

# Pituitary adenomas: automatic static perimetry and Goldmann perimetry. A comparative study of 345 visual field charts

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## Abstract

In a series of 81 cases of pituitary adenoma 345 charts of visual field performed with static automatic perimetry (AP) on the Vision Monitor and Goldmann perimetry (GP) were compared. Generally both methods were equivalent in the detection of chiasmal compression. The charts were divided into two groups: (A) 208 charts and (B) 137 charts according to the number of isoptres investigated: two (V4, 112) or three (V4, 112, 12). In group A the AP was more often altered than the GP, and the difference was statistically significant ( $p < 0.001$ ). In group B the GP seemed more effective, but the number of questionable cases was greater and the difference was not statistically significant. When the most internal isoptre of GP was outside the central 30°, AP was more often abnormal (29%) than GP (2.2%), and the difference was statistically significant ( $\chi^2$ ,  $p < 0.001$ ). Within the central 30° the GP seemed more often to be altered (23% of cases) than the AP (19.4%), but one-third of the cases were questionable. Within the central 30° both techniques gave identical results and there was no statistically significant difference. The discrepancies between both static and kinetic techniques are an argument for their complementary use.

Goldmann perimetry (GP) remains the reference method in neuro-ophthalmic investigations despite the advance of automatic perimetry (AP). Many studies have been reported on AP in the assessment of chiasmal compression.<sup>1-9</sup> But the role of AP remained a matter of debate<sup>10</sup> because of clinical and physiopathological considerations. Goldmann perimetry was reported to be less tiring for the patients than AP<sup>5,10</sup> and easier to perform when the fixation was poor.<sup>5</sup> Comparison of different studies of automatic static perimetry is difficult because of the many types of apparatus on the market and the different techniques used, namely, liminal or supraliminal. For example, Meienberg *et al*<sup>11</sup> stated that the frequent occurrence of relative defects in chiasmal lesions was a circumstance favouring a quantitative liminal method, but Wirtshafter and Coffman<sup>3</sup> found that a supraliminal AP could 'at least equal the performance of an experienced perimetrist using manual Goldmann kinetic . . . in the detection of visual field defects resulting from chiasmal tumors.'

We studied the visual fields of 81 patients with pituitary adenomas by both techniques, Goldmann and automatic static perimetry. For the latter we used a fast-thresholding programme,

tested previously in the investigation of various neuropathies.<sup>12,13</sup>

## Patients and methods

Eighty-one patients with pituitary adenomas were examined in our Clinic of Neuro-ophthalmology from June 1987 to June 1989. All patients with surgical and immunocytochemical confirmation of the diagnosis were included. We also included non-surgically treated patients whose evidence on a CT scan and/or magnetic resonance imaging (MRI), biological perturbations highly suggestive of pituitary adenoma, and a correlation between the volume of the tumour and the degree of the hormonal hypersecretion. We excluded patients with a previous ophthalmological disease such as chronic glaucoma, cataract, and retinal disease, or who were known to have an associated disease possibly altering the visual field, such as multiple sclerosis. We also excluded nearly blind patients and patients with a serious intellectual deterioration. GP and AP were performed as part of a comprehensive battery of ophthalmological investigations described elsewhere.<sup>12,13</sup>

The investigation of the visual field combined a GP study with two (V4, 112) or three (V4, 112, 12) isoptres with a static AP study. The last was carried out on the Vision Monitor. The fast-thresholding programme coupled a 4-2-2-2 foveolar threshold determination<sup>8</sup> to a relative suprathreshold (4dB) strategy for the 94 other points scattered within the central 30°. Its sensitivity and clinical acceptability seemed to us to be a good compromise. This programme allowed a clear mapping of the blind spot. The patients had one or more visual fields. Each chart corresponded to the visual field of one eye.

The analysis of the charts was undertaken by three of us, two ophthalmologists (MG, SB) and one neurologist (AV), who classified them separately. The analysis of the charts was performed technique by technique. The results of the biological and radiological studies were concealed, but the observers knew that the patients had pituitary adenoma. The analysis was qualitative and topographic.<sup>14</sup> The evaluation of scotomas had been previously carried out.<sup>12</sup> We considered as 'questionable' the cases in which the defect of the visual field was isolated and in contradiction to the results of other ophthalmic tests and to the surgical and the radiological assessments.

A comparison was undertaken between 345 charts with AP and 345 with GP performed on the same day in the same patient. Two groups were specified according to the number of

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isoptres used for the Goldmann perimetry and compared with the corresponding AP. Group A included 208 charts with two isoptres (V4, 112), group B 137 charts with three isoptres (V4, 112, 12). Group B was smaller either because the smallest isoptre, 12, was not looked for during the examination or because it was impossible to detect it (25% of the patients).

Finally a topographic and comparative study was made between 345 charts of AP with 345 charts of GP in accordance with the most internal isoptres in GP regardless of their number. Two groups were specified according to the position of the most internal isoptre of GP – outside the central 30° (n=93) and inside the central 30° (n=252).

## Results

### Comparison between the charts of the visual fields with AP and GP, n=345 (Table 1)

We recorded the charts as one of the two alternatives 'normal' or 'abnormal'. With this study of the paired alternatives in 79.7% of the eyes the visual fields were evaluated by both methods in the same way as 'normal' (31.9%) or 'abnormal' (47.8%). AP was found to be altered alone (37 eyes) slightly more often than the GP (33 eyes), but the difference was not statistically significant ( $\chi^2=0.228$ ).

### Comparison of AP and GP according to the number of the isoptres of GP (Table 2)

Group A, GP with 2 isoptres compared with AP (n=208). – AP and GP were equivalent in 63.5% (132 eyes). In 30.3% of cases (63 eyes) the charts made with AP displayed more defects than those with GP. The difference was statistically highly significant ( $\chi^2$  test,  $p<0.001$ ). In a few cases (13 eyes, 6.2%) there were more abnormalities on the GP than on the AP.

Group B; GP with three isoptres compared with AP (n=137). – In 77 eyes (56.2%) the visual fields were identical by both methods. The Goldmann perimetry was more altered than the AP in 34.3% (47 eyes) but the number of questionable cases increased and the difference was not statistically significant. In a few cases (13

Table 1 Comparison between the charts of the visual fields with automated perimetry (AP) and Goldmann perimetry (GP): n=345. Study of the paired alternatives

Visual field charts	n=345
<i>Identical AP and GP</i>	
Normal	110 31.9%
Abnormal	165 47.8%
<i>Abnormal AP and normal GP</i>	
	37 10.7%
<i>Quadrantal anomalies: simple defect or extense scotoma:</i>	
Supertemporal quadrant	12
Inferotemporal quadrant	3
Nasal quadrant	5
Extensive, nasal and temporal	2
General depression	7
Isolated relative central scotomas	6
Multiple relative central scotomas without	
Systematisation	2
<i>Abnormal GP and normal AP</i>	
	33 9.5%
Notch on supertemporal quadrant	32
General depression	1

Table 2 Comparisons of automatic perimetry (AP) and Goldmann perimetry (GP) according to the number of the isoptres of GP

	Group A V4, 112	Group B V4, 112, 12
<i>Visual field charts</i>		
Identical	n=208 132	n=137 77
AP and GP	63.5%	56.2%
<i>Isolated or predominant alteration of AP:</i>		
Increase of defect area	30.3%	9.5%
Temporal notch	39	2
Quadrantal defect	18 (6*)	8 (3*)
<i>Isolated or predominant alteration of GP:</i>		
Increase of defect area	6	3
Temporal notch	13	47
Quadrantal defect	6	3
<i>Isolated or predominant alteration of GP:</i>		
Increase of defect area	6.2%	34.3%
Temporal notch	6	22
Quadrantal defect	7 (3*)	15 (8*)
	–	10 (8*)

\*Questionable cases.

eyes, 9.5%) the defects were larger with AP than with GP.

### Topographic study according to the position of the most internal isoptres of GP (Table 3)

AP and GP were identical in 68.8% and 60.3% of eyes according to the position of the most internal isoptre of GP, respectively outside and inside the central 30°. When the most internal isoptre of GP was outside the central 30°, AP was more often abnormal (29%) than GP (2.2%), and the difference was statistically significant ( $\chi^2$  test,  $p<0.001$ ). Within the central 30° the GP was apparently altered more often (23% of cases) against 19.4% for AP, but one-third of the cases were 'questionable'. Within the central 30° both techniques were identical, and there was no significant difference statistically.

## Discussion

In our study in nearly 80% of the eyes the visual fields were evaluated in the same way by both methods as normal or abnormal (Table 1). When only two isoptres were investigated, AP seemed to be superior to GP in disclosing more important defects than Goldmann perimetry or even a defect neglected by it. The results were reversed when three isoptres were used. But the use of this third index I2 was not always feasible even in a normal subject, and the evident rise in results of GP was linked with a rise of 'questionable' results (16/47). When the most internal of the Goldmann isoptres was outside the 30°, AP was more effective (Table 3). In contrast, when it was

Table 3 Topographic study according to the position of the most internal isoptre of Goldmann perimetry

Visual field charts	Out. 30° n=93	Ins. 30° n=252
<i>Visual field charts</i>		
Identical	64	145
AP and GP	68.8%	60.3%
<i>Isolated or predominant alteration of AP:</i>		
Increase of defect area	27	49
Temporal notch	29%	19.4%
Quadrantal defect	9	32
Quadrantal defect	12	14
Quadrantal defect	6	3
<i>Isolated or predominant alteration of GP:</i>		
Increase of defect area	2	58
Temporal notch	2.2%	23%
Quadrantal defect	–	(1/3*)
Quadrantal defect	–	28
Quadrantal defect	2	20
Quadrantal defect	–	10

\*Questionable case.

Outer 30°=outside the central 30°; ins. 30°=inside the central 30°.

inside the 30° the results of GP were better than AP but the number of 'questionable' cases increased (1/3), and both methods seemed to be equivalent.

The problem of the qualitative analysis of these visual field data was whether to consider as pathological or not a slight defect in the supero-temporal quadrant. This was especially evident for Goldmann perimetry with an important number of questionable cases. Knowing that the patient was suspected of having a pituitary adenoma impressed the perimetrist as much in his carrying out Goldmann perimetry as it did the ophthalmologist in his analysis of the visual field. The standardisation of the visual fields recorded with AP suppressed the perimetrist's bias but evidently not the observer's knowledge. In general we found better interobserver agreement with AP than with GP (data in preparation), though the interpretation of small defects at the limit of eccentricity (temporal notch) remained problematic.

Good concordance has been reported<sup>1,2,3,5,6</sup> in the interpretation of both AP and GP (between 66 and 83% of cases). The correlation between automatic perimetry and Goldmann perimetry was good either with a liminal<sup>1,2,5,6</sup> or with a supraliminal<sup>3</sup> technique, whatever the device used – Dicon,<sup>3</sup> Humphrey,<sup>5</sup> or Octopus.<sup>1,2,6</sup> But a quantitative comparison was frequently impossible.<sup>3</sup> The results changed with the number of isoptres used, with the Goldmann perimeter and the clinical conditions of the examination.

An important feature of our results may be the thorough investigation of the internal 30°. It was emphasised by Frisen,<sup>15</sup> who found 'a bitemporal foreshortening of central isoptres, not extending beyond 15 degrees of eccentricity as an early sign of mid chiasmal compression.' He also thought that these defects seemed to be more difficult to detect in static profiles. In a comparative study of static and kinetic perimetry on the same device Charlier *et al*<sup>8</sup> stressed that kinetic perimetry appeared to be more sensitive in the detection of small scotomas located over 15° of eccentricity. But the interest of a static central investigation of the visual field was demonstrated in the lesions compressing the anterior visual pathway,<sup>16</sup> and the association of both methods is mandatory for investigating the statokinetic dissociation.<sup>17</sup> The

discrepancies between both static and kinetic techniques were an argument for their complementary use.

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