

Easy iphone to Direct Ophthalmoscope Conversion

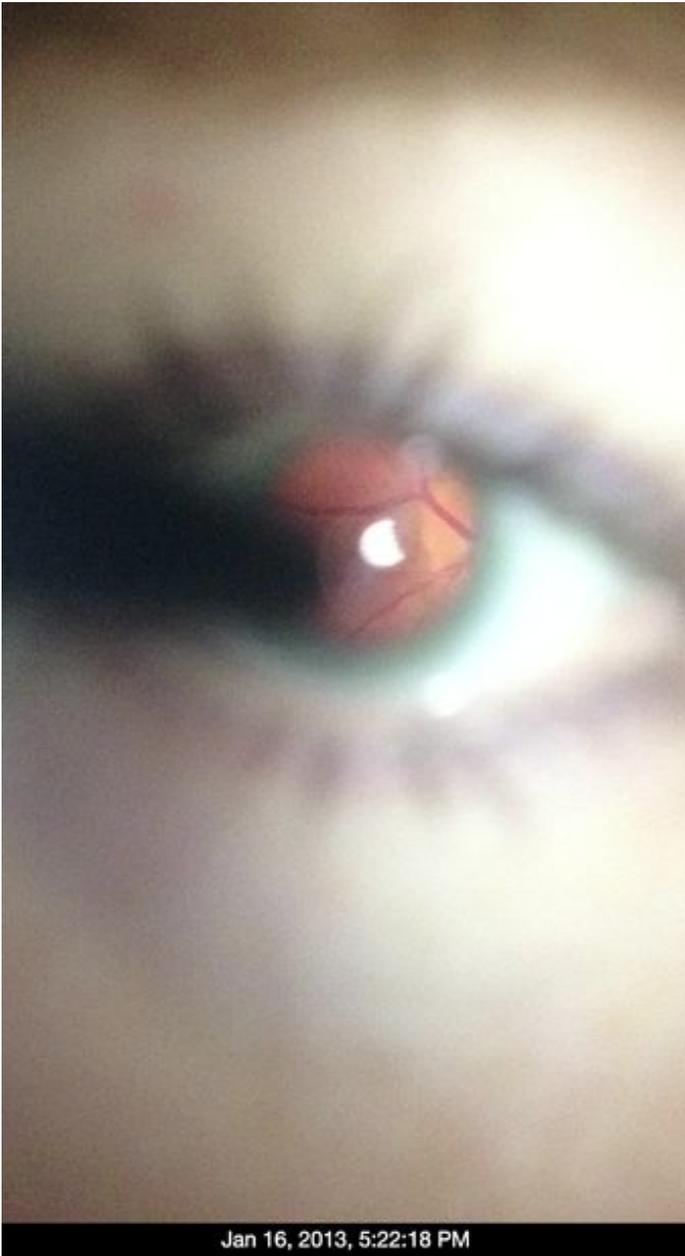
by [rabbitcreek](#) on January 19, 2013

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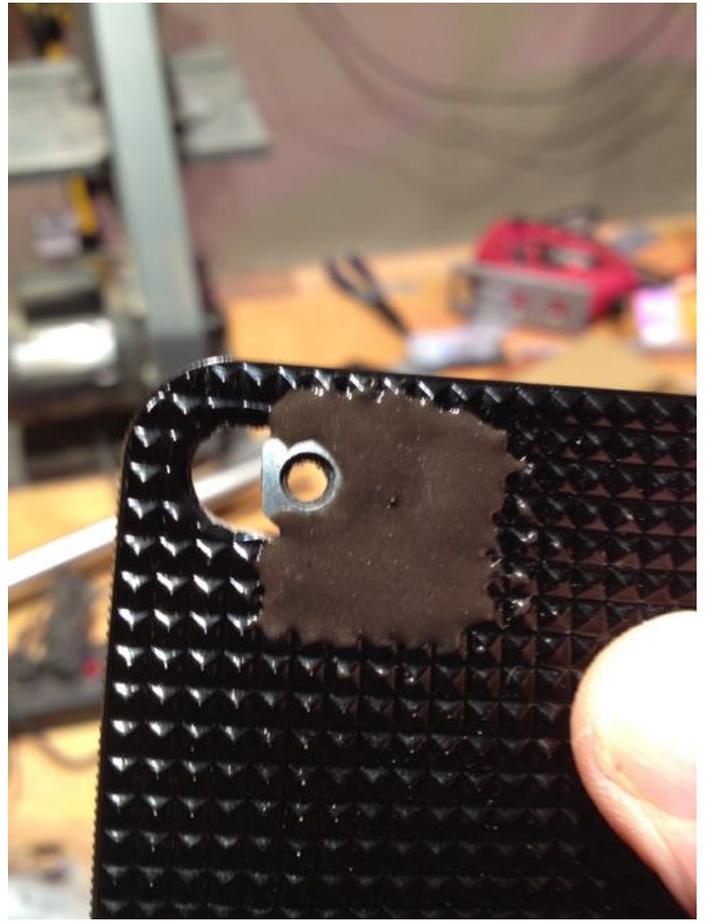
Intro: Easy iphone to Direct Ophthalmoscope Conversion

I have taught a lot of Medical Students and PA students over the years and dread the requirement that they purchase a direct ophthalmoscope for their studies--it is expensive and not very handy instrument that doesn't lead to many "Dr House" style moments in their lives. The otoscope is another matter, but for an eye exam a couple things become obvious very quickly--you cannot see much of anything through an undilated pupil and when you dilate what you see is of little importance. But the requirement for physical examination must be honored. (The new scopes from Welch-Allyn with the bellows do give great views by the way...but the price...!) So I have devised a cheap alternative that gives great video views with your old iPhone. Cheap meaning about 10 bucks. It won't work through undilated pupils just like the real thing but works great with a little Tropicamide and Phenylephrine drops just like the real thing. The trick with using the iPhone is to get the LED, normally a few millimeters lateral to the lens, to align with the lens through a fiberoptic light guide. This allows the light to become coaxial with the view through the pupil. It also works well as an indirect ophthalmoscope too.



Step 1: Modding the Cheap Case

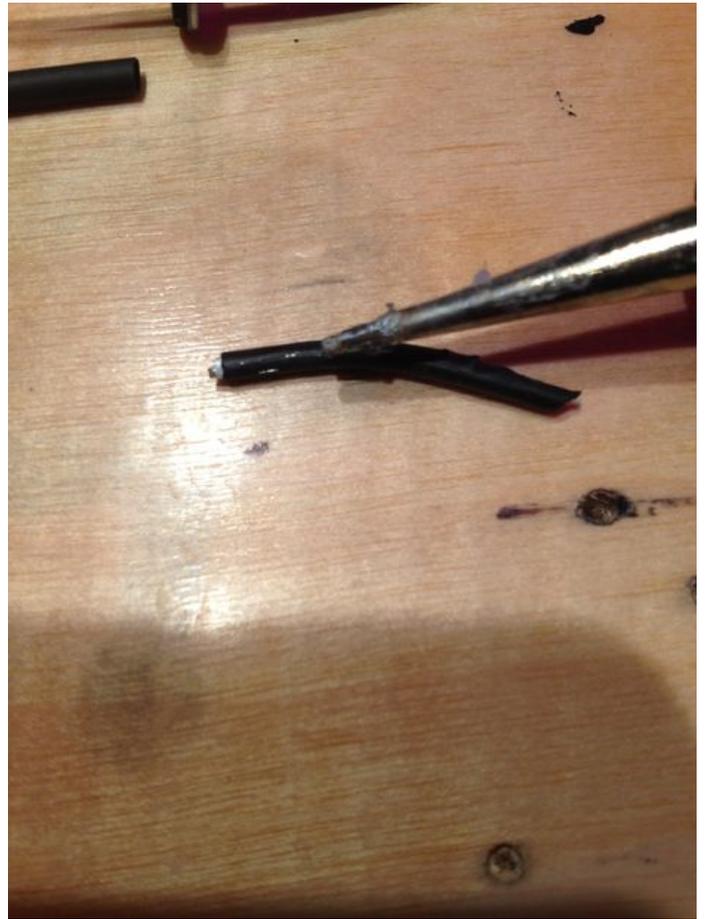
Find yourself a cheap hard plastic snap-in single-piece case on the internet--it should be a couple mm thick. I got mine for a couple of bucks. The hard plastic seems to enable the use of epoxy to stick to them which is nice. To make it easy to slide in and slide off of your phone you should slice off the bottom half leaving the top intact with the oblong lens/LED window intact. You can do this with a bench band saw or any other method you choose. The opening over the LED has to accommodate a neoprene washer that will sit just centered over the LED but not obscure the lens opening. You may have to slightly enlarge the case window opening to accommodate it loosely and allow perfect alignment with the LED. Place your iPhone in the truncated case and inspect that the washer will center well in the opening. Do not worry if it is loose as you will be gluing this in place. If a portion of the washer extends over the lens area, truncate it off with a sander. I got these from Loews; they are called "sealing washers #8" and have an aluminum washer with a bonded neoprene core which works well to seal the light and align the glass fibers. Place a piece of clear plastic tape over your iPhone lens area and replace back into case--this will allow you to glue the neoprene washer in place in perfect alignment while not getting excess glue on your lens. Center the washer over the LED and epoxy it to hold it in position.



Step 2: Building the Light Pipe

Go to Surplus Shed on the web and buy some cheap glass fiberoptic leads. I found some thin diameter ones that easily come apart and get you the loose fibers. I cut these with a wire cutter and it seems to work ok. The glass fibers are loose in these bundles and allow you to work with them very easily. I made my light pipe about 1/2 inch long but it could have been shorter and still worked. Find a package of heat shrink tubing from the electrical section of Loews (3/32-3/64) and cut it to 1/2 inch length. Cut your glass fibers longer than this so you can trim it later. Cut a equal length section of 20 G wire. The piece of wire is added to the light pipe to supply enough stiffness to keep the light pipe in position. Fill the heat shrink with glass fibers and your piece of 20G wire until nearly full. Apply a fine soldering iron tip to the outside of the bundle to shrink it solid. Trim off the ends smoothly with a wire cutter. You now have your malleable light pipe.





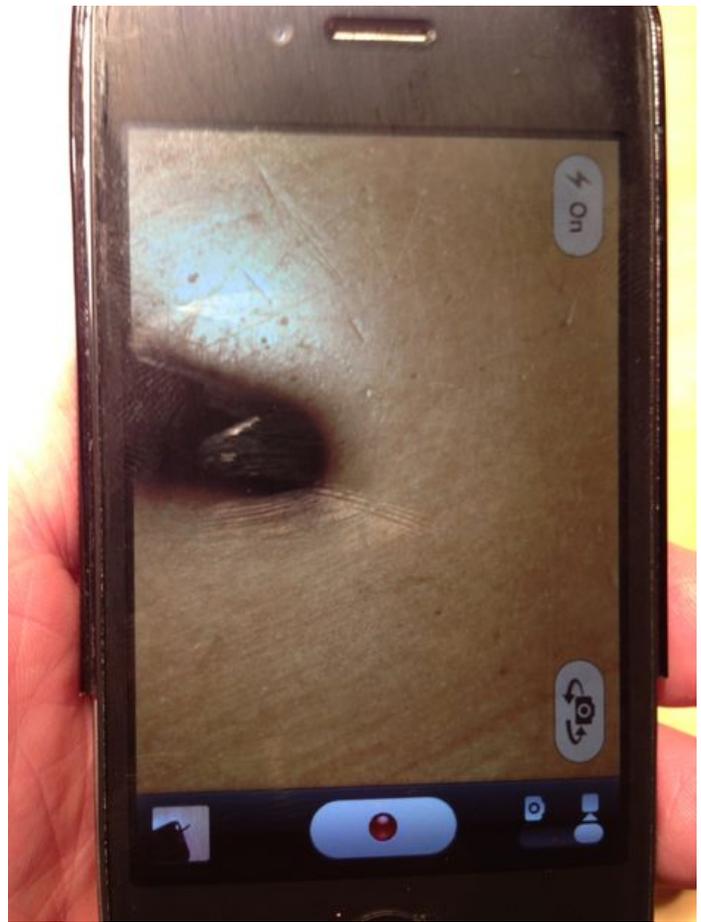
Step 3: Attaching the Light Pipe

With your protective tape on and the LED turned on place your light pipe in the neoprene washer hole and align it until you get the maximum amount of light through the pipe. Use some gel super glue to hold this in place in the washer hole. Remove the iphone from the case. Mix more epoxy --I use JB Fast set (it seems to stick well to these surfaces) and epoxy the light pipe solidly into position on the case.



Step 4: Using the iPhone Direct Ophthalmoscope

Dilate your patient (or your cat or housemate) with neosynephrine 2.5% and tropicamide--standard drops used for any dilated exam. The light pipe must be bent to merge into the lens view and provide light down the axis of the camera. Don't bend it too much at first and experiment with your view. Approach your subject with the video on and LED light illuminated. I have found Procamera (App Store) works well for this as it allows digital zoom which makes the image much bigger and allows positioning of the focus and exposure on the retina which is necessary for a good image. Just like the direct ophthalmoscope it has the same limitations of very magnified view. The optic nerve can be seen in great detail but peripheral features not so well. Have a great time if you build it and stay tuned for the otoscope--same principal but with auxiliary lens.



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