Comparison of original HFA visual field printouts with EyeSuite Perimetry PC software printouts following importation
Matthias Monhart, Haag-Streit AG

Summary:
The programs 24-2 and 30-2 amongst others can be transferred via serial RS-232 interface from the Zeiss Humphrey® HFA700 and HFA700-i series to the Haag-Streit EyeSuite™ PC software. The accuracy of the EyeSuite database for SITA Standard and SITA Fast has been analyzed. The comparability of visual fields originally printed from HFA perimeters were compared with the printouts of these visual fields following importation to EyeSuite.

The EyeSuite database for SITA Standard and SITA Fast is very accurate. The deviation is on average 0.01 ±0.11dB for SITA Standard and 0.18 ±0.13dB for SITA Fast. All values in the total deviation plot stay within ±1dB of the local deviations in the original printouts. In general the printouts look very similar and the comparability is well given. In detail, the local sensitivities are identical and the grayscales follow the sample report, published in the new DICOM visual field standard and correspond with Zeiss-HFA grayscales. The total deviation probabilities are well comparable but slightly more sensitive in EyeSuite printouts. MD and PSD correlate mostly well, exceptions are mainly 30-2 tests with pronounced peripheral defects, like lens rim artifacts. In such cases, it is recommended to only look at the change on the total deviation plot or do the complete analysis within EyeSuite. It is the strength of EyeSuite to allow online global and cluster based trend calculation and to merge HFA and Octopus® data in one networked database for continuously working with HFA and Octopus visual field results.

Graph 1: Original HFA printout
Graph 2: Printout of the same field via EyeSuite after importation
Purpose
Trend analysis requires the selection of the relevant visual fields to calculate the rate of progression\(^2\). To facilitate a simple reselection of visual fields for progression analysis, all data must be available in its original, electronic form at the place of work for the diagnosing person. This is, for example, the computer on the desk of the practitioner’s examination room. Haag-Streit EyeSuite™ provides a complete solution for loading Humphrey® and Octopus® visual fields on a PC and analyzing them. This study shall answer the questions, how accurate the reference database of EyeSuite matches the original database in the HFAII and HFAII-i field analyzers, and if the printouts can be compared.

Methods
In a retrospective study, 56 Humphrey® visual fields, from normal to advanced stage, were first printed on the HFA field analyzer and then copied via transfer over the serial interface to the EyeSuite PC software. The visual fields included the 24-2 and 30-2 patterns and the SITA Standard and SITA Fast strategies. The instruments used were an HFA750-II with version 12.3 and a HFA740-IIi with version 4.1. The EyeSuite version i2.000 was installed on a PC with Windows XP Professional SP3. After loading the visual fields to EyeSuite, each visual field was printed to an image file using the "HFA Style" as proposed in the DICOM visual field standard\(^1\). The values, grayscale, total deviation and global indices were compared.

Results
All visual fields were transferred successfully. The local sensitivities were identical on both printouts. The grayscales were almost indistinguishable between original and EyeSuite printouts, only the interpolation of grayscales between neighboring test locations appears slightly different.

To know how accurate the EyeSuite database matches the original database on HFA instruments, the total deviation plot was compared point by point on a subset of the imported visual fields. For this purpose, a subset of 24 visual fields with 1622 test locations was analyzed. The fields were chosen to reflect different stages of severity and patient age.

For SITA Standard results, the average deviation between total deviation values calculated by EyeSuite compared with original printouts was 0.01 \(\pm 0.11 \text{dB} \) (2SD). For SITA Fast visual fields the according value was -0.18 \(\pm 0.13 \text{dB} \). All values of the analyzed total deviation plots were within \(\pm 1 \text{dB} \) of the original printouts. To compare: The normal intra-individual variation per test location is 2.2dB\(^2,3\) resulting in a point-wise reproducibility of approx. \(\pm 3 \text{dB} \) (2SD)\(^4\) respectively 0.29 \(\pm 0.19 \text{ dB} \) for the average of all test locations\(^5\). The found deviations are well below these values. Therefore the database of EyeSuite can be applied to original HFA data.

The coefficients of determination between printed global indices in SITA Fast are as follows: MD \(R^2=0.99\), PSD \(R^2=0.97\) and in SITA Standard 0.99 for both indices. Most of the indices calculated by EyeSuite are in the range of \(\pm 1 \text{dB} \) compared to the indices on the original printout. Especially in a case with pronounced potential lens rim artifact, the deviation was significantly higher – see also the PSD correlation graph for an example.

\[\text{MD}_{\text{original}} \quad \text{vs.} \quad \text{MD}_{\text{EyeSuite}}, R^2=0.99\]

\[\text{PSD}_{\text{original}} \quad \text{vs.} \quad \text{PSD}_{\text{EyeSuite}}, R^2=0.97\]
Discussion

Some of the information, available on the original printout is though missing after electronically importing SITA Standard and SITA Fast visual fields to EyeSuite: The false positive rate is not transmitted and false negative rates calculated in a different way. Also gaze track and GHT information are missing. If this information is considered important, then an original printout should be used. The strength of EyeSuite is to allow online global and cluster based trend calculation and to merge HFA and Octopus data in one networked database for continuously working with HFA and Octopus visual field results. This goal has doubtlessly been reached.

Conclusion

EyeSuite represents a viable solution to analyze and print original HFA data, in addition to Octopus data, on a PC. It conserves the familiarity of traditional HFA single field printouts and provides additional analysis functions not available in the HFA field analyzer.

The database used in EyeSuite i2.000 appears to match the original database very accurately, with an average point wise deviation of 0.01 ±0.11dB (2SD) for SITA Standard and 0.18 ±0.13dB for SITA Fast. The printouts can be directly compared on the base of the Values, Grayscales and the total deviation plot. The total deviation probability is similar but slightly more sensitive in EyeSuite. When comparing the global indices, care should be taken in cases with pronounced peripheral deviations, like lens rim artifacts. In such situations, it is advisable to either use the original printout from the instrument, only look at the change on the total deviation plot or do the complete analysis within EyeSuite.

References

1 Digital Imaging and Communications in Medicine (DICOM), Supplement 146, Ophthalmic Visual Field (OPV) Static Perimetry Measurements Storage SOP Class, DICOM Working Group 9, Rosslyn, Virginia 22209 USA