

# PHOTODOCUMENTATION OF THE RETINA IN SHAKEN BABY SYNDROME

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**E**ven under the best circumstances, photodocumentation of the pediatric retina can be quite challenging. Yet when attainable, these photographs can be invaluable for the consultative and investigative process in cases of suspected child abuse.

**T**he ideal conditions for retinal photography require either the cooperation of a patient who can fixate at a desired target, thus keeping the eye still, or an altered state of consciousness that renders the eye stationary. This allows focusing and alignment of the camera and thereby the avoidance of photographic artifacts. Some children, as they lie in a bed or in the security of a caregiver's arms, will respond to gentle coaxing, encouragement and methods of distraction long enough to allow the required images to be captured. In other cases it may be necessary to bundle the infant, insert an eyelid speculum and manually control the movement of the eye using a probe, cotton swab, or forceps after applying topical anesthesia. This technique can be quite frightening for the observing caretaker as well as the child, and one must also take care not to injure the eye during manipulations. Alternatively, compliance can be achieved artificially either through sedation or general anesthesia, but may also occur as a result of injury-induced altered level of consciousness.

**M**any instruments for retinal photography also require a dilated pupil. In the child with severe central nervous system damage, the pupil may be fixed and dilated. Otherwise, pharmacologic mydriasis should be achieved (e.g. phenylephrine 2.5% + cyclopentolate 1%), except in the rare circumstance when there is concern about disrupting pupillary responsiveness for neurologic monitoring. In such cases, the neurologist may permit the dilation of only one eye at a time if the acquisition of photographs is of paramount concern. One must also be aware that image clarity can be compromised in children who are on life support, by the ointment applied to protect the cornea from exposure. Ocular lavage with normal saline is often a great aid to obtaining clearer images.

**B**ecause flexibility and mobility are important in capturing the telltale hemorrhages of shaken baby syndrome, the photographic

system should be portable and hand-held. The equipment must often move to the bedside (e.g. intensive care unit) and be used with the child in the supine position.

## 30° Fundus Photography

**Kowa RC-2** — For many years, the film-based Kowa RC-2 hand-held retinal camera (Kowa Corporation, Tokyo, Japan) has been the standard for retinal photography of the supine pediatric patient. Although this model is no longer manufactured, it is still often used in pediatric centers. The camera provides a 30° field of view that shows the optic nerve and macula. Images peripheral to the macular area can be achieved by angling the camera or rotating the eye. A wider field of view requires the use of a hand-held indirect ophthalmoscope lens between the camera and the patient wherein the photographer is actually photographing a mirror virtual image of the retina suspended in space, thus adding another level of complexity to the technique. Patient compliance and user skill are two significant challenges with this camera. It is unlikely to be successful for the casual, infrequent user.

**The Genesis**: The Genesis is Kowa's current generation of portable fundus imaging. It has the same 30° angle of view as its predecessor, but it is lighter and equipped with motorized focusing and auto film advance. All generations of Kowa's portable cameras can be easily packed in a suitcase for travel between offices and locations. The camera uses standard color film but can be adapted for digital imaging. The price for the current standard system is approximately \$8,300.

**The Handy NM 100 (Type D)** (Nidek Co. Ltd., Japan) is a lightweight, hand-held digital retinal camera that does not require pupillary dilation beyond 4mm. Its angle of view is also a fixed 30°. The camera uses an infrared viewing light source and motorized focusing. The image is viewed on an LCD monitor as

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opposed to the operator looking directly through a viewfinder. As the illumination required for focusing is undetectable by the patient, it provides a greater comfort and therefore increased chances of compliance. A low-intensity flash is emitted at the time of image capture. As with the Kowa series of cameras, it is possible to attain more peripheral views by rotating the eye or angling the camera; however, pharmacologic dilation is recommended for optimal results. The current price of the system is approximately \$16,000.

**Innovations** Other creative people in the field have dusted off, resurrected and modified old standard tabletop retinal cameras that sit unused as backup systems in their centers. By removing them from the tabletop mount, these cameras have been affixed to microscope arms, heavy floor stands and monopods to facilitate imaging the retina of the supine infant. While more cumbersome than any other form of portable photography, the camera-to-cornea distance is greater than standard portable systems and may provide a degree of increased compliance in awake infants. Also, the modifications may provide an alternative solution to buying a new system if such a camera already exists in a facility.

## Wide-Angle Photography

**RetCam 120** — Designed for use in children, the RetCam imaging system (Massie Research Laboratories, Dublin, California) is a digital camera with wide-angle capability that can capture a field of up to 120°. Images are produced through a hand-held camera probe that must come into direct contact with the cornea. The camera is attached to a computer through which images are immediately displayed, captured and stored. Focusing, illumination and image capture are controlled using a footswitch while the user observes a real-time display on the system's computer screen. Although the system requires a computer monitor, hard drive, and supporting technology, the unit is supplied on a cart that can be wheeled easily to the bedside.

**Best results** for wide-angle imaging are achieved with a well-dilated pupil. Small pupil size may result in a central dark shadow artifact. Because the camera makes contact with the cornea, awake infants must be bundled with a lid speculum inserted and topical anaesthetic instilled. It is most suitable for unconscious or sedated children. Angling the camera can show areas of retina beyond the mid periphery. This, combined with the technique of indenting the eye, illustrates the ora serrata (edge of the retina). The RetCam requires some training but much less than other portable systems. Some centers have successfully trained nurses or other non-physicians/non-ophthalmologists to use the RetCam.

**In our experience**, the intensity of the red color of hemorrhages with the wide angle lenses may be decreased, particularly in darkly pigmented children in whom various degrees of haze and reduced contrast may be experienced due to the camera optics.

Nonetheless, the camera adequately documents the presence and distribution of retinal hemorrhages.

**The RetCam system**, including the basic wide-angle lens, costs approximately \$60,000. A high-magnification lens option costs an additional \$9,500. To adequately photograph retinal hemorrhages as often seen in the Shaken Baby Syndrome, it is ideal to have both the basic-wide angle and the high-magnification lenses.

## Conclusion

**Capturing a clear, focused retinal photograph** in a "moving target" infant or child is always a challenge. Selecting the appropriate imaging system depends on many factors including cost, technical support, user expertise, and demand for use. There are clear advantages to the digital systems in the immediacy of viewing images, teaching opportunities and telemedical applications, but some specialists in the field have raised concern about legal challenges of image manipulation in courtroom settings.

**To take the best of all designs and create the perfect pediatric camera**, it would have no visible light for illumination, no need for pupillary dilation, wide angle/zoom, digital image capture, lightweight, easy portability, noncontact, no need for extensive operator training or experience, and low cost. However, regardless of the system that is chosen, photodocumentation should not replace live examination by an ophthalmologist using the indirect ophthalmoscope or postmortem gross and microscopic ocular examination. Wherever possible, premortem ophthalmology consultation should be obtained.

## Resources

### The Genesis

Kowa Optimed, Inc  
20001 S Vermont Ave  
Torrance, CA 90502  
Phone: (310) 327-1913, Fax: (310) 327-4177

### The Handy NM 100 (Type D)

Nidek Co., Ltd  
47651 Westinghouse Drive  
Fremont, CA 94539  
Phone: (610) 626-6322, Toll free: (800) 223-9044, Fax: (610) 626-2749  
www.nidek.com

### RetCam 120

Massie Research Laboratories Inc  
6761 Sierra Court, Suite F  
Dublin, CA 94568  
Phone: (925) 560-2465, (V/M) (800) 895-3308, Fax: (925) 560-2466  
www.retcam.com

\*Levin has no proprietary interest in any of the products mentioned in this newsletter. MacKeen has received remuneration for consultant services from the manufacturers of the RetCam.

