Ocular photography: Comparison of a +90 Diopter Volk lens and a contact Hruby lens

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OCULAR PHOTOGRAPHY:

COMPARISON OF A +90 DIOPTER VOLK LENS
AND A CONTACT HRUBY LENS

By
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Biographical Sketch of the Author

Naomi Godtland Barnes is a graduate of Montana State University in Bozeman, Montana. She received her Bachelor of Science Degree in biological science with highest honors in Spring, 1984.

While at Pacific University, she was nominated and accepted into Beta Sigma Kappa, Who's Who Among American Colleges and Universities, Academic All-American, and Outstanding Young Women in America. Her awards include second place in the 1985 Nikon Scholar Essay Competition, the 1987 Varilux II Award, and first runner-up in the 1987 Bausch & Lomb Excellence in Academic Achievement Award.

Naomi plans to practice general optometry in the Northwest in a private setting.
Abstract

Photographic slides were taken through both a +90 Diopter Volk lens and a contact Hruby lens with a photo slit lamp. Being non-invasive, the +90 D procedure was usually quicker and easier on the subject compared to the contact lens. Photos taken through the +90 D lens had more reflections, a yellow tinge, less magnification, and a wider field of view, while those taken through the contact Hruby had more shadows, truer color, more magnification, and a smaller field of view. Both were capable of providing well-focused photographs of the ocular fundus.
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Introduction

In recent years, an increasingly popular method of documenting records has been with photography. Not only do pictures provide a permanent record, but allow a very accurate way of observing minute pathological changes of the eye. This is particularly useful for the fundus, or back of the eye, because it can only be viewed with special instruments. There are various ways of photographing the fundus. This study will concentrate on a method that utilizes a biomicroscope, an instrument used primarily for viewing anterior portions of the eye. The fundus of the eye can be seen and photographed with a biomicroscope when auxiliary lenses are used in conjunction with it, to extend the optics of the instrument. The lenses are of two types:

1) one that is held in front of the eye, such as a +90 Diopter Volk Lens, or
2) one that is placed directly on the eye, such as a contact Hruby Lens.

Although other types of these auxiliary lenses have been compared, these two have not, primarily because the +90 D lens is relatively new. Photographically speaking, the contact lenses have always provided superior pictures compared to the non-contact type.\(^1\) This project will determine if this is also the case with these two lenses, as well as list the advantages and disadvantages of each.

Subjects

Nineteen students from Pacific University College of Optometry volunteered as subjects. The students' pupils were previously dilated for their optometric procedures laboratory.
Methods and Materials

+90 D Lens

Subjects were seated at the biomicroscope and properly aligned. Starting with low magnification, a narrow beam, and low illumination, the fundus reflex was achieved, with the illumination angle less than 10 degrees. The +90 D lens was placed approximately one centimeter from the subject's eye and the image brought into focus by pulling back on the viewing system. The magnification was increased, the illumination increased, and the slit widened enough to illuminate the optic nerve head and its vasculature. Photographs were then taken as described below.

Contact Hruby Lens

After instilling a local anesthetic (0.5% proparacaine hydrochloride) in both eyes, the contact Hruby lens was applied, using goniosol (2.5% hydroxypropylmethylcellulose) as the wetting agent. As before, low magnification, low illumination, and a narrow slit width at an illumination angle less than 10 degrees were used to start with and increased enough to view the optic nerve head and its vasculature. Again, photographs were taken as described below.

Photographic Procedure

Photographic slides were taken through each lens of either one or both of the subjects' eyes through the right ocular of a Nikon Zoom Photo Slit Lamp Microscope FS-2 using 16x and/or 30x magnification. Kodak Ektachrome 200 film was used with a flash output of 2, 3, or 4 for the +90 D lens and 1, 2, or 3 for the Contact Hruby lens. To decrease the number of reflections in the photographs, no background or fill-in illumination was used with either lens. Slit width and illumination intensity varied due to different light tolerances of the subjects and the width of the auxiliary lenses themselves.
Results

Comparison of Methods

While there are some similarities between the two lenses, each has its own unique characteristics. The biggest advantage of the +90 D lens over the Contact Hruby is that it is non-invasive. No anesthetic or wetting agent is needed, nor any need to rinse the eye out after the procedure. Thus, in most cases it was quicker, but not always. In some subjects it took longer since they could move their eyes around more readily to avoid the bright light. However, this proved also to be another advantage overall, because it helped provide proper alignment of the optical system and the optic nerve. Although the contact lens is invasive and there is sometimes the problem of bubbles in the solution that interfere with the view of the fundus, once the lens was on properly, it stayed in place. Since there was no movement along the Z-axis, the contact lens was easier to keep in focus once it was on, and thus, several pictures could be taken successively. With the Volk lens, proper distance and steadiness was very critical. Any movement or tilting of the lens usually resulted in losing the view and/or picture. Additionally, the Hruby lens did not allow the subject to blink or squint. Even with the eyelids held open, this occurred sometimes with the non-contact lens, and was particularly troublesome in subjects with long eyelashes, who could dirty the lens with one blink. Another slight disadvantage of the +90 D lens is that the image is inverted and reversed, which is not the case with the Hruby lens.

For both lenses, almost all subjects complained of photophobia. In some subjects, this resulted in loss of fixation or troping of the eye being photographed. Some could not tolerate the brightness, so no photographs were obtained. Another characteristic inherent to both lenses was only having one hand free to work the focusing, magnification, illumination, flash, and camera itself. Fortunately, the shutter release button was located on the joystick of the slit lamp rather than the camera. Naturally, any problems that arose with the camera, such as the flash not going off, affected both lenses similarly. And due to basic optical principles, the depth of focus decreased as the magnification was increased, making it more difficult to keep a higher magnified image steadily focused.
Comparison of Photographs

It is apparent that good photographs can be taken with both the contact and non-contact lenses (see photos 1 and 2). Again, there are some similarities between them. First of all, reflections off both lenses sometimes obscured part of the pictures (photos 3 and 4). This seemed to be worse with the +90 D lens. Next, there were often shadows that blocked out part of the pictures, probably resulting from either lens being tilted (photos 5 and 6). This, on the other hand, happened more frequently with the Hruby lens. As would be expected, since the +90 D lens is yellow and the Hruby is clear, the true color of the fundus was seen in the Hruby pictures and not the Volk ones, which ended up with a yellow tinge (photos 7 and 8). However, this does not seem to affect judging the structures of the fundus in a well-focused picture. Due to the powers of each lens in conjunction with the optics of the slit lamp, the Hruby lens provided higher image magnification on the same slit lamp magnification than the Volk (photos 7 and 8). In turn, however, the +90 D lens offered a wider field of view, often enough to include the macular area in several pictures (photo 9). This was also due to the larger diameter of the lens itself. As mentioned previously, the +90 D lens gives an image that is inverted and reversed, which is obvious when comparing pictures taken with it and the contact lens (photos 7 and 8).

Discussion

With a little practice, both of the lenses discussed are easily mastered. They both provide excellent views of the fundus, and with even more practice, both can provide very good photographs. This type of photographic set-up would be beneficial to the practitioner who has an anterior segment camera but not a fundus camera, when photo-documentation is helpful in diagnosis and treatment. Keeping the advantages and disadvantages of each lens in mind, the clinician can decide which lens would be more appropriate for each patient. The non-contact lens should be used on patients
with anterior segment diseases, orbital trauma, or post-operative patients or patients
with allergies to local anesthetics. Also, since it is non-invasive and can be easily
removed from the light path to give patients relief, it is probably more suited for
apprehensive and pediatric patients. Although it is bright, photophobic patients can be
reassured that the light entering their eyes is devoid of ultraviolet and visible
short-wavelength radiation when using a yellow +90 D lens.\(^2\),\(^3\) The +90 D lens would
also be more ideal when a wider field of view is needed to photograph a larger lesion,
or one located more anteriorly. The field of view and magnification depend on the
width of the slit lamp beam and magnification of the slit lamp. Theoretically, a
70-degree field is possible, but not obtainable due to the limit of maximum slit width.\(^3\)
In the case where the clinician desires more magnification, the contact lens perhaps is
more suitable. For either lens, he or she must learn to minimize reflections that
obscure picture details by manipulating the lenses and/or the illumination system of the
biomicroscope without losing the fundus view. Reflections are avoided when the
entrance and exit areas of illumination and observation rays are through separate
areas of the pupil.\(^4\) Therefore, it is recommended that the pupils be dilated.

When taking photographs, it is extremely important that the ocular through which
the picture is taken is properly focused, or the pictures will not be clear, even though
the view looks perfectly focused.\(^3\) It is helpful to look through just the eyepiece that
takes the photograph to make sure it is in focus and a good view. Also, since the time
this study was conducted, Volk has developed a holder for the +90 D lens, which
would probably help reduce reflections and improve image stability in the +90 D lens
photographs.

In conclusion, this study has determined that both the +90 Diopter Volk lens and
the contact Hruby lens are capable of producing well-focused photographs and that
the contact lens does not necessarily provide superior pictures. The main advantages
of the +90 D Volk lens is that it is usually quicker, is non-invasive, and provides a wider
field of view, while the contact Hruby lens gives truer color and higher magnification.
(However, it should be noted that the +90 D Volk lens is also available in clear.) Both
lenses provide excellent stereoscopic views that help the clinician assess the internal
health of a patient's eyes, and with the use of a photographic biomicroscope, both can help provide a permanent record for future reference, benefitting both patient and doctor.
Bibliography


