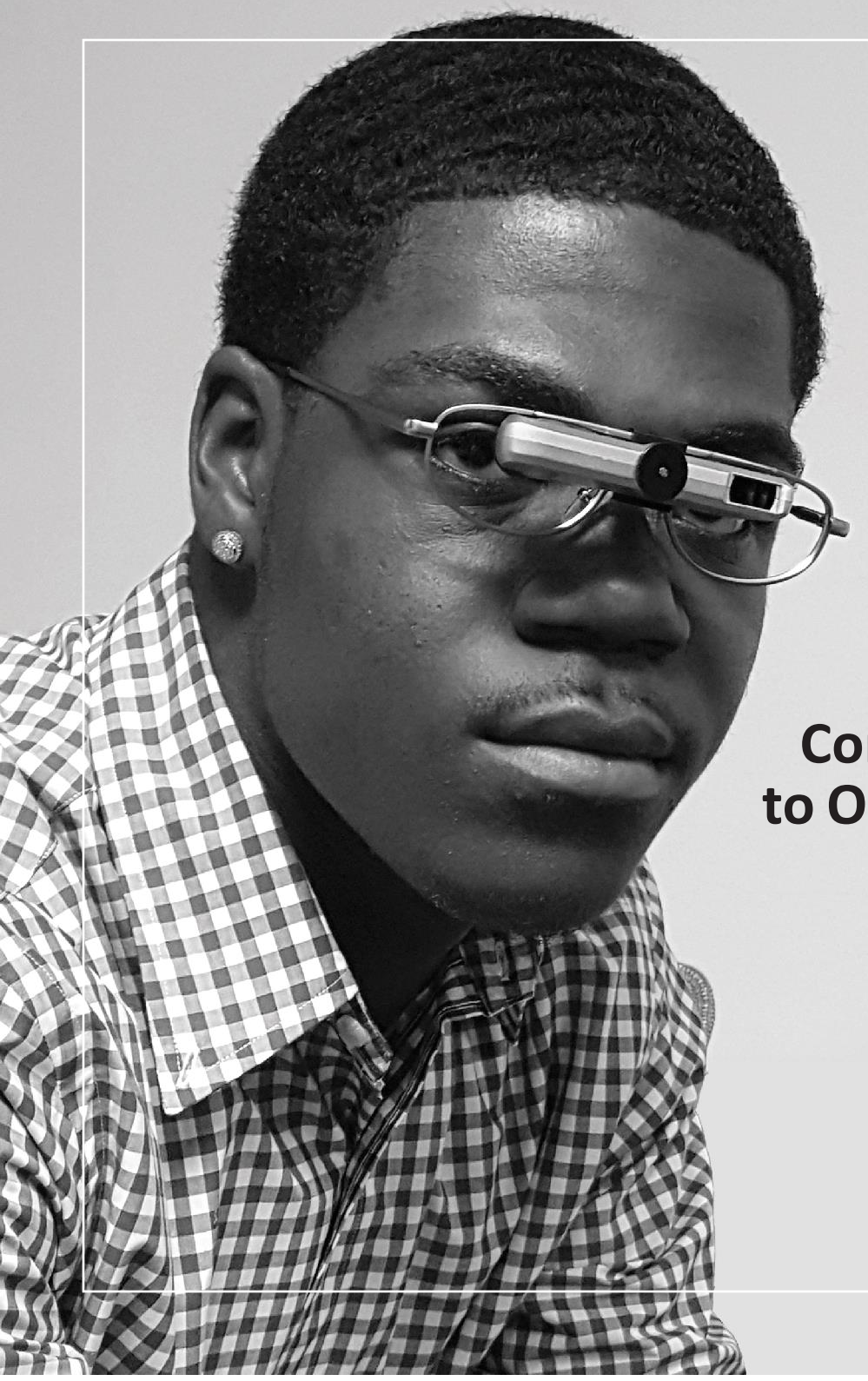

Consumer's Guide to Ocutech® Bioptic Telescopes Part I, II and III

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OCUTECH® *Sight Enhancement Technology*

Part 1: Understanding Telescopic Low Visions Aids

Consumers often ask "Which Ocutech bioptic telescope is right for me?"

My first answer is that it's your low vision specialist's job to help guide you to make that decision—you can't reliably choose it by yourself as there are too many variables that need to be considered. And you'll need your low vision specialist to demonstrate, prescribe, and fit the bioptic, as well as support you as you learn to use it.

With that being said, it certainly makes sense for you to know what your low vision specialist is thinking about when you are evaluated, and what information they collect through your history, needs, goals, and testing that will drive their recommendation.

First of all, what are bioptic telescopes?

Bioptic telescopes are eyeglasses that have a miniature telescope attached that magnify the image seen by the user. The telescopes are usually (though not always) mounted toward the top of the eyeglass frame, which allows the user to look through their regular eyeglass prescription (the carrier lenses) and then be able to dip their head down slightly to look into the telescope eyepiece to see the magnified image. In much the same way that Ben Franklin invented bifocal eyeglasses so he wouldn't have to constantly switch between his distance and near eyeglasses, a bioptic is more convenient than having to stop what you are doing, pick up another device, and aim and focus it. If you're doing other things with your hands it's even less convenient. It's called a 'bioptic' because the name 'bifocal' was already taken!

There are two types of bioptic telescope optical designs—Galilean and Keplerian.

Galilean telescopes are smaller and lighter weight and are great at 1.7x and 2.2x powers, but their fields of view become very narrow at powers of 3x and higher. So, when prescribing powers of 3x and higher, Keplerian telescopes, which have a more complicated optical design which includes both lenses and prisms, will provide much wider fields of view that users prefer.

All bioptic telescopes can be used both for distance and near seeing distances. Galilean telescopes are available as manual focusable or fixed

focus devices that use 'reading caps' to be focused at near distances. Keplerian telescopes are available as both manual focus and autofocus versions.

What are we trying to accomplish when prescribing a bioptic telescope?

1. Get you the visual acuity you need to see more clearly!

Well, the obvious answer is to get you to see what you want to see. So, the first goal is to provide adequate visual acuity through the telescope. As practitioners, we know that our patients can see just about everything they need to see with visual acuity of 20/40. In fact all states will allow individuals to drive with no restrictions if their acuity is no worse than 20/40 with regular eyeglasses or contacts if needed. In the classroom, studies have shown that students can see everything they need to see with acuity of 20/40, and lastly most newspaper print is legible with 20/50 visual acuity.

So, once we know what your best-corrected visual acuity is (with eyeglasses or contacts if they are helpful), we can start to determine what power telescope is likely to provide 20/40 vision through the device.

Below is a chart that can help determine a starting point for telescope power selection.

Usually visual acuity gain from telescope magnification is geometric—a two power telescope will give you a two-times improvement in acuity. However as visual acuity worsens, especially beyond 20/200 and more frequently with wet macular degeneration, diabetes, and glaucoma, the acuity gain may not always be geometric. You may require more magnification than expected to achieve the visual acuity you seek. And if 6x magnification doesn't achieve your goal, it's unlikely you'll be successful with a bioptic telescope.

Why not prescribe for better visual acuity than 20/40?

To achieve better visual acuity through the telescope a higher magnification power must be used. The higher the power, the narrower the field of view, the greater the image motion due to head movement, and the dimmer the magnified image will be (all telescopes reduce retinal illumination and contrast- and the stronger the power, the greater this effect).

So, once adequate visual acuity is achieved when looking through the telescope, the primary goal users have is to gain the widest field of view possible, which allows you to more easily find what you are looking for and obviously to see more at one time. As a result it usually makes sense to use the lowest power telescope that will provide adequate visual acuity so as to achieve the widest field of view

For Best-Corrected Visual Acuity up to: (With regular glasses or contacts if helpful)			**Start with telescope power**
Snellen Measure	**Metric Measure**	**Decimal Measure**	
20/60	6/18	0.32	1.7x
20/80	6/24	0.25	2.2x
20/125	6/40	0.16	3.0x
20/160	6/48	0.125	4.0x
20/200	6/60	0.10	5.0x
20/240 - 20/300	6/72 - 6/90	0.08 - 0.067	5.5x or 6.0x

possible. Low vision specialists have found that users do most well when fields of view through the telescope are at least 10 degrees in diameter.

Here's a chart that shows the fields of view of bioptic telescopes. The decision point comes at 3x—at powers lower than 3x only Galilean versions are manufactured. At 3x and higher both Galilean and Keplerian versions are available. As you can see, Keplerian telescopes have wider fields of view than Galilean designs especially as telescope powers increase. Ocutech only manufactures Keplerian telescopes at 3x and higher as they are sharper and the fields of view are much wider.

Power	Galilean *(degrees)*	Keplerian *(degrees)*
1.7x	18-22	n/a
2.2x	11-18	n/a
3.0x	8-10	12.5-15
4.0x	6	12.5
5.0x	5	10.5
6.0x	4	9.6

Fields of View of Telescopes in different powers and designs

2. Help you do the things you want to do!

We can organize our thinking about what you want to do by defining the distances at which you want to do them—distance, midrange, or near? Bioptics can support all of these distances.

- Do you want a bioptic solely to obtain or keep your driver's license and nothing else?
- Do you want to be able to watch TV without sitting right in front of it and blocking everyone else?
- Do you want to see friends and family in social settings and at different distances?
- Do you want to see the board in the classroom, see the teacher and classmates?
- Do you want to see the pulpit in Church, Synagogue, or Mosque?
- Do you want to see details in movies, maybe the pins when bowling?
- Do you want to shop and be able to see aisle signs, displays, and packages on store shelves?
- Do you want to visit museums and see the displays on the walls and in cabinets?
- Do you want to look at computer screens or read music on a stand at normal distances?
- Do you want to play cards, board games or do other tabletop activities?

You get the idea!

These are just some of the many activities you might seek to improve at different distances.

Telescopes, of course, magnify the image size making it easier to see what you're looking at. It's like moving closer without having to move closer. When looking at someone from across the room, they'll look twice as close with a 2x telescope, 3 times as close with a 3x, etc. But the benefit for seeing at distance with a telescope is that it will let you see that much further away—twice as far with a 2x, 3 times as far with a 3x, etc.!

When you need magnification to see at near, hand magnifiers or strong reading glasses require that you get very close to the material you want to see, sometimes only inches away. This can be inconvenient and certainly fatiguing and uncomfortable. Looking at computer screens, table top activities such as cards and board games and dexterity tasks, and music on music stands for instance all require that we have a further working distance than what hand magnifiers and strong reading glasses can provide. And often times we want our hands to be free (for playing music or typing on a computer keyboard for example).

Seeing at different distances

Bioptic telescopes can be focused to allow you to see a magnified image at any distance you may require. Galilean telescopes are available as either manually focusable or set for near by using 'reading caps.' All Keplerian telescopes are manually focusable and one offers autofocusing.

When looking through a telescope, you may still see clearly for some distance in front of and behind the point at which you have focused. This is called the depth of field. The stronger the telescope power and the closer you are looking the shallower the depth of field will be. This can become a challenge for extended near vision activities, as it will require that you either maintain a very fixed posture or refocus the device.

So focusing is an important feature that makes the bioptic helpful for the range of things you may be interested to do. If you expect to want to look at a lot of different distances a focusable version is obviously preferable. If you choose a fixed focus telescope you'll need to have near-focus caps for each distance you want to work. If you only need them for one specific distance that would be fine, however, it's rather inconvenient to having to change reading caps frequently for different distances, or alternatively to keep a fixed working distance and posture for all near activities.

Below is a chart that gives you the working distance ranges for different common power reading caps for non-focusable Galilean telescopes.

If you need your hands free (for music or typing perhaps), or if you have to continually look at different distances, or if you don't have the dexterity to manually focus a bioptic, an autofocus bioptic is ideal. It provides the closest to natural telescopic vision because wherever you look the image will be clear virtually immediately. All you have to do is look—there will be no manipulation of the device or postural constraints required.

Reading Cap Power	Activity Working Distance	
Diopters	***inches***	***cm***
+1	40	100
+1.5	26	67
+2	20	50
+3	13	33
+4	10	25

Alternatively, if you seek vision help solely for distance vision (20 feet or 6m) or further away, there's no need for autofocus, as bioptics generally don't need to be focused when you are looking that far away.

Stay Tuned for Part 2 as we explore Bioptics for one eye or both eyes? The 'Nuts and Bolts' of Ocutech's Galilean Bioptics.

Part 2: Bioptics for One Eye or Both Eyes?

Part 1 explored what bioptics are, how they are used, and whether they might be right for you.

This section (Part 2) we explain how bioptics are prescribed, the range of Ocutech's bioptic products and the benefit of Autofocusing.

Bioptics for one eye or both eyes?

Bioptics can be prescribed for one eye (monocular) or for both eyes (binocular). Since weight factors into the decision of what type of bioptic to choose, a monocular design will of course be lighter, though in low power Galilean versions (1.7x and 2.2x) weight is not significant even in binocular versions.

However since we prefer Keplerian telescopes when powers of 3x and higher are needed due to their wider field of view, monocular bioptics offer the only compelling options.

There is a benefit to a binocular device. The field of view will be slightly wider, you may get slightly better vision when using two eyes together than with either eye alone, and finding what you are looking for through the telescope may be a bit more natural. But, because of their field of view, the most compelling binocular bioptics are limited to the 1.7x, 2.2x and maybe 3.0x powers.

The eye the telescope is prescribed to is important.

We all have a dominant eye, just as we do a dominant hand. When looking through a monocular telescope it is much easier and more natural to find what your are looking for (localize) when using the dominant eye. Some folks don't have a strong eye dominance and can look through a telescope comfortably with either eye, but most of us do.

Your better-seeing eye (with eyeglasses if they help) is not automatically your dominant eye. It often is, but not always. If you have a turned eye, the eye you normally see with will likely be your dominant eye.

So, when using a monocular bioptic, we would prefer to prescribe it for the dominant eye, hoping, of course, that it's also the better-seeing eye. If the dominant eye is not the better-seeing eye, it sometimes makes sense to prescribe a higher power telescope for the poorer-seeing dominant eye if we can achieve the visual acuity we seek and especially if the user finds it much more natural to sight through. Sorry if this is a bit confusing.

Want to figure out which is your dominant eye?

It's easy!

Step 1: With both eyes open look at a small target that's as far away as possible that you can see reasonably well.

Step 2: Extend your arm and with both eyes open point a finger directly at the target.

Step 3: While still pointing at the target, close or cover one eye and then the other.

Step 4: The eye that sees your finger most accurately pointing to the target is your dominant eye.

Want to figure out which is your better-seeing eye?

That's also easy!

Step 1: With both eyes open look at a target that's as far away as you can see reasonably clearly.

Step 2: While looking at the target close or cover one eye and then the other.

Step 3: Whichever eye sees more clearly is your better-seeing eye! Obviously!

Having trouble deciding? It's possible that both of your eyes see about the same.

The "Nuts and Bolts" of Ocutech's Galilean Bioptics

Ocutech manufactures both **Galilean** and **Keplerian** bioptic telescope systems. They can be either attached to the eyeglass frame using Ocutech's adjustable bridge-mounting systems, which gives the prescriber complete control of the positioning of the telescopes, or traditional through-the-lens designs, where the carrier lens is drilled and the telescope is permanently inserted through the eyeglass lens. The bridge-mounted system allows for fine-tuning of the telescope positioning even after they are made. Traditional mounting methods require careful measurements for proper positioning of the telescope(s). Optimum positioning of the telescope is important to maximize its visual benefit.

Galilean Telescopes

SightScope® systems are available in 1.7x and 2.2x powers (and also 0.5x Field Expander for Tunnel Vision—*not the topic of this white paper*) and are appropriate for individuals with best-corrected vision of 20/100 or better. They can be prescribed for one or both eyes. The adjustable mounting allows for complete positioning control of the telescopes and can also maximize the field of view. The SightScope is available as a permanent frame mounted version (using Ocutech's specially designed frames) and also as a clip-on version. In either version, the telescope can be flipped out of the way when not needed. Reading cap adapters are available that slide onto the front of the telescope and allow the SightScope to be used at near working distances anywhere between 40 inches to 10 inches. A near-only version called the *SightScope NearView* is also available.

SightScope NearView

SightScope Telescope

The **InstaMount** and **Reveal** bioptics are traditional Galilean telescopes available in 2.2x (and also 0.5x for patients with tunnel vision) that can be glued to the front of the eyeglass lens (InstaMount) either permanently or by using a clip-on frame, or permanently inserted through the eyeglass lens (Reveal). These are small and lightweight. They do not focus and are intended only for distance seeing beyond 10 feet. They are also appropriate for individuals with best-corrected vision of 20/100 or better.

InstaMount Self-Adhesive Telescope

InstaMount Clip-on Telescope

Reveal Through the lens Telescope

The "Nuts and Bolts" of Ocutech's Keplerian Bioptics

Keplerian (VES) Telescopes

Ocutech makes two styles of Keplerian (VES) telescopes—bridge-mounted designs and traditional through-the-lens designs. Keplerian telescopes provide the widest fields of view possible in bioptic telescopes and are available in 3x, 4x, 5x, 5.5x and 6x versions depending upon the individual product.

Ocutech's bridge-mounted systems make it very easy for the prescriber to optimize the position of the telescope for the individual user. They can be conveniently repositioned even after dispensing. Eyeglass prescriptions can also be readily updated without completely remaking the device. Keplerian bridge-mounted systems (VES K, Explorer, Sport-II, Falcon) are only available in monocular versions. All bridge-mounted systems include Ocutech's specially designed metal eyeglass frames available in three different styles and several sizes and colors.

The **VES Sport-II** is Ocutech's most frequently prescribed product. It is an updated version of the original Sport and is slightly smaller and retains the same bright, crisp optics. It is available in 4x, 5x and 6x powers. The Sport II has manual focusing and can be used at any distance and to as close as 10 inches (25cm). You can choose your favorite color (or standard black and silver) for the case. The Sport-II is appropriate for individuals with best-corrected visual acuity of 20/300 (6/90) and better.

The VES Sport-II

The **VES Explorer** and **VES K** each contain the same optics and are available in 3x and 4x powers and are focusable to as close as 9 inches (23cm). The Explorer has an updated, smaller, more fashionable hi-tech design and is available in colors. It is popular with both children and adults. Both the VES-Explorer and VES-K have a smaller front entrance window than the Sport-II and as a result their image is slightly less bright. These devices are appropriate for individuals with best-corrected visual acuity of 20/200 and better.

The VES Explorer

The VES-K

The **VES Mini** is a 3x traditional through-the-lens bioptic telescope. It offers the combination of the smallest size and widest field of view of any 3x bioptic available. Since the eyeglass lens is drilled to insert the telescope through the lens, the low vision specialist needs to take careful measurements to position it properly when ordered. It can be prescribed for one or both eyes. It can be focused for any distance and to as close as 9 inches (23cm).

The VES-Mini (3x)

The 'Nuts and Bolts' of Ocutech's Autofocus Keplerian Telescope

The VES Falcon Autofocus Bioptic Telescope

Autofocus offers the most natural telescopic vision possible because wherever you look the image will be clear right away. You do not have to manipulate the device.

When you look through a telescope that is miss-focused one can hardly see anything at all. That makes it hard to find what you are looking for, let alone focus on it. If you are frequently looking at different distances you'll need to refocus a manual focus telescope every time. If you are looking at near objects, and move in or out even just a little bit the image will likely blur, so you'll either need to be continually refocusing the telescope or keep a very still posture. If your hands are busy with other things—music, typing, writing, drawing—keeping the image clear through the bioptic can be inconvenient not to mention fatiguing.

Autofocus addresses all of these issues. Wherever you look (up to about 12 inches) it will be clear right away. Hands-free. All you have to do is look. Autofocus enables you to pay attention to your activity and not to manipulating the device.

The Falcon is an autofocusing Keplerian monocular telescope available in 3x, 4x and 5.5x powers and in silver and black case colors. It is appropriate for individuals with best-corrected visual acuity of 20/300 and better. It will operate up to 8 hours using its separate rechargeable battery.

If you need to frequently look at different distances or need your hands to be free to do other things, the Falcon may be ideal for you. However, if you only seek to see at distances beyond 20 feet (6m) then there may be no benefit from autofocus because very little, if any, focusing is required at those distances.

The Falcon Autofocus Bioptic

In summary…

Seeing better is really important and seeing clearly at distance is especially important. In addition to enabling you to see and do things that you might otherwise not be able to accomplish, it helps you to feel connected with the world around you avoiding feelings of isolation, loss of independence, and potential irrelevance. Coming to terms with the benefit of adopting and using vision assistive technology is a journey—it may start out uncomfortably for you due to a range of physical, and emotional reasons, but once you are able to accept it as a part of your life, it can open up your world, help you to feel more engaged, more content and more worthwhile. It takes a special person to accept such realities, and you are entitled to all the help and support that you deserve. And, you are special—accept that and be proud of it! Go for it! Most folks are glad they did!

Stay Tuned for Part 3 as we explore driving with bioptics.

Part 3: Driving with Bioptics FAQs

Part 1 explored what bioptics are, how they are used, and whether they might be right for you. Part 2 explained how bioptics are prescribed, the range of Ocutech's bioptic products and the benefit of Autofocusing.

Our final section, Part 3, provides answers to frequently asked questions about how to choose the best product for the user, and also about how bioptics may enable a visually impaired individual to be eligible to drive.

Question:

Ocutech makes four different 3x telescopes—the VES K, VES Explorer, VES Mini and the VES Falcon. Which should I choose?

Answer:

The **VES K** and the **VES Explorer** have identical optics—your decision is solely a function of which design is more appealing to you. The VES-K is wider (right to left) than the Explorer. When one dips their head to look through the telescope eyepiece, the VES-K case can block the other eye which may make it easier for you to sight through the telescope. This may be helpful for individuals who must use their non-dominant eye when looking through the telescope.

Question:

What is the difference between the VES Mini and the VES-K or Explorer? And what sets it apart from the 3x Falcon Autofocus?

Answer:

The **VES Mini** has a slightly wider field of view than does the VES-K or Explorer. It is inserted into the eyeglass lens (carrier lens) and must be positioned perfectly when ordered. If the telescope needs to be repositioned, a new eyeglass lens may need to be ordered, and updating eyeglass prescriptions in the future will require a remake of the system. The Mini can be prescribed for both eyes that may make it more appealing to some individuals because of the slightly wider fields of view, however each telescope will need to be focused individually to be clear at different distances. Also if a binocular system is ordered and aligned for distance-seeing, when looking at close distances you will only be able to use one side of the device, because otherwise you will see double.

The 3x Falcon Autofocus bioptic has the same bright, wide field optics as the Mini, and of course it focuses to almost any distance almost immediately. If you'll need to look at a lot of different distances, need to work at close distances for extended periods of time, or need your hands free for other activities, the Falcon may be ideal for you.

Question:

Ocutech manufactures 4 telescopes in a 4x power—The VES-K, Explorer, Sport-II, and Falcon. How do I I choose which of these to consider?

Answer:

As with the 3x versions, the **4x VES K** and the **4x VES Explorer** have identical optics—your decision is solely a function of which design is more appealing to you. The VES-K is wider (right to left)

than the Explorer. When one dips their head to look through the eyepiece, the VES-K case can block the other eye which may make it easier for you to see through the telescope. This may be helpful for individuals who must use their non-dominant eye when looking through the telescope.

The **VES-Sport II** has a larger entrance window and larger front (objective) lens and hence the telescope image will be slightly brighter than with the VES K or Explorer. The horizontal field of view of the VES K, Explorer and Sport-II telescopes are all the same at 12.5 degrees. The vertical field of the Sport II and Falcon is slightly wider than the Explorer or K. The Sport is larger in physical size and for children, small adults, and individuals with a narrow pupillary distance (how far the eyes are apart) it may appear to be overly large, and hence the Explorer may be preferred for cosmetic reasons. Individuals with genetic visual disorders such as albinism, nystagmus, achromatopsia, and rod-cone disorders, who often favor lower illumination, may prefer the Explorer or K.

Here's a photo that shows the comparison of size between the VES Sport-II (top) and the VES Explorer (bottom):

The 4x Falcon Autofocus bioptic has the same bright, wide field optics of the 4x VES-Sport II, and of course it focuses to almost any distance virtually immediately. If you'll need to look at a lot of different distances, need to work at close distances for extended periods of time, or need your hands free for other activities, the Falcon may be ideal for you.

Question:

How do bioptics work for driving?

Answer:

Most states in the US and several countries allow individuals with visual impairments to obtain a restricted driver's license while using a bioptic telescope, when without it they would otherwise be ineligible. The laws and regulations vary from state-to-state and by country. These regulations usually relate to one's best-corrected vision with conventional eyeglass lenses (or contacts) if beneficial, the driver's visual field (the width of your side vision) using only regular eyeglasses or contacts (if needed), and your vision through the telescope. You cannot use the telescope to pass the vision test to receive an unrestricted driver's

license—the license is based upon your vision using your conventional eyeglasses or contacts if they are helpful. Some states have limits on the type and power of the telescope, whether it can be prescribed to only one or both eyes, and whether it can be focusable. The state may also restrict individuals to speed limits, time of day driving, and sometimes even distance from home limitations.

A bioptic telescope is intended to help you be a safer driver on the road—to avoid obstacles, see traffic, signals, signs and pedestrians. It will allow you to see further up the road which will give you more time to make the proper driving adjustments to keep you and others safe. They are used in a similar fashion as the car's mirrors and only for brief periods of time. One does not look through the telescope all the time while driving—studies show they are only used about 1-2% of the time. That means that 98% of the time you are driving looking through the regular eyeglass (carrier) lenses. So, you must be a competent driver without the telescope—a bioptic cannot make an incompetent driver safe, but it can make a competent driver a safer driver!

Obtaining a bioptic will not automatically make you eligible for a special driver's license. To pursue a bioptic driving license you really need to visit a low vision expert in your state to 'hold your hand' through the process.

Read more about bioptic driving at:
https://ocutech.com/driving-with-bioptics/

Ocutech frequently receives requests from individuals seeking advice about which Ocutech bioptic might be best for them. Certainly, the final decision should be based upon the recommendations of a low vision specialist after testing and evaluation of our devices. Our hope is that the information in these Ocutech Consumer Guides will help you begin to identify an appropriate Ocutech product as well as determine the likelihood of a favorable prognosis to benefiting from the device.

Thanks for reading!

I hope this discussion has been helpful. I invite you to visit the Ocutech website (www.ocutech.com) for more information on Ocutech products, general information and helpful videos.

And as always, we invite your questions, suggestions and feedback.

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