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Comparison of Perimetric Results with the Medmont and Octopus Perimeters

Jan Lešták[1,2,3]* and Pavel Rozsíval[3]

[1]JL Clinic, V Hurkách 1296/10, Prague, Czech Republic
[2]Czech Technical University in Prague (Faculty of Biomedical Engineering), Czech Republic
[3]Charles University (Faculty of Medicine in Hradec Kralove), Czech Republic

Abstract

Objectives: To find out whether there is a difference in measured values of visual fields at the same patients by two different perimeters.

Methods and patients: The authors examined 40 eyes of 20 persons with hypertensive glaucoma in an incipient stage (aged 14-77 years, mean 60 years) using the device Medmont M700 and Octopus 900. In both cases similar strategy and programs of examination for determining threshold sensitivity in decibels (dB) were used, namely at the device Medmont-the fast threshold, and at the Octopus-the TOP strategy (G standard). Measured values of mean sensitivity in dB and apostilbs (asb) were processed statistically. Since the data significantly deviated from a normal distribution, particularly in the case of asb, non-parametric Wilcoxon pair test was used.

Results: The authors proved higher values of mean sensitivity (MS) in dB at the device Octopus (p=0.000055). On the contrary, they found a lower threshold of brightness in device Medmont (p=0.0000), when the values were converted to asb.

Conclusion: Both devices are able to determine threshold sensitivity in glaucoma changes. Perimeter Medmont using the fast threshold software program of examination gives more sensitive results than the TOP program at Octopus. Although the values of MS differ, both devices are able to demonstrate pathological conditions with almost the same probability (r=0.85).

Keywords: Medmont M700; Octopus 900; Fast threshold; TOP; Comparison

Introduction

At present, the most widely used devices for visual field examination in the Czech Republic is the Medmont M600 or M700 (170 pieces). Even though it is a product of the firm Medmont Pty Ltd, Victoria 3124, Australia, it reached this position due to excellent business policy of its representing Czech company. In Europe, the devices Octopus of the company Haag-Streit AG, Koeniz, Switzerland and Humphrey field analyzer (HFA) of the firm Carl Zeiss Meditec are approximately equally represented. In the Czech Republic, the Octopus model101 is used in five, the type Octopus 900 in four workplaces. The problem is that each of these devices uses a different range of light stimuli and a different grid of investigated points, and due to it, there are non-standard conditions for perimeter evaluation of the visual field in the same patients. Another problem is that each of them uses different statistical symbols. From the literature, a study comparing Medmont and Humphrey devices is well-known. Both perimeters correlate well, and can be used for both clinical and research goals with the same reliability [1]. Other authors compared the Octopus 300 and Topcon SBP-3000 [2].

Information of similar comparison of Medmont and Octopus devices is missing. Therefore, we tried in this study to compare the test results of these two devices.

Group of Patients and Methods

We examined 40 eyes of 20 subjects with hypertensive glaucoma (aged 14-77 years, mean 60 years). Measurements were performed first on the perimeter Medmont M700 (the right and then the left eye) and then, with an interval of at least 30 minutes, on the perimeter Octopus 900 (first the left and then the right eye). To eliminate the learning curve, all the involved patients underwent repeated examinations. Visual acuity of all the subjects in the study was 1.0 without correction. The patients had various changes in visual fields, from normal sensitivity up to the stage of incipient changes. The diagnosis of glaucoma was based on clinical examination (biomicroscopy, gonioscopy, the daily curve of intraocular pressure, NFI, GDx, and in controversial cases PERG and PVEP). The intraocular pressure was above 21 mmHg before the beginning of treatment and after CCT correction. We used the glaucoma G standard program for the examination at the Octopus perimeter in the range 0–30 degrees, altogether in 59 points, at the Medmont perimeter in the range 0 - 22 degrees, and in the nasal half - up to 50 degrees, altogether 104 points. The MS was calculated from the sensitivity values in the range of 0-15 degrees, at the Octopus it was 26 points, at the Medmont 44 points. The distance between the points was approximately the same in both the programs. In all cases we used a similar strategy of examination–the TOP at the Octopus and the fast threshold at the Medmont.

TOP (Tendency Oriented Perimetry)

The examination starts at half the normal value (NV), i.e., the start

***Corresponding author:** Jan Lestak, JL Clinic, V Hurkách 1296/10, Prague, Czech Republic, E-mail: lestak@seznam.cz

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value in dB is 8/16 NV. Thereafter, testing proceeds with bracketing, applying steps in relation to the patient´s age-corrected normal value, i.e., 4/16, 3/16, 2/16, and finally the step of 1/16 NV in either direction to determine the actual of d.l. sensitivity.

Fast threshold strategy

The fast threshold strategy is a modern efficient method using a sophisticated probability algorithm. The initial set of calibration points (in each quadrant one point) is fully threshold and provides accurate data of surrounding functions. Then it is compared with the age population of the new light point with the adjacent point. Both the strategies are the most common and mutually comparable. As both the devices use different statistical symbols for evaluating visual fields, we compared the mean sensitivity (MS) values. The MS is expressed in both of them in decibels (dB). Each of the devices works with a different range of brightness stimuli – Octopus 900 from 0.02 to 4000 asb, Medmont M700 from 0.03 to 1000 asb. For comparing the detected threshold stimuli, we had to recalculate the values from the dB to the asb scale. For conversion of decibels to apostilbs we used the equation:

Sensitivity (dB) = 10xlog (maximum possible sensitivity / measured sensitivity)

Results

The measured values are given in Table 1. Mean values of sensitivity are given in both dB and asb. In each line, the results refer always to the same eye. Odd numbers indicate the values of right eyes, even numbers those of left eyes. Lower value (asb) shows higher threshold sensitivity.

When testing the differences between the devices Octopus and Medmont, there were always two dependent data selections, because the patients´ eyes were always tested on both the devices. As the data deviated significantly from the normal distribution, in particular in case of asb results, the non-parametric Wilcoxon pair test was used. It tests the null hypothesis that there is no significant difference between the two devices (medians are not different), against the alternative hypothesis that they are significantly different. If the significance value of the test is less than 0.05 (5%), then there are statistically significant differences between devices at the 5% confidence level. In published papers, in case of using non-parametric tests, it is necessary to give rather medians and quartiles than the average and standard deviations.

The MS (dB) at the Octopus shows higher sensitivity values (Figure 1). This paradoxical difference is due to higher upper value of brightness of light stimuli–at the Octopus 900 from 0.02 to 4000 asb, at the Medmont M700 from 0.03 to 1000 asb.

The recalculated values of the used threshold stimuli brightness in asb suggest an increased sensitivity of the device Medmont M700 when the testing program (fast threshold versus TOP) is used (Figure 2).

Figure 3 shows the correlation dependence of the measured MS at both devices. Mutual correlation dependence was calculated using the Spearman correlation coefficient. According to the values of correlation coefficient we can distinguish weak (R<0.3), medium (0.3<R<0.8) and strong (R>0.8) dependence. In our group, we have proved a high dependence of the compared values (0.85).

Discussion

The first computer-controlled perimeter was developed and introduced in 1972 by Fankhauser [3]. That device has been commercially used by Interzeag with the label Octopus. In the Czech Republic, the Octopus 2000R was installed in the Central Military Hospital in 1983 [4].

Octopus(dB)	Octopus(asb)	Medmont(dB)	Medmont(asb)
26.4	9.163	24.88	3.251
26.4	9.163	24.56	3.499
18.7	53.959	21.18	7.621
24.7	13.554	23.52	4.446
25.3	11.805	20.72	8.472
21.7	27.043	20.72	8.472
26.7	8.552	24.56	3.499
27.1	7.799	24.59	3.475
28.3	5.916	25.09	3.097
28.1	6.195	25.25	2.985
15.6	110.169	16.4	22.909
14.5	141.925	17.2	19.055
25.3	11.805	25.27	2.972
23,9	16,295	23,45	4,519
25.7	10.66	25.22	3.006
26.3	9.377	24.18	3.819
27.7	6.93	24.72	3.373
28.5	5.65	24.75	3.35
23.8	16.675	24.59	3.475
25.8	10.521	24.4	3.631
21.5	28.318	19.43	11.402
20.7	34.046	23.7	4.266
26.6	8.751	24.22	3.784
25.6	11.017	23.68	4.285
23.8	16.675	21.93	6.412
26.9	8.167	24.43	3.606
28.9	5.153	25.45	2.851
29	5.036	25.77	2.649
22.4	23.018	22.22	5.998
24.4	14.523	22.34	5.834
25.1	12.361	24.1	3.89
24.3	14.861	23.31	4.667
22.1	24.664	21.3	7.413
24.5	14.193	24.1	3.89
25.1	12.361	24.1	3.89
24.3	14.861	23.1	4.898
24.3	14.861	23.4	4.571
25.6	11.017	24.6	3.467
24.7	13.554	23.8	4.169
22.9	20.514	21.9	6.457

Table 1: Mean sensitivity (MS) of visual field detected by the Octopus device (in dB and asb) and by the Medmont device (dB and asb). In each line, the results are always of the same eye.

The Medmont M600 perimeter, brought out in the late 1980s, was promoted as faster than the Humphrey Field Analyzer in performing a full threshold analysis of the visual field. Recent advances in HFA full threshold analysis have meant that it can be performed in the same time as Medmont [5].

Since the device Medmont has currently the largest representation in the Czech Republic, we tried to compare the results obtained by its use primarily to those of Octopus.

To assess and diagnose normal and pathological findings, we used the mean sensitivity calculated of the threshold sensitivity values. This choice has been done deliberately because of various statistical symbols, and also because of the different maximum light brightness used in both devices. Mean sensitivity can be defined as the sum of sensitivity in

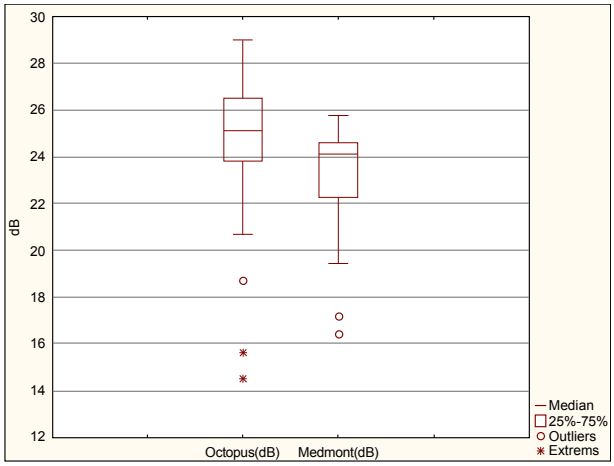

Figure 1: Comparison of mean sensitivities in visual fields (dB) at both devices. The graph shows statistically significant differences in the detected sensitivity (p = 0.000055).

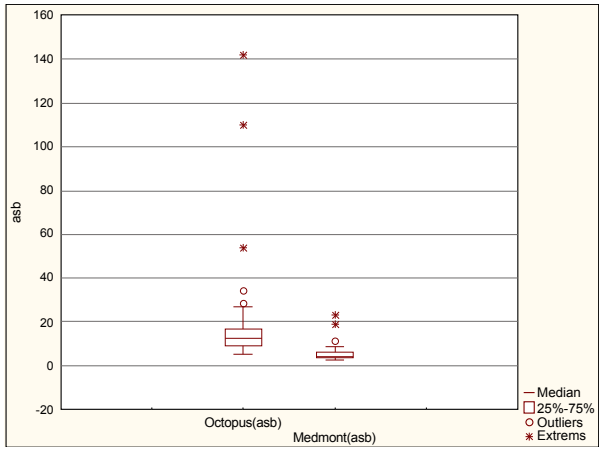

Figure 2: Comparison of MS in visual fields (asb) at both devices. The graph shows the statistically significant differences in the observed sensitivity (p = 0.00000).

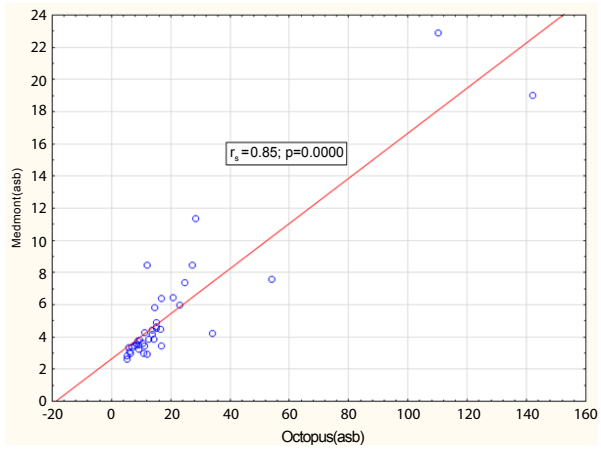

Figure 3: Comparison of MS of the visual fields (asb) at both devices. The graph shows a high correlation (r = 0.85, p = 0.0000).

measured points of the visual field divided by the number of the points. The value of mean sensitivity is given in decibels. It is known that with the duration of examination this value decreases. Therefore new programs have been developed to shorten substantially the examination time, and we have chosen such programs for our examinations, namely TOP and Fast Threshold strategies. The average time of examination was at Octopus 2.59 minutes, at Medmont 6.27 minutes. The difference is mainly due to the number of investigation points of which the Octopus had 59 and Medmont, 104. These differences, and also another type of examination (TOP) may result in different threshold sensitivities found in asb. We noticed higher threshold sensitivity in asb at the device Medmont M700. The correlation coefficient, however, shows a strong correlation dependency (r=0.85, p=0.0000) in examinations at both the devices. It is possible that the threshold sensitivity is influenced by the color of the light stimulus as well. The Octopus device uses white stimuli, Medmont pale green ones - 565nm wavelength.

Morales et al. studied the relationship between the TOP and full-threshold strategies. TOP was four times faster than the traditional full-threshold technique and was successful in detecting visual field abnormalities. Defects with TOP tended to be smaller, shallower, and with softer edges than those with the standard approach. TOP could perform an alternative to traditional perimetric techniques [6]. We found a strong correlation between TOP and fast threshold (r=0.85, and P=0.000) in our glaucoma patients. We think that for a quick orientation, this strategy is sufficient to assess pathological signs even in the stage of incipient changes. It is appropriate especially for people who cannot sustain attention for longer time.

Let´s mention here the work by King et al., who compared modern programs at the Humphrey perimeter SITA fast (HSF) and the Octopus TOP. There was a high correlation between the HSF and TOP strategies for measurements of global indices. However, the TOP strategy tended to underestimate focal visual field loss compared with SITA Fast. The TOP strategy was faster than the SITA Fast. The sensitivity and specificity of the two algorithms were similar. This study establishes the ability of these fast strategies to successfully assess visual fields in glaucoma patient with perimetric experience [7].

Allow us to enclose a table (Table 2) with basic information about the devices applied. At Octopus, the individual light stimuli are projected on the copula from a template. Medmont has the LED light sources firmly mounted in the device copula.

Conclusion

It is not correct to compare MS in dB at various devices that have

Parameter	Octopus 900	Medmont M700
Type of copula	30 cm aspherical	30 cm spherical
Max. intensity of stimulus	4 000 asb	1 000 asb
Size of stimuli	I – V	III
Time of stimulus	100 ms, 200 ms, 500 ms	200 ms
Backlighting	4 asb	10 asb
Extent of VF	90°	50°/ 80°
Method of fixation control	Video eye monitoring	Heijl-Krakau Video eye

Table 2: Basic parameters of the compared devices.

different maximum brightness value. Ophthalmologists should bear it in mind. Although Octopus indicates higher sensitivity in dB, its threshold sensitivity in asb is lower than that at Medmont.

We think, however, that both devices using TOP or Fast Threshold examination strategies are able to show both normal and pathological findings. Considering the examination time, the Octopus perimetry with the TOP strategy is suitable for the elderly or persons with reduced attention and mainly for anticipated changes in the visual field.

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