How to draw the contour line
Contour Line

Once we have acquired our image with the HRT II we define a contour line around the optic disc. The contour line should fall upon Elschnig’s ring. This is the same boundary that physicians must reference when making cup/disc ratio measures during a routine clinical examination.

The contour line is used to generate stereometric parameters with two and three-dimensional measurements that describe the shape of the optic nerve head.

Important parameters are rim area, rim volume, cup shape measure and mean retinal nerve fiber layer (RNFL) thickness.
These parameters can be monitored over time and provide one of the ways to show change and/or disease progression.

However, the physiologic variability of individual eyes is high. There is a large overlap between normal eyes and eyes with early, moderate and advanced glaucoma. Hence it is difficult – except in advanced cases – to classify an individual eye as being normal or glaucomatous based on a single test or set of measurements. So a diagnosis should never be made on one parameter alone. An appreciation of the relationship of several parameters is much more reliable.

*Remember, the contour line has to be drawn only once!*

Once drawn on the baseline image, it is automatically imported to the same location on all follow-up images. This ensures that you are measuring and comparing the same areas from exam to exam.

Studies have been done to measure the variability between contour lines drawn by different users. The findings showed that contour line placement variability with different operators has little effect on parameter data. Instead, quality of the images had the largest impact on results. *(Miglior, Ophthalmology 2002 109:1072-1077)*

The papillomacular bundle is the most stable nerve fiber bundle observed in glaucoma patients. Because it deteriorates last in advancing glaucoma it is a logical place to set a benchmark for monitoring change.
Reference plane

A reference plane is calculated using the contour line. It is a plane that runs parallel to the peripapillary retinal surface, and is set 50 microns below the retinal surface height at the papillomacular bundle which is located in the 350° to 356° section (temporal) of the contour line.

The reference plane is used as the boundary between the cup and the neuroretinal rim. The area below the plane is cup, while the area above the plane is rim. This convention may vary a bit from physicians’ methods of determining cup and rim, but it allows for an objective reference point when comparing baselines to follow-up exams.
The disc margin is defined as the inner edge of the scleral (Elschnig's) ring.

The color of the disc is slightly pink with a central depressed portion that is a pale pinkish white in color.

This pale area can be slightly cupped, the cup is usually centrally located but is not abnormal if located near either edge.
The disc margin is not always obvious in the reflectance image.

Use both the reflectance and the topography image to guide contour line placement.

Look at the topography image. The scleral ring is frequently apparent as a depressed (pale) band. The contour line should be placed at the inner edge of the scleral ring.

Place 5 or 6 points to make your contour (too many points makes it difficult to control shape).

Place 4 points at the temporal, nasal, superior and inferior disc margin (at 0, 180, 90, 270 degrees). Thereafter, place 1 additional point between each two of the first 4 points (at 45, 135, 225, 315 degrees).

Pixels in the reflectance image can be dark for two reasons:

- more light is being absorbed by the tissue.
- the surface is angled (a steep contour will appear dark).

Check contour line placement in both images to be sure you are on the margin.

The goal is to accurately outline disc margin by placing contour line on stable retinal tissue not sloping rim tissue.
What to look for:

- **Color change:**
  Often color differences between surrounding retina and optic nerve head serves as an obvious indicator but sometimes color change can be misleading.

- **Bending of vessels:**
  Look for change in the direction blood vessels travel. A change of direction is often accompanied visually by a loss of the white reflection off the vessel.

- **Scleral ring**

- **Halo of peripapillary atrophy**

The nasal portion of the disc can be masked by the vessels.

Look at the topography image for the scleral ring.

Discs are often symmetrically round top to bottom (not necessarily perfect circles), with no evidence to the contrary, use this as a guide.
Use the interactive topographic display while placing points to verify their correct positioning.

The graph displays the surface height variation along the white position marker line from the center of the optic nerve head to the edge of the image.

Check the retinal surface height variation graph (in green) to see that it is above the red reference plane.

In most cases, the retinal surface height should not dip below the reference plane. If it does, double check your contour line to be sure it is placed properly.
Often the disc margin becomes “readily” apparent/obvious when the display view is changed from a color image to black and white (select Color menu and then select black and white).

You can also use both horizontal and vertical cross section graphs on the “interactive measurements” window to further check the accuracy of your contour line placement. Contour line points should not be placed on sloping rim tissue.

The interactive measurement display shows cross-sectional height. Since blood vessels have height they are included on the interactive measurement graphs.

Often the disc margin becomes “readily” apparent/obvious when the display view is changed from a color image to black and white (select Color menu and then select black and white).
You can view the optic nerve head in 3-D either before, during or after placing contour line points to ensure accurate placement at the optic disc margin.

The contour line should appear to rest on stable retinal tissue. If it looks to be on sloping tissue – like a rope that has fallen off a cliff – adjust the line until it rests at the surface.

During drawing of the contour line you can select display of one of the optical section images which shows the "in question" area in better focus. Display the series of section images in the contour line window, then scroll through the images and watch the rim area that you are unsure about. When you find a section image that highlights the area better, use it instead of the reflection image to draw the contour line."
Here is an example of a tilted myopic disc.

Do not be misled by the scleral crescent or halo of peripapillary atrophy.

The contour line should never extend into the scleral crescent or halo of peripapillary atrophy.

Push the contour line to the inner margin of the scleral crescent.

Here is an example of a tilted disc with a scleral ring.

In this case the disc margin is best seen in the reflectance image.
Discs with a halo of peripapillary atrophy often have a band next to the disc margin which is darker than the atrophy.

Place the contour line on the inner edge of this band.

The topography image can be helpful in such cases.

In this case there is a large disc with shallow cupping. The disc edge is most easily seen on the topography image.
In most images the disc edge is more obvious.

Check out other reference materials available in our “How to” series including:

- How to read the printout
- How to interpret progression

Heidelberg Engineering offers regional HRT II product training plus educational presentations at national tradeshows. Additionally, product specialists are available to assist you.

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