Henson Perimeters

Screening with the Henson Perimeters

When you screen for a disease there are two very important statistics to consider that define the performance of the screening test.

1. **Sensitivity:** the percentage of cases detected by the screening test. A test that is 85% sensitive will detect 85 out of every 100 cases with the disease.
2. **Specificity:** the percentage of cases without the disease that pass the test. A test that is 95% specific will pass 95% of 'normals'.

An ideal screening test will be 100% sensitive and 100% specific, however, this can never be achieved. There will always be a few patients with the disease who pass the test (false negatives) and a few 'normals' who fail the test (false positives).

Another very important characteristic of a screening test is its speed. It needs to be fast and easy to apply.

Needless to say sensitivity/specificity/speed are interdependent. Generally speaking if you want a faster test you have to make some sacrifices to either the sensitivity or specificity. ***However, good design can make a big difference and that is where the Henson Perimeters score over their competitors. They have been designed to be fast without making sacrifices to performance.***

The World Health Organisation (WHO) published a series of criteria that need to be met for screening to be worthwhile. One criteria is that you only screen for diseases that have what is called a latent period. A period where the disease can be detected by the screening test but before there are any symptoms. Glaucoma is one such disease. It can be detected often years before symptoms arise. A second criteria is that you only screen for diseases where early, pre-symptomatic treatment, has benefits. Again, glaucoma meets these conditions. Early detection reduces the risk of blindness and often results in treatment being less invasive (medical rather than surgical). It is important to emphasise that glaucoma can lead to total blindness and that glaucoma is still the second most common cause of blindness and the largest cause of preventable blindness.

The screening tests

So how do the Henson screening tests meet the 3 important criteria, ***high sensitivity, high specificity and short test times.***

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High sensitivity.

The visual field defects in glaucoma are more likely to occur in certain visual field locations than in others. ***This topic has been researched into by Henson who has established the most likely locations for an early visual field defect.*** The research has shown that you do not need a large number of stimuli to have a test that is very sensitive. The graph below shows the relationship between sensitivity and the number of test stimuli.

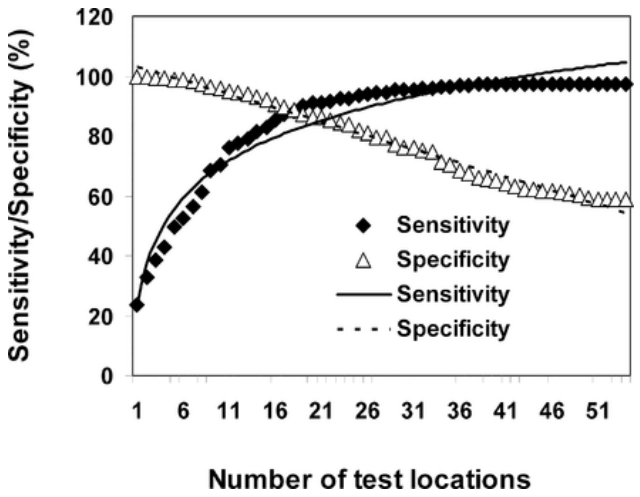

Figure 1 The sensitivity and specificity of the optimized test patterns with increasing numbers of test locations. From Wang Y, Henson DB. Investigative Ophthalmology & Vision Sciences 2013;54:756-761.

From this graph you can see that with just 26 optimally placed stimuli you can get very high sensitivity (almost 100%) to early visual field loss.

High specificity

You can also see from figure 1 that while you can get high sensitivity with a small number of stimuli the specificity, with just 26 optimally placed stimuli and the stringent cut off criteria used in this research, is low ~80%. The specificity of a screening test should be above 95%. Specificity of the Henson 7000/8000 screening tests is increased by:

1. ***Undertaking repeat measures at locations where a stimulus has been missed.*** In the Henson a stimulus has to be missed twice at any given test location before it is recorded as a miss. This alone has a massive effect on the false positive rate.
2. ***Extending the test to more locations to see if the patient has a glaucomatous visual field defect.*** Extensions take the number of test stimuli within the central 24 degree field to 68 and then 134 positions. This allows the clinician to differentiate between random misses

(false positives) and glaucomatous defects.

3. ***Allowing the perimetrist to repeatedly test a missed location.*** This is a unique and very important characteristic of the Henson screening tests. It is not unusual for a patient who has never had a visual field test before to miss some stimuli. To get high specificity you need to be able to confirm these misses are a true defect and not just a false positive. The best way to do this is to allow the perimetrist to re-test the location as many times as they see fit.
4. ***Allow the perimetrist to test around any missed locations with additional stimuli.*** The stimuli on the Henson Perimeters are arranged on a 3 degree square matrix within the central 30 degrees. This allows detailed verification and mapping of any central field defect and further aids differentiation between false positive responses and glaucomatous defects

Fast test times

The 26 point screening program can be conducted in less than 1 minute per eye. In ~80% of cases a 'normal' will see all of the stimuli and this will be the end of the test. In ~20% of cases some additional testing will be needed to establish whether missing one or more stimuli was a false positive (a normal but unreliable patient) or a true positive (a case of glaucoma). The time taken for the additional testing will vary. For a false positive it might take another minute for a case of glaucoma it could take longer.

To make things even faster the Henson Perimeters have an option to use multiple stimulus presentations rather than single stimulus ones (no other major supplier offers this option). With multiple stimulus presentations a pattern of 2, 3 or 4 stimuli are presented at the same time and the patient reports the number that they see. Besides speeding up the test it is also more patient friendly, i.e. patients do not get so flustered. This leads to more accurate results with less false positives.

Summary

Facility	Benefit	Humphrey	Octopus
Multiple and single stimulus presentation options	Multiple is faster, has less false positives and more patient friendly	Single only	Single only
Manual re-test of any stimulus at any stage of examination	Reduces false positives	Not available	Not available
Manually add test locations at any stage of examination	Explore area around any missed stimuli to confirm defect and establish extent of loss	Not available	Not available

Optimised test pattern.	Faster test times without loss of sensitivity	Has series of screening patterns	Has series of screening patterns
Extendable screening program	Reduce false positives	Not available	Can further test missed stimuli with threshold routine

Other facilities to aid screening/speed

Facility	Benefit	Humphrey	Octopus
Fast start up with LED technology	No need to wait until light sources have warmed up	Uses old style light sources that require long warm up times	LED technology
Fast start up with no need to enter Pt details prior to test (entered at end if perimetrist chooses to save data)	Saves test time especially where storage of every Pt not needed, e.g. when field is perfectly normal	Have to enter Pt details for every test	Have to enter Pt details for every test
Stream lined software with most operations requiring single click	Faster testing, easier operation and faster training	Poorly designed software which requires many slow response selections for routine tasks	
Fast printing on wide range of printers (any Windows based printer)	Better quality prints with many options regarding page size, colour etc. Does not need to finish printing prior to continuing with other tasks.	Very limited range of printers. Slow and unable to multitask.	
Fast storage of data with wide range of options through Windows OS	Easy to link to other Windows based systems including file servers	Very poor networking facilities backup options etc.	
Excellent, fast Windows based database	Easy to access data and export to other SW	Very poor database which can only be used after machine has warmed up. Not accessible to third	

		party software. Limited search options, slow response times.