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CLINICAL INVESTIGATION

Thierry Zeyen
Maureen Roche
Luca Brigatti
Joseph Caprioli

Formulas for conversion between Octopus and Humphrey threshold values and indices

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T. Zeyen · M. Roche · L. Brigatti
J. Caprioli
Glaucoma Section,
Yale University School of Medicine,
Department of Ophthalmology
& Visual Science,
330 Cedar Street, New Haven,
CT 06520, USA

T. Zeyen (✉)
Middelheim Hospital, Lindendreef 1,
B-2020 Antwerp, Belgium
Fax: +32-3-280-55-39

Abstract ● Background: Comparing the results in a patient tested with two different automated perimeters can be difficult. The purpose of this study is to derive and test formulas for conversion between threshold values of every single test location and indices measured with Octopus and Humphrey perimeters. ● Methods: We tested 50 eyes of 27 patients with program G1 of the Octopus perimeter and program 24-2 of the Humphrey Field Analyzer. All pairs of tests were performed on separate days but within 1 month of each other. Twelve eyes had normal visual fields, and 38 eyes had mild to moderate glaucomatous defects. Thirty-three eyes were chosen to determine empirically prediction equations for each test location and for each of the global indices, while the 17 remaining eyes were used to test the validity of the predictions. ● Results: The mean absolute difference (i.e. the mean of the absolute values of the differences) between the predicted and the actual Octopus thresholds was 4.2 ± 1.6 dB. The mean absolute difference between the predicted and the actual Humphrey thresholds was 5.7 ± 1.6 dB. These differences were lower than the mean expected 5th to 95th percentile range of long-term fluctuation (10.3 ± 2 dB for the Octopus fields and 9.2 ± 2.2 dB for the Humphrey fields). ● Conclusion: Conversion formulas between Octopus and Humphrey formats can be used, with a known error of the estimate, to compare the perimetric results of the patients tested with the two instruments.

Introduction

Several automated perimeters have become popular in clinical usage. Perhaps the most commonly used instruments are the Humphrey and the Octopus. Comparing the results obtained with two different instruments in one patient is difficult, because available perimeters are not standardized with respect to background illumination levels, range of target luminances, target presentation pattern and duration of stimulus. Hence there is a need to establish conversion formulas between the threshold values measured with the two most popular instruments, the Octopus and the Humphrey Field Analyzer. Conversion formulas between the global indices computed by both perimeters are also useful. These formulas are necessary because the calculation of indices which conceptually have the same meaning actually differs slightly between the two instruments. In the Octopus program calculations are not weighted, positive values of mean defect (MD) represent loss of sensitivity, and the indices of localized loss are given as the variance (dB^2) instead of the standard deviation (dB). We undertook this study to derive and test conversion formulas between threshold values and indices measured with the Octopus and Humphrey perimeters.

Materials and methods

We tested 50 eyes of 27 patients aged 21–82 years (mean 64.2±14.4) with program G1 of the Octopus perimeter model 201 (Interzeag, Schlieren, Switzerland), and program 24-2 of the Humphrey Field Analyzer model 620 (Humphrey Instruments, Palo Alto, Calif.). The study was performed with the permission of the local ethics committee for clinical experiments. All perimetric examinations used all phases of program G1 [3], in which two separate threshold determinations are made at each test location. The average of these two measurements was taken as the value for threshold sensitivity at each test location. The threshold values taken for the Humphrey perimeter were all those which are reported in the printout; averaging of the ten reported double determinations was made. All pairs of tests were performed on separate days but within 1 month of each other. Twelve eyes had normal visual fields and 38 eyes had chronic open-angle glaucoma with mild to moderate field defects. Patients were considered glaucomatous if they had a history of elevated intraocular pressure, early glaucomatous visual field defects as determined by the clinical criteria given below, and typical glaucomatous disc damage consistent with visual field loss. Elevated intraocular pressure was defined as>21 mmHg on at least two consecutive visits 1 month apart with or without treatment. Early glaucomatous visual field defects were defined as a minimum of two consecutive visual fields with: at least 10 dBV loss at two or more contiguous points in Bjerrum's area compared with perimeter-defined age-matched normals; or at least 5 dB loss at three of more contiguous points in Bjerrum's area; or 10 dB difference across the nasal horizontal midline at two or more adjacent points. All patients had previous experience with automated perimetry and gave their informed consent prior to their inclusion in the study. Subjects were excluded if they had: visual acuity less than 20/30, refractive error greater than ±5 D (spherical equivalent), false-positive of false-negative rates exceeding 15%, or any other ocular or neurologic disease that could produce visual field defects.

Because the two instruments had different target presentation patterns, it was not possible to perform one-to-one correlations of threshold values for individual test locations. A transparent sheet was used to overlay the standardized test locations of both perimeters (Figs. 1–3). We used the closest test locations plus the adjacent test locations to predict the threshold in the other visual field (Fig. 4). A linear model, implemented with a statistical package (Systat, Evanston, Ill.) was used to estimate the threshold value of each point in the other visual field of the same eye. The linear model had the general form:

$$O=k+a(H1)+b(H2)+c(H3)...$$

where O was the threshold of a test location in the Octopus visual field to predict, k was a constant, H1, H2, H3,... were the actual thresholds of test locations in the corresponding Humphrey visual field of the same eye, and a, b, c, ... were dependent variable coefficients. Similar formulas were used to predict the Humphrey thresholds. Linear regression formulas were used to predict each of the global indices [mean deviation and mean defect (MD), pattern standard deviation (PSD) and corrected pattern standard deviation (CPSD), loss variance (LV) and corrected loss variance (CLV)] from one instrument to the other.

We randomly chose 33 eyes to determine empirically prediction equations for each test location and for each of the global indices, while the 17 remaining eyes were used to test the validity of the predictions. In these 17 eyes each predicted threshold was compared to the corresponding actual threshold of the visual field. The mean difference between the predicted and actual threshold of the Octopus visual fields was compared with the mean estimated long-term fluctuation (LTF). The same calculation was performed for the Humphrey visual fields. The LTF of each test location was estimated using an Octopus database of serial, stable glaucomatous visual fields chosen from the Yale Glaucoma Service for a previous study of LTF at individual test locations [2]. These visual fields were entirely different from the population used to define and test the conversion formulas. In this database we applied linear model equations to calculate the 5th to 95th percentile range of the initial and all subsequent threshold sensitivities for each test location as a measure of the LTF in dB. These equations were used to predict the magnitude of the LTF of the 17 visual fields used to test the validity of the prediction formulas. The predicted magnitude of LTF estimated in this way was then compared to the differences

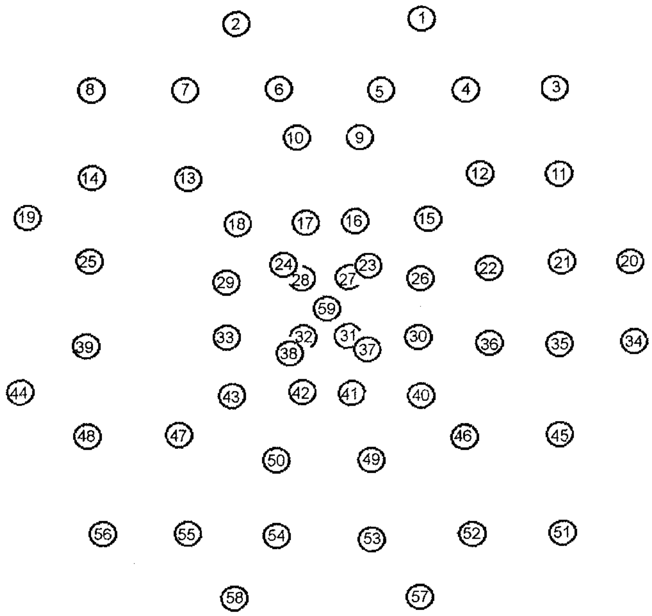

Fig. 1. Test locations (presented as a left eye) in program G1 (Octopus)

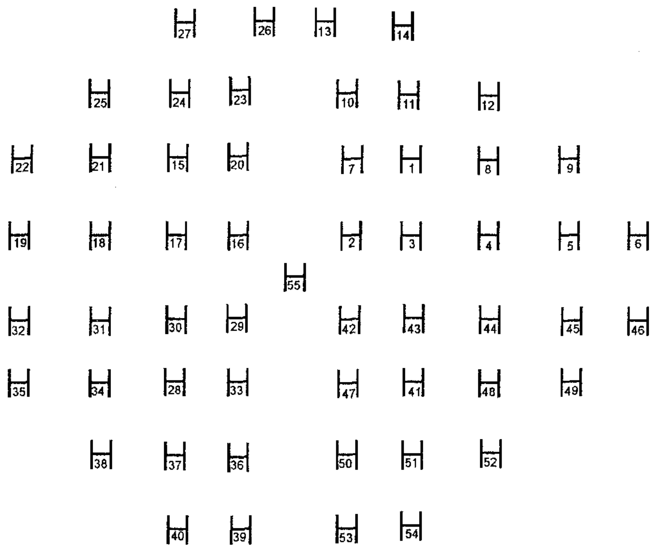

Fig. 2 Test locations (presented as a left eye) in program 24-2 (Humphrey)

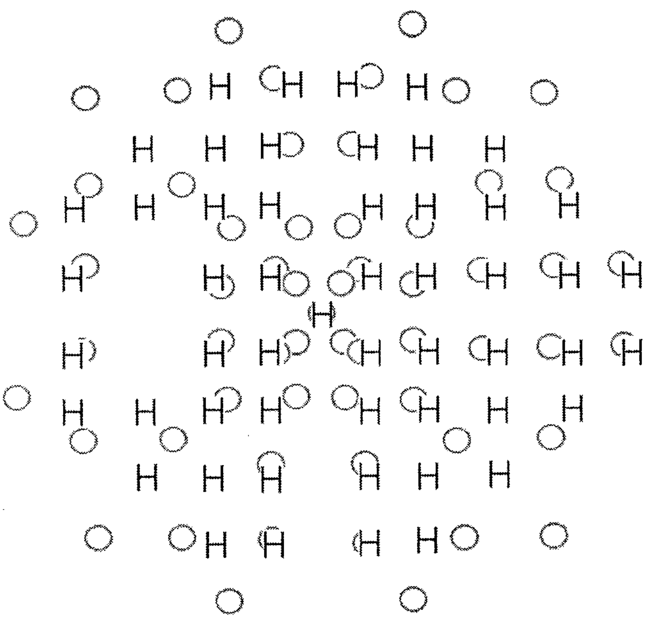

Fig. 3 Overlay of test locations (presented as a left eye) in program G1 (Octopus) and program 24-2 (Humphrey)

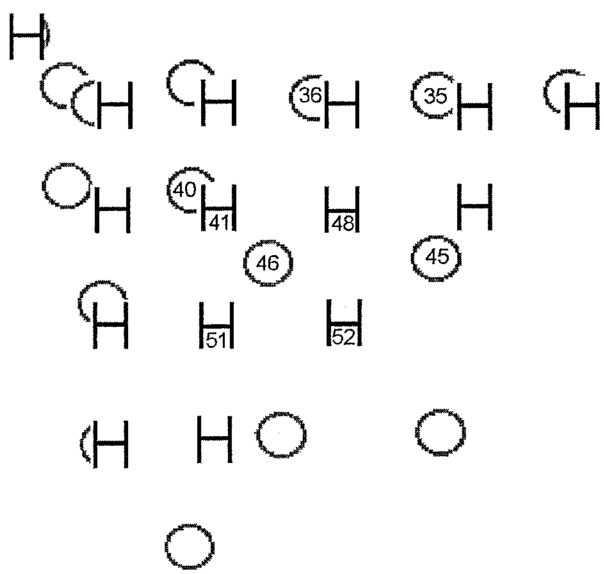

Fig. 4 Example of empirically determined conversion formulas.
O46=19.129+H48*0.537+H41*−0.207+H51*−0.370
+H52*0.271
H48=−9.934+O35*1.779+O36*0.043+O40*−0.718+O46*
−0.114+O45*0.530

between the actual and predicted dB values of each test location.

Normal probability plots were used to test the distribution of data. Student's *t*-test was used for hypothesis testing of the mean. The value of statistical significance used was $P<0.05$.

Table 1 Data for age and visual indices for the eyes tested with the Octopus program G1 and the Humphrey program 24-2 (n=50). *SD* standard deviation of the mean

	Mean±SD
Age (years)	64.2±14.4
Mean sensitivity Octopus (dB)	22.4±4.6
Mean sensitivity Humphrey (dB)	23.3±5.3
Mean defect (dB)	3.6±4.4
Mean deviation (dB)	−4.5±5.5
Loss variance (dB^2)	41.4±38.2
Pattern standard deviation (dB)	6.6±4.1
Corrected loss variance (dB^2)	33.6±33.1
Corrected pattern standard deviation (dB)	6.1±4.3
Short-term fluctuation Octopus (dB)	2.0±0.6
Short-term fluctuation Humphrey (dB)	2.4±1.0

Results

The data for age and visual field indices of the 50 eyes tested are summarized in Table 1. Figure 5 shows the frequency distribution of the global indices in our test database: MD for diffuse loss, and (C) PSD and (C) LV for localized loss. On average, when comparing actual Octopus with actual Humphrey test results, the Humphrey values were 2.2±1.7 dB higher. The pairwise correlation of the mean sensitivities for each instrument (comparing one eye, randomly chosen, per patient) was highly significant: $n=27$, $r=0.87$, $P=0.000$ (Fig. 6).

An average of 4.4 test locations were used to estimate the threshold value of each point in the other visual field. Figure 7 shows the correlation between the mean of each predicted and each actual test location for the 17 Octopus visual fields used to test the validity of the formulas ($r=0.74$, $P=0.000$). The corresponding correlation for the 17 Humphrey fields is shown in Fig. 8 ($r=0.85$, $p=0.000$). Table 2 shows the differences between the predicted and actual thresholds and between the predicted and actual indices of the 17 visual fields tested with both perimeters. The mean absolute difference between the predicted and the actual Octopus thresholds was 4.2±1.6 dB ($P<0.001$, Student's *t*-test). The mean absolute difference between the predicted and the actual Humphrey thresholds was 5.7±1.6 dB ($P<0.001$, Student's *t*-test). These differences were lower than the mean expected 5th to 95th percentile range of LTF (10.3±2 dB for the Octopus fields, and 9.2±2.2 dB for the Humphrey fields). The complete list of conversion formulas is presented in the Appendix.

Discussion

The Octopus G1 and Humphrey 24-2 programs are widely employed for the detection and follow-up of glaucomatous visual field damage. Comparing the results obtained

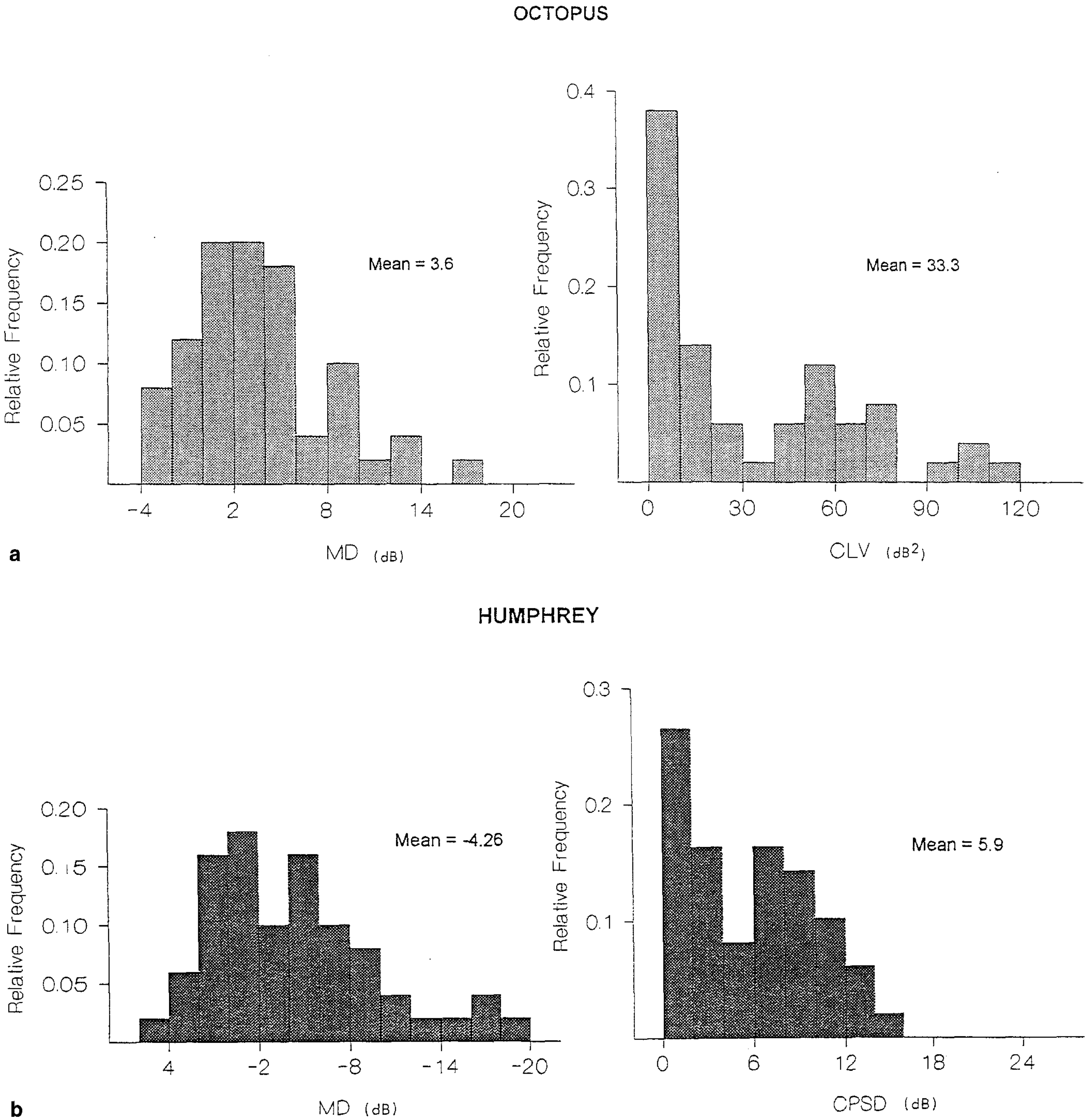

Fig. 5 a, b Frequency distribution of visual field indices in the test database. **a** Octopus indices; **b** Humphrey indices

with these two programs in the same patient is difficult, because the two instruments differ with respect to background illumination, range of target luminance, target presentation pattern, and calculation of the indices. The complexity of predicting equivalence from theoretical consideration creates the need for empirically determined conversion formulas. Our present findings suggest that it is possible to apply a simple linear regression model to convert threshold values and indices obtained with one instrument to those of another instrument.

The difference of 2.2±1.7 dB we found between the mean sensitivities (MS) as measured with the two perimeters is comparable with the 2–3 dB found by Anderson et al. [1]. They studied a similar group of patients, but compared programs with identical presentation patterns (P32 from Octopus with 30-2 from Humphrey).

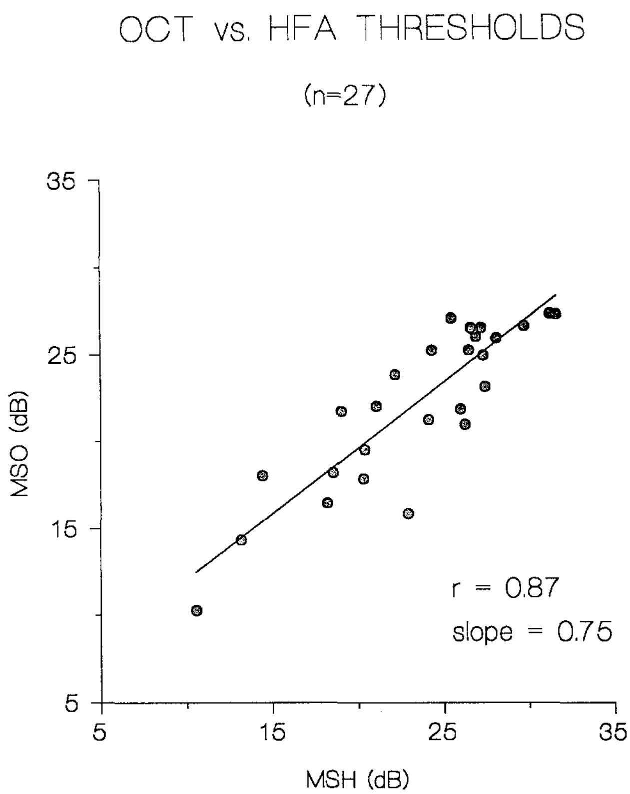

Fig. 6 Correlation between the mean sensitivities of the Humphrey visual fields (*MSH*) and the mean sensitivities of the Octopus visual fields (*MSO*) in the test database (comparing only one eye per patient). MSO=0.75. MSH+4.52

Our coefficients of correlation between the MS measured with both perimeters (r^2=0.77, r=0.87) were very similar to the ones found in Anderson's study [1] (r^2=0.78), and to the coefficient found by Vivell et al. [7], who compared the MS of program G1X [6] (Octopus) with program 30-2 (Humphrey) in 120 normal subjects (r=0.71). Johnson et al. [5] described linear model equations to convert program 30-2 (Humphrey) to program G1 (Octopus) in 12 patients with visual field loss, but they correlated sectors instead of individual test locations. Their formulas predicted the actual values on the other perimeter within 7 dB approximately 85% of the time. This was very similar to our results, where the predicted Octopus thresholds were within 7.4 dB of the actual values 90% of the time.

The mean difference between the predicted and the actual thresholds (4.2±1.6 dB for Octopus and 5.7±1.6 dB for Humphrey) was lower than the mean expected 90% range of LTF (10.3±2 dB for Octopus and 9.2±2.2 dB for Humphrey). It must be pointed out, however, that the estimated LTF for the Humphrey fields was calculated with equations derived from Octopus data. This approximation seems appropriate since the published Humphrey LTF data are comparable to the Octopus LTF data we used [4]. On the other hand, we found that the differences between the predicted and the actual thresholds, expressed in relative values, were scattered around zero for both perimeters (Table 2), which suggested that these differences, expressed in absolute values, were explained by the LTF. These predictions, based on a number of neighborhood test locations, represent regional averages which may dampen the LTF. Outliers (i.e., high differences between predicted and actual values) are expected when thresholds are predicted from glaucomatous visual fields, since a small shift in fixation from one perimeter to the other can produce important shifts in scotomas measured with the two instruments.

Table 2 Differences between the predicted and the actual thresholds and between the predicted and the actual indices of the patients tested with both instruments (n=17)

	Difference in absolute values Mean±SD	Difference in relative values Mean±SD
Octopus thresholds (dB)	4.2±1.6	−0.3±2.5
Humphrey thresholds (dB)	5.7±1.6	0.2±2.3
Mean sensitivity Octopus (dB)	1.8±1.3	−0.2±2.3
Mean sensitivity Humphrey (dB)	2.2±1.1	0.1±2.5
Mean defect (dB)	1.9±1.6	1.4±2.1
Mean deviation (dB)	2.0±1.5	1.2±2.3
Loss variance (dB^2)	11.6±13.3	1.3±17.8
Pattern standard deviation (dB)	1.5±1.5	0.3±2.1
Corrected loss variance (dB^2)	10.6±11.5	1.6±15.8
Corrected pattern standard deviation (dB)	1.4±1.6	0.3±2.1

The conversion formulas presented here have been derived from visual fields which have glaucomatous abnormalities. The patterns of glaucomatous visual field loss could contribute to the weights of the component predictors of the threshold values. It should be pointed out, therefore, that such conversions are likely to be valid only when dealing with glaucomatous visual fields. Our data were collected using the average of all the Octopus double determinations and the Humphrey data as reported on the printout. The conversions are therefore valid only for data collected in this manner.

To our knowledge, this is the only study to have determined conversion formulas for each test location and for each of the global indices measured with program G1 (Octopus) and program 24-2 (Humphrey). The high differences between the predicted and actual LV and CLV, contrasting with the low differences between the predicted and actual PSD and CPSD, are explained by the fact that these differences are squared for the Octopus indices of localized loss (expressed in dB^2) but not for the Humphrey ones (expressed in dB).

A larger database could enhance the accuracy of the results. The computational simplicity of our formulas makes it possible to include this conversion process into

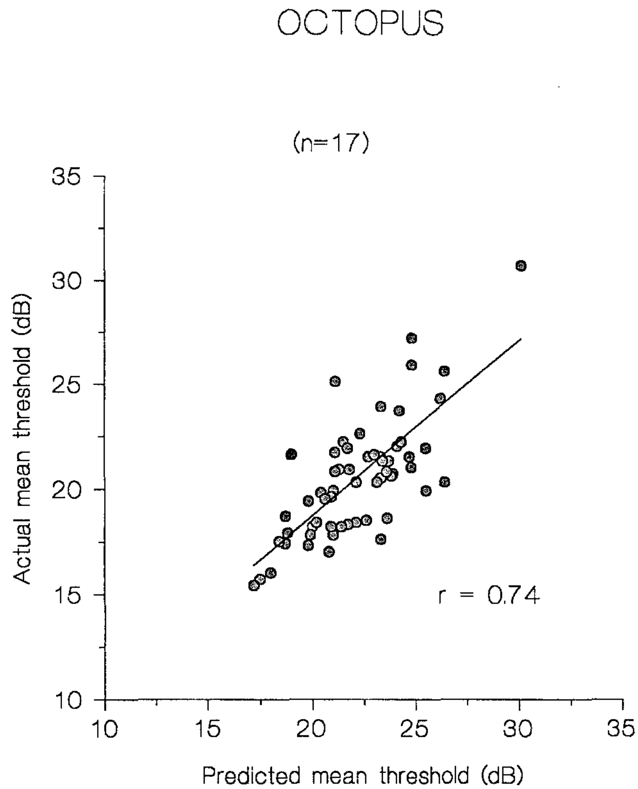

Fig. 7 Correlation between the mean of each predicted and each actual test location for the 17 Octopus visual fields used to test the validity of the formulas. Actual mean threshold (dB)=0.84. Predicted mean threshold (dB) +1.98

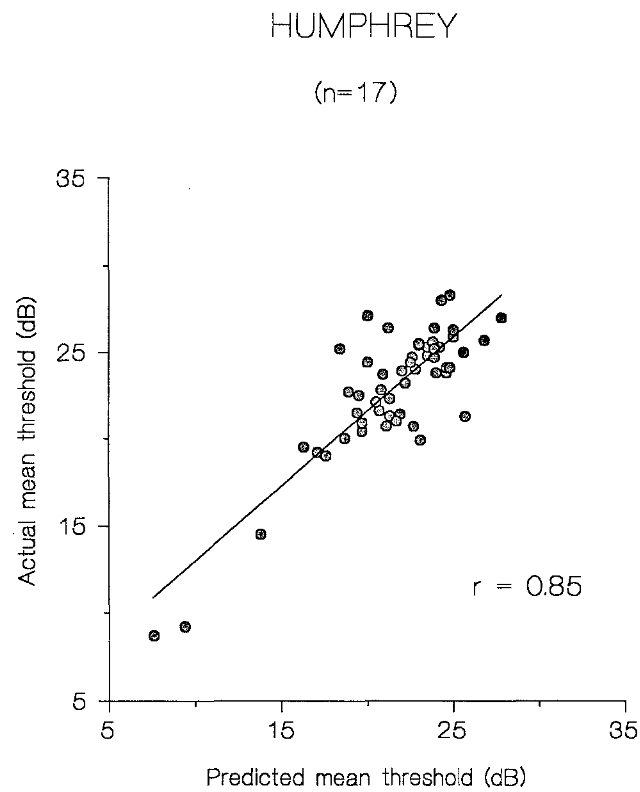

Fig. 8 Correlation between the mean of each predicted and each actual test location for the 17 Humphrey visual fields used to test the validity of the formulas. Actual mean threshold (dB)=0.86. Predicted mean threshold (dB) +4.38

the existing data analysis software. For many practitioners this could be of great clinical benefit.

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Appendix: List of conversion formulas

Humphrey to Octopus equations

H1=5.259+O15*0.130+O12*696+O9*0.407+O16*−0.910 +O23*0.807+O22*−0.197+O26*−0.102
H2=−3.245+O23*0.760+O27*0.308
H3=−9.438+O26*0.002+O22*0.338+O15*0.899+O23* −0.012+O30*0.173
H4=−1.306+O22*0.348+O21*0.904+O26*−0.161
H5=−4.403+O21*0.529+O20*0.343+O22*0.247
H6=−5.308+O20*1.124
H7=−4.737+O16*−1.218+O15*0.939+O9*0.318 +O17*0.660+O23*0.481
H8=−2.259+O11*0.676+O12*0.335+O15*0.213+O22* −0.184+O21*0.093
H9=−9.057+O11*0.493+O21*0.375+O20*0.560+O12*0.313 +O22*−0.360
H10=1.515+O9*0.038+O4*−1.029+O5*0.820+O6*0.956 +O10*0.173+O17*−0.087+O16*−0.098+O15*−0.106 +O12*0.359
H11=−1.738+O4*−0.568+O5*1.199+O9*−0.228 +O12*0.632
H12=−2.980+O3*2.215+O4*−0.917+O11*−0.359 +O12*0.366
H13=−3.096+O5*0.755+O4*−0.261+O6*0.660+O9*−0.064
H14=−2.807+O4*−0.565+O5*1.178+O1*0.483
H15=9.271+O18*0.663
H16=−7.969+O24*0.600+O28*0.685
H17=−14.412+O29*0.627+O18*0.556+O24*0.246 +O33*0.092
H18=blind spot
H19=3.251+O25*0.847
H20=−6.407+O17*−0.277+O16*0.123+O10*0.340 +O18*1.069+O24*0.012
H21=−5.654+O13*−0.014+O14*−0.404+O18*0.173 +O19*1.423
H22=−0.467+O14*−0.322+O25*−0.647+O19*1.997
H23=4.324+O10*0.285+O5*0.105+O6*1.469+O7*−0.058 +O13*−0.805+O18*−0.032+O17*0.377+O16*−0.330 +O9*−0.050
H24=0.496+O6*1.615+O7*0.075+O13*−0.501+O10* −0.107
H25=−6.590+O7*−0.157+O8*1.169+O13*0.288 +O14*0.041
H26=−2.483+O6*1.393+O5*0.012+O7*−0.312
H27=−0.230+O7*−0.198+O6*1.335+O2*−0.137

H28=3.195+O43*−0.147+O33*0.597+O38*−0.394 +O42*0.729+O50*1.154+O47*−0.998
H29=−6.639+O32*0.231+O38*1.027
H30=−9.553+O33*−1.134+O29*0.992+O38*1.368 +O43*0.114
H31=blind spot
H32=−1.472+O39*1.076
H33=−10.656+O42*0.488+O41*1.150+O38*−0.041+O43* −0.475+O50*0.320
H34=−4.516+O43*0.253*O44*1.015+O47*0.031+O48* −0.089
H35=1.217+O39*0.483+O48*0.284+O44*0.215
H36=3.705+O50*0.902
H37=−3.140+O50*0.329+O47*−0.099+O55*0.546+O54* −0.018+O43*0.454
H38=−4.883+O47*−0.404+O48*−0.253+O55*1.238 +O56*0.682
H39=6.745+O54*−0.554+O53*0.225+O55*−0.032 +O50*0.134+O58*1.026
H40=−2.618+O54*0.040+O55*−0.097+O58*1.225
H41=3.061+O40*0.956
H42=−11.192+O31*0.816+O37*0.640
H43=−12.044+O30*1.418
H44=−2.032+O36*1.129
H45=−9.170+O35*1.395
H46=−9.471+O34*1.349
H47=−7.199+O41*1.561+O42*−0.037+O40*−0.166+O37* −0.036+O49*−0.022
H48=−9.934+O35*1.779+O36*0.043+O40*−0.718+O46* −0.114+O45*0.530
H49=−14.762+O35*−0.061+O45*1.664
H50=−5.157+O49*1.223
H51=7.359+O46*0.801+O49*−0.063+O53*−1.128 +O52*1.183
H52=−5.384+O45*1.416+O46*−0.205+O51*1.017+O52* −0.829
H53=−5.858+O53*−0.821+O49*0.200+O54*−0.466 +O57*2.021+O52*0.503
H54=−18.616+O52*0.620+O53*−1.374+O57*2.705
H55=21.104+O59*−0.308+O27*−0.144+O28*0.378 +O31*0.385+O32*0.183
Msh=−2.538+Mso*1.149
Mdh=−0.874+Mdo*−1.170
Psd=0.759+ Lv*1.378
Cpsd=−1.047+ Clv*1.414

Octopus to Humphrey equations

O1=10.353+H14*0.119+H13*0.336
O2=13.320+H26*0.104+H27*0.179
O3=9.310+H9*−0.281+H12*0.406+H14*0.323
O4=12.029+H12*−0.169+H14*0.316+H11*0.276
O5=11.970+H13*0.448
O6=9.586+H26*0.542
O7=14.555+H27*14.555+H24*0.136+H25*0.084
O8=−2.259+H11*0.676+H12*0.335+H15*0.213+H22* −0.184+H21*0.093
O9=14.924+H10*0.255+H14*−0.070+H13*0.051 +H26*0.095+H29*−0.459+H20*−0.102+H7*0.235 +H1*0.617+H11*−0.264
O10=9.892+H23*0.722+H13*0.111+H26*−0.013 +H27*0.177+H24*−0.400+H15*−0.032+H20*0.168+H7* −0.039+H10*−0.141
O11=10.167+H9*−0.177+H12*0.123+H8*0.512
O12=11.152+H12*0.012+H11*0.070+H1*0.003+H8*0.400
O13=15.157+H24*0.429+H25*0.149+H21*−0.380 +H15*0.142
O14=17.320+H25*0.390+H21*−0.159+H22*0.036
O15=15.520+H1*−0.633+H12*−0.633+H11*0.640+H10* −0.047+H7*0.432+H2*−0.273+H3*0.815+H4*0.202+H8* −0.296
O16=24.157+H7*−0.221+H11*−0.063+H10*0.256 +H23*0.007+H20*0.371+H16*−0.415+H2*0.393 +H3*0.773+H1*−1.031
O17=17.697+H20*0.485+H10*−0.191+H23*0.020+H24* −0..051+H15*−0.273+H17*0.016+H16*−0.245 +H2*0.493+H7*0.020
O18=8.269+H15*0.534
O19=16.505+H22*0.356+H19*−0.042
O20=13.886+H6*0.327
O21=17.972+H5*0.068+H6*0.326+H4*−0.037+H45* −0.144
O22=20.972+H4*0.499+H9*−0.096+H8*0.208+H1*−0.911 +H3*0.453+H43*−0.330+H44*−0.314+H45*0.657 +H5*0.040
O23=24.975+H2*0.458+H1*−0.636+H7*−0.173+H20*0.354 +H16*−0.347+H29*−0.137+H42*0.010+H43*−0.035 +H3*0.608
O24=22.535+H16*0.494+H7*−0.291+H20*0.475+H15* −0.505+H17*0.437+H30*0.121+H29*−0.227+H42* −0.092+H2*−0.258
O25=21.416+H19*0.138
O26=21.366+H3*0.266+H8*0.032+H1*0.171+H7*−0.088 +H2*0.328+H42*−0.092+H43*−0.206+H44*0.144+H4* −0.392
O27=22.301+H2*0.304+H1*−0.383+H7*−1.035+H20*0.317 +H16*−0.187+H29*−0.063+H42*−0.052+H42*−0.082 +H3*1.320
O28=16.568+H16*0.246+H7*−0.234+H20*−0.104 +H15*0.041+H17*0.595+H30*0.003+H29*0.225+H42* −0.181+H2*−0.177
O29=16.374+H17*0.107+H16*0.260+H15*−0.065 +H30*0.078
O30=14.269+H43*−0.488+H4*−0.357+H3*0.425+H2* −0.092+H42*−0.141+H47*0.480+H41*0.050+H48*0.050 +H44*0.911
O31=18.478+H42*0.567+H3*0.223+H2*−0.135+H16* −0.100+H29*−0.153+H33*−0.326+H47*0.052+H41* −0.110+H43*0.293
O32=21.891+H29*0.277+H2*−0.064+H16*−0.049 +H17*0.155+H30*0.187+H28*−0.053+H33*−0.141 +H47*0.108+H42*−0.177
O33=23.440+H30*0.095+H17*0.115+H29*−0.118 +H28*0.084
O34=12.414+H46*0.409
O35=14.706+H45*0.907+H6*−0.145+H5*0.164+H4*−0.189 +H44*−0.440+H48*0.161+H49*−0.218+H46*0.134
O36=7.263+H44*0.351+H5*−0.138+H4*−0.800+H3*0.728 +H43*−0.734+H41*0.716+H48*−0.616+H49*−0.018 +H45*1.121
O37=18.350+H42*0.525+H3*0.145+H2*−0.080+H16* −0.079+H29*−0.293+H33*−0.246+H47*0.078+H41* −0.057+H43*0.302
O38=22.081+H29*0.065+H2*−0.099+H16*−0.062 +H17*0.089+H30*0.295+H28*−0.073+H33*−0.091 +H47*0.014+H47*0.014+H42*0.047
O39=21.099+H32*0.146
O40=7.913+H41*0.588+H44*0.952+H43*−0.692+H42* −0.183+H47*0.342+H50*0.531+H51*−0.638+H52*0.091 +H48*−0.428
O41=18.063+H47*0.269+H43*0.640+H42*0.110+H29* −0.268+H36*0.062+H50*0.062+H51*−0.566+H41*0.073
O42=18.963+H33*0.261+H42*0.317+H29*−0.563 +H30*0.089+H28*−0.644+H37*0.989+H36*−0.169 +H50*−0.296+H47*0.284
O43=15.591+H28*0.324
O44=22.531+H32*0.081+H35*0.016

O45=1.859+H49*0.250+H48*0.104 +H52*0.019
O46=19.129+H48*0.537+H41*−0.207+H51*−0.370 +H52*0.271
O47=22.778+H28*−0.105+H42*−0.066+H38*−0.418 +H37*0.681
O48=22.809+H34*0.134+H35*0.139+H38*−0.171
O49=13.212+H50*0.581+H41*0.527+H47*−0.139+H33* −0.052+H36*0.418+H39*−0.111+H53*−0.146 +H54*0.234+H5*−0.931
O50=22.951+H36*0.277+H47*−0.088+H33*−0.076 +H28*0.388+H37*−0.703+H40*0.222+H39*−0.566 +H53*−0.114+H50*0.755
O51=13.436+H49*0.392+H52*−0.306+H54*0.252
O52=17.745+H52*0.515+H51*−0.575+H54*0.312
O53=19.656+H53*0.640+H51*−0.982+H50*0.408+H36* −0.107+H39*−0.019+H54*0.272
O54=23.387+H39*−0.715+H50*−0.089+H36*0.264+H37* −0.245+H40*0.761+H53*0.116
O55=22.861+H37*0.006+H38*0.127+H40*−0.036
O56=21.477+H35*0.246+H38*−0.238+H40*0.456+H32* −0.270+H34*0.228+H37*0.207+H39*−0.529
O57=13.097+H54*−0.052+H53*0.448
O58=20.406+H39*−0.277+H40*0.431
O59=29.628+H55*−0.008+H2*0.011+H16*0.114+H42* −0.063+H29*0.036
Mso=5.602+Msh*0.726
Mdo=0.174+Mdh*−0.625
Lv=6.540+Psd^2*0.494
Clv=6.612+$Cpsd^2$*0.488

References

1. Anderson DR, Feuer WJ, Alward WL, Skuta GL (1989) Threshold equivalence between perimeters. Am J Ophthalmol 107:493–505
2. Boeglin RJ, Caprioli J, Zulauf M (1992) Long-term fluctuation of the visual field in glaucoma. Am J Ophthalmol 113:396–400
3. Flammer J, Jenni F, Bebie H, Keller B (1987) The Octopus glaucoma G1 program. Glaucoma 9:67–72
4. Heijl A, Lindgren A, Lindgren G (1989) Test-retest variability in glaucomatous visual fields. Am J Ophthalmol 108:130–135
5. Johnson CA, Keltner JL, Lewis RA (1987) JASW (joint automated weighting statistic). A method of converting results between automated perimeters. Doc Ophthalmol Proc Ser 49:563–568
6. Messmer C, Flammer J (1991) Octopus program G1X. Ophthalmologica 203:184–188
7. Vivell PM, Lachenmayer BJ, Schaumberger MM, Zimmermann P, Dietrich J, Bain C (1993) Conversion of normal visual field data between the Humphrey Field Analyzer 640, the Rodenstock Peristat 433, and the Octopus 1-2-3. In: Mills RP (ed) Perimetry update 1992/1993. Kugler, Amsterdam, pp 353–357