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CLINICAL STUDY

Comparison between fixed-angle and customised corneal-polarisation compensation methods in scanning laser polarimetric measurement of the retinal nerve fibre layer in glaucoma

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Abstract

Purpose **To investigate the differences between the results of scanning laser polarimetric (SLP) measurements of the retinal nerve fibre layer thickness (RNFLT) made using two different corneal-polarisation techniques; customised (SLP-C), and fixed-angle (SLP-F) compensations.**

Methods **Both SLP-C and SLP-F were performed on 37 consecutive phakic patients with chronic open-angle glaucoma, and on 14 healthy control subjects. One randomly selected eye per subject was evaluated.**

Results **Both SLP-C and SLP-F parameters were able to discriminate between the glaucoma group and the control group, except in the case of the ellipse modulation, which differed significantly between the two groups with SLP-C ($P = 0.017$), but not with SLP-F ($P = 0.056$). When SLP-C and SLP-F values were compared, inferior maximum thickness and ellipse standard deviation were significantly lower with SLP-C in both groups ($P < 0.05$ for each parameter). Superior maximum thickness was significantly lower in glaucoma with SLP-C than with SLP-F ($P = 0.006$) and tended to be lower with SLP-C than with SLP-F in the control group ($P = 0.053$). In the glaucoma group, it was only with SLP-C that a significant (positive) correlation between the superior maximum thickness and the inferior hemifield mean sensitivity (MS) ($r = 0.653$, $P < 0.001$), and between the inferior maximum thickness and the superior hemifield MS ($r = 0.420$, $P = 0.023$) was found. The other global and sectoral SLP parameters showed significant correlation with the corresponding visual field parameters with both techniques.**

Conclusion **Our findings suggest that SLP measurements with customised compensation provide more realistic results for RNFLT than those made with the conventional fixed-angle compensation.**

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Introduction

Scanning laser polarimetry (SLP) of the retinal nerve fibre layer has become widely used for glaucoma diagnosis; it can be rapidly performed, and is a noninvasive technique. [1–5] The technique is based on the optical retardation of the illuminating laser beam, which is produced by the parallel retinal nerve fibres around the optic nerve head.[6] The optical retardation caused by the retinal ganglion cell axons has been shown to have a linear relationship with the anatomical thickness of the retinal nerve fibre layer (RNFLT), and is therefore suitable for the detection of retinal

nerve fibre loss.[6] A decrease of the RNFLT corresponds to a loss of the retinal ganglion cells, which is the most important pathological alteration in glaucoma. The measured retardation in SLP, and thus the software-calculated RNFLT values, are, however, influenced by the retardation caused by other ocular tissues, especially that from the parallel collagen fibres of the central cornea.[7–14] This anterior-segment retardation therefore requires neutralisation in order to increase the measurement accuracy of SLP.[7–14]

The conventional built-in corneal polarisation compensator of the nerve fibre analyser instruments[9–10] has a polarisation magnitude of 60 nm, and its slow axis is set to 15° nasally downwards (fixed-angle compensation, SLP-F). Many corneas have a polarisation axis aligned in approximately this direction;[10] it has, however, been shown that the distribution of the direction of the slow axis of corneal polarisation is widely variable between individuals.[9,10] This means that with a fixed-angle compensator, the corneal polarisation effect cannot be completely neutralised in all eyes.[9–11,13]

In order to improve the compensation of corneal polarisation in SLP, a new customised corneal compensation technique (SLP-C) has recently been introduced. In SLP-C, a polarimetric image of the macula is acquired as the first step of the measurement.[9] Since the fovea has no retinal ganglion cell axons, the resulting polarimetric image of the macular area represents the polarimetric effects only of the cornea, the lens, and the Henle fibre layer. The second step is the imaging of the actual peripapillary retinal nerve fibre layer. The peripapillary polarimetric image is automatically corrected for the data derived from the macular image, and analysed automatically by the software. The customised compensation has been shown to be able to neutralise the retardation changes in the superior and inferior quadrant around the optic nerve head caused by laser *in situ* keratomileusis,[15] and improve the ability of SLP to discriminate between glaucomatous and healthy eyes.[16] These findings suggest that the advantage of SLP-C is not just a theoretical one. Little information is available on the usefulness of the recently introduced SLP-C technique in the diagnosis of glaucoma as compared to the original SLP-F method, and therefore in a cross-sectional study on glaucomatous and healthy eyes we have investigated the differences between the results of SLP-C and SLP-F measurements, and the correlations between the measured thickness values and the corresponding visual field parameters.

Patients and methods

The clinical investigation protocol was approved by the Ethics Committee of the Semmelweis University. A total of 37 consecutive phakic Caucasian patients (age: 20–85 years, mean age 63.1 years) suffering from chronic open-angle glaucoma (primary open-angle, normal tension, or exfoliative glaucoma) were enrolled in the study, together with 14 healthy Caucasian subjects without any ocular abnormality and normal visual function (age: 22–61 years, mean age 30.6 years). The glaucoma patients had reproducible visual field defects typical for glaucoma (MD and CPSD higher than 2 dB with inferior and/or superior paracentral or arcuate scotomas, nasal step, hemifield defect, or generalised depression), glaucomatous and optic nerve head damage, and open chamber angle on both eyes. Each participant had sufficient central vision for optimal fixation in both eyes. SLP of the retinal nerve fibre layer (without pupil dilation) was performed by the same experienced investigator (AK) using the GDx Nerve Fibre Analyser Access instrument with software version 5.0 (Laser Diagnostic Technologies, Inc., San Diego, CA, USA). This instrument was developed for glaucoma screening. It contains a conventional fixed-angle (slow axis 15° nasally downwards) corneal polarisation compensation unit for classic type measurements (SLP-F), but the software also permits customised corneal compensation for image acquisition in the 'customised mode' (SLP-C). Both types of measurement can be performed during the same measurement session, immediately after one another. The noninvasive polarimetric measurement technique with fixed corneal polarisation compensation has been described in detail elsewhere.[1–5] In brief, a beam of 780 nm polarised laser light is projected onto the retina by the instrument. The birefringent, parallel nerve fibres cause retardation in the polarised light passing through them, and this retardation of the light reflected from the retina is measured automatically by the detector unit of the instrument. The degree of the retardation corresponds to the thickness of the RNFL, and is analysed by the built-in polarisation detection unit. RNFLT is automatically calculated for each pixel, and is then imaged for the retinal area in a colour-coded manner. To stabilise fixation an internal fixation stimulus is used. The image of the optic nerve head is positioned in the centre of the display. Image acquisition requires only 0.7 s. In the 'customised mode', as a first step a polarimetric image is acquired from the macula area with the image of the fovea positioned in the centre of the screen. Data derived from this image of the macular area are then automatically used for correction of the peripapillary polarimetric image of the same eye, which is obtained as the second step of image acquisition. (In the GDx Access instrument used by us the macular images are not stored, and cannot be printed, and therefore cannot be used for further detailed analysis.) The resulting 'corrected' image of the peripapillary

retinal nerve fibre layer is then analysed automatically by the instrument software in a manner similar to the analysis used for images obtained with the conventional fixed-angle corneal compensator.

In our investigation, polarimetric measurements with both the conventional (fixed-angle compensation) image acquisition technique and the customised corneal compensation technique were performed for each eye. Actual ametropia was corrected before each image acquisition, using the instrument software. The optic nerve head contour line was placed exactly on the edge of the disc. The line of the four-pixels-wide measuring ellipse was set at 1.75 disc diameters from the centre of the optic nerve head. Default quadrant positions were used. The definition of each polarimetric parameter analysed by us is shown in Table 1. Both eyes were imaged, but only one randomly selected eye per participant was included in the evaluation.

For automated threshold perimetry, the Octopus G2 normal strategy test of the Octopus 101 perimeter instrument (Interzeag AG, Schlieren, Switzerland) was used, this test being performed in each case within 7 days of the time of the SLP measurement. The patients were trained in Octopus automated perimetry. Reliable tests (rates of false-positive and false-negative responses lower than 20%) were obtained on 29 of the 37 randomly selected glaucomatous eyes, and on all but one of the 14 control eyes for the examination performed at the time of the RNFLT measurement. Visual field parameters (in dB) used to study the correlation with the SLP parameters were: mean sensitivity (MS), mean deviation (MD) and corrected pattern standard deviation (CPSD) as indices characterising the whole 30° central visual field, and mean sensitivity in the superior and the inferior hemifield (MS-S, MS-I, respectively) to characterise the differential light sensitivity in the corresponding hemifield. MS-S and MS-I were calculated from the sensitivity values of the corresponding superior or inferior hemifield, excluding the value measured for the fixation point representing the fovea. The mean deviation in Octopus perimetry is positive in case of sensitivity loss, and negative when sensitivity is better than the average age-corrected normal value.

The Statistica 5.5 programme package was used for all kinds of statistical analyses. The paired *t*-test was used for the comparison between the corresponding SLP-C and SLP-F values obtained from the same eye, and the unpaired *t*-test was used for the comparison between the corresponding parameters measured on glaucomatous and control eyes. The Wilcoxon matched pairs test was used to compare The Number obtained with SLP-C and SLP-F from the same eye, and the Mann–Whitney U-test was used for the comparison of The Number between the two groups of participants. Pearson's correlation test was used to investigate correlation between the SLP-C and SLP-F parameters, and the corresponding visual field indices. Global SLP parameters were correlated with the global visual field parameters, and SLP parameters characterising the RNFLT in the superior or in the inferior sector were correlated with the mean sensitivity of the opposite hemifield (MS-S or MS-I). The correlation coefficients were calculated for the whole study group as

Table 1 Definitions of the parameters analysed in the study

Polarimetric parameter	*Definition*
Superior maximum thickness	Average thickness (μm) for the 210 thickest pixels in the superior quadrant
Inferior maximum thickness	Average thickness (μm) for the 210 thickest pixels in the inferior quadrant
Normalised superior area	The area under the superior hump of the RNFLT calculated after the subtraction of the average of the temporal and nasal minimum values from the RNFLT values along the measuring ellipse
Normalised inferior area	The area under the inferior hump of the RNFLT calculated after the subtraction of the average of the temporal and nasal minimum values from the RNFLT values along the measuring ellipse
Superior thickness ratio	The thickness ratio of the average of the 200 thickest pixels in the superior quadrant to the average for the 200 median pixels in the temporal quadrant
Inferior thickness ratio	The thickness ratio of the average of the 200 thickest pixels in the inferior quadrant to the average for the 200 median pixels in the temporal quadrant
Superior/Nasal ratio	The thickness ratio of the average of the 200 thickest pixels in the superior quadrant to the average for the 200 median pixels in the nasal quadrant
Maximal modulation	The difference (μm) between the thickest and the thinnest part of the retinal nerve fibre layer
Ellipse modulation	The difference (μm) between the thickest and the thinnest part of the retinal nerve fibre layer along the measuring ellipse
Ellipse standard deviation	The standard deviation (μm) of the RNFLT values along the measuring ellipse
Ellipse average thickness[a]	Average thickness (μm) for the pixels along the total measuring ellipse
The Number	An indicator of the probability that the eye suffers from glaucoma

[a]Available only for SLP-C ('customised mode').

well as for the glaucomatous eyes and the healthy control eyes, respectively. P-values of less than 0.05 were considered statistically significant.

Results

In the SLP-C mode the macular retardation images were of regular bow-tie pattern in each case. The RNFLT values of the glaucoma group and the control group as measured with SLP-C and SLP-F are shown in Table 2. Both for SLP-C and SLP-F all the parameters differed significantly between the glaucoma group and the control group, except in the case of the ellipse modulation, which differed significantly between the groups with SLP-C ($P=0.017$), but not with SLP-F ($P=0.056$). When SLP-C and SLP-F values were compared, inferior maximum thickness and ellipse standard deviation were significantly lower with SLP-C both in the glaucoma group and in the control group. Superior maximum thickness was significantly lower in glaucoma with SLP-C than with SLP-F ($P=0.006$), and a tendency for being lower with SLP-C than with SLP-F was seen in the control group ($P=0.053$). The Number was significantly higher in both groups with SLP-C than with SLP-F ($P=0.004$ in glaucoma and 0.026 in the healthy control group). The other parameters did not differ in a statistically significant manner when comparing the methods, in either group.

The visual field parameters for the two groups are shown in Table 3. Correlations between the global and sectoral SLP parameters and the corresponding visual field parameters are shown in Tables 4 and 5. For glaucomatous eyes, a significant positive correlation was seen between the superior maximum thickness and MS-I ($r=0.653$, $P<0.001$), and between the inferior maximum thickness and MS-S ($r=0.420$, $P=0.023$) with SLP-C, but not with SLP-F. For the whole study population and for the glaucomatous eyes, significant correlations were found with both compensation techniques between the SLP parameters developed to increase the diagnostic

Table 2 Comparison of the corresponding SLP values between the glaucoma group and control group, and between the SLP-C and SLP-F modes

SLP parameter	*SLP-C*		*SLP-F*		P *value*[a]	P *value*[b]
Control (n=14) *Glaucoma (n=37)*	*Mean±SD*	*95% CI*	*Mean±SD*	*95% CI*	*SLP-C vs SLP-F*	*Control vs glaucoma*
Superior maximum thickness *control*	83.0±9.9	77.2–88.9	92.8±18.2	82.3–103.3	$P=0.053$[a]	$P_c=0.002$[b]
Superior maximum thickness *glaucoma*	65.1±19.7	58.5–71.6	74.1±19.6	67.6–80.7	$P=0.006$[a]	$P_f=0.003$[b]
Inferior maximum thickness *control*	81.5±12.9	74.2–88.7	95.5±18.7	84.7–106.3	$P=0.014$[a]	$P_c=0.004$[b]
Inferior maximum thickness *glaucoma*	65.3±18.6	59.1–71.5	76.1±21.4	68.9–83.2	$P=0.002$[a]	$P_f=0.004$[b]
Normalised superior area *control*	0.144±0.027	0.128–0.159	0.129±0.022	0.116–0.142	$P=0.050$[a]	$P_c=0.001$[b]
Normalised superior area *glaucoma*	0.100±0.046	0.084–0.115	0.094±0.038	0.081–0.106	$P=0.215$[a]	$P_f=0.002$[b]
Normalised inferior area *control*	0.142±0.041	0.119–0.166	0.141±0.023	0.128–0.154	$P=0.896$[a]	$P_c=0.002$[b]
Normalised inferior area *glaucoma*	0.099±0.043	0.084–0.113	0.105±0.040	0.091–0.118	$P=0.287$[a]	$P_f=0.002$[b]
Superior thickness ratio *control*	3.14±1.04	2.54–3.75	3.06±1.14	2.40–3.72	$P=0.843$[a]	$P_c=0.002$[b]
Superior thickness ratio *glaucoma*	2.13±0.97	1.81–2.45	2.15±0.69	1.92–2.38	$P=0.882$[a]	$P_f=0.001$[b]
Inferior thickness ratio *control*	3.06±0.98	2.49–3.62	3.18±1.32	2.42–3.94	$P=0.776$[a]	$P_c=0.001$[b]
Inferior thickness ratio g*laucoma*	2.12±0.86	1.83–2.40	2.17±0.64	1.96–2.38	$P=0.626$[a]	$P_f<0.001$[b]
Superior/Nasal ratio *control*	2.67±0.90	2.15–3.18	2.61±0.68	2.22–3.00	$P=0.765$[a]	$P_c=0.029$[b]
Superior/Nasal ratio *glaucoma*	2.11±0.74	1.87–2.36	1.96±0.60	1.77–2.16	$P=0.180$[a]	$P_f=0.002$[b]
Maximal modulation *control*	2.48±1.04	1.88–3.07	2.27±1.28	1.53–3.01	$P=0.623$[a]	$P_c=0.003$[b]
Maximal modulation *glaucoma*	1.52±0.95	1.20–1.84	1.38±0.67	1.16–1.61	$P=0.239$[a]	$P_f=0.002$[b]
Ellipse modulation *control*	3.80±1.82	2.75–4.85	3.35±1.33	2.58–4.12	$P=0.467$[a]	$P_c=0.017$[b]
Ellipse modulation *glaucoma*	2.59±1.45	2.11–3.08	2.56±1.26	2.14–2.98	$P=0.871$[a]	$P_f=0.056$[b]
Ellipse standard deviation *control*	23.3±4.9	20.5–26.2	27.0±3.2	25.2–28.9	$P=0.002$[a]	$P_c=0.001$[b]
Ellipse standard deviation *glaucoma*	15.9±7.1	13.5–18.3	19.2±6.9	16.9–21.5	$P<0.001$[a]	$P_f<0.001$[b]
Ellipse average thickness *control*[e]	57.2±7.4	52.9–61.5				$P_c=0.002$[b]
Ellipse average thickness *glaucoma*[e]	46.5±11.2	42.8−50.3				
The Number *control*	14.3±7.9	9.7–18.9	9.8±3.6	7.7–11.9	$P=0.026$[c]	$P_c<0.001$[d]
The Number *glaucoma*	51.7±30.2	41.6–61.8	40.1±30.1	30.1–50.2	$P=0.004$[c]	$P_f<0.001$[d]

[a]Paired *t*-test.
[b]unpaired *t*-test.
[c]Wilcoxon matched pairs test
[d]Mann-Whitney U-test.
[e]Available only in the SLP-C mode.
P_c, *P* value for comparisons between glaucoma and control in the SLP-C mode.
P_f, *P* value for comparisons between glaucoma and control in the SLP-F mode.

Table 3 Global and sectoral visual field parameters for the two groups of subjects.

Visual field indices	*Glaucoma group* (n = *29*)		*Control group* (n = *13*)		*P*[a]
	Mean ± *SD*	*95% CI*	*Mean* ± *SD*	*95% CI*	
MS	22.2 ± 6.0	19.9–24.4	29.3 ± 1.1	28.6–29.9	$P<0.001$[a]
MD	4.99 ± 5.89	2.75–7.23	0.00 ± 0.73	−0.44–0.44	$P=0.004$[a]
CPSD	3.61 ± 2.84	2.53–4.69	1.11 ± 0.35	0.90–1.32	$P=0.003$[a]
MS-S	21.0 ± 6.0	18.7–23.3	28.7 ± 1.3	27.9–29.4	$P<0.001$[a]
MS-I	23.1 ± 6.7	20.6–25.7	29.7 ± 1.0	29.1–30.3	$P=0.001$[a]

[a]*P*: Unpaired *t*-test.

Table 4 Correlation between the global SLP and the global visual field parameters in the total study population (glaucomatous plus normal eyes), and in the glaucoma group alone

SLP parameter	*Glaucomatous and healthy eyes* (n = *42*)						*Glaucomatous eyes* (n = *29*)					
	MS		*MD*		*CPSD*		*MS*		*MD*		*CPSD*	
	r	*P*	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*
The Number *SLP-C*	−0.7541	<0.001	0.7220	<0.001	0.8039	<0.001	−0.6582	<0.001	0.6554	<0.001	0.7569	<0.001
The Number *SLP-F*	−0.5801	<0.001	0.5572	<0.001	0.6175	<0.001	−0.4451	0.016	0.4505	0.014	0.5213	0.004
Maximal modulation *SLP-C*	0.6063	<0.001	−0.5705	<0.001	−0.5832	<0.001	0.6052	0.001	−0.5851	0.001	−0.5924	0.001
Maximal modulation *SLP-F*	0.5491	<0.001	−0.4865	0.001	−0.5353	<0.001	0.6717	<0.001	−0.6275	<0.001	−0.7347	<0.001
Ellipse modulation *SLP-C*	0.4986	0.001	−0.4591	0.002	−0.5208	<0.001	0.5316	0.003	−0.4977	0.006	−0.5712	0.001
Ellipse modulation *SLP-F*	0.6139	<0.001	−0.6018	<0.001	−0.5754	<0.001	0.7516	<0.001	−0.7336	<0.001	−0.7082	<0.001
Ellipse standard deviation *SLP-C*	0.6987	<0.001	−0.6629	<0.001	−0.7563	<0.001	0.6573	<0.001	−0.6348	<0.001	−0.7460	<0.001
Ellipse standard deviation *SLP-F*	0.6950	<0.001	−0.6732	<0.001	−0.7448	<0.001	0.6266	<0.001	−0.6234	<0.001	−0.6981	<0.001
Ellipse average thickness[a]	0.6343	<0.001	−0.6237	<0.001	−0.6734	<0.001	0.5647	0.001	−0.5832	0.001	−0.6525	<0.001

[a]Available only for SLP-C mode.

Table 5 Correlation between the superior and the inferior sector SLP parameters, and the mean sensitivity in the corresponding (opposite) visual hemifield in the total study population (glaucomatous plus normal eyes), and in the glaucoma group alone

SLP parameter	*Glaucomatous and healthy eyes* (n = *42*)				*Glaucomatous eyes* (n = *29*)			
	MS-S		*MS-I*		*MS-S*		*MS-I*	
	r	*P*	*r*	*P*	*r*	*P*	*r*	*P*
Superior maximum thickness *SLP-C*			0.692	<0.001			0.653	<0.001
Superior maximum thickness *SLP-F*			0.411	0.007			0.352	0.061
Normalised superior area *SLP-C*			0.670	<0.001			0.643	<0.001
Normalised superior area *SLP-F*			0.629	<0.001			0.620	<0.001
Superior thickness ratio *SLP-C*			0.531	<0.001			0.507	0.005
Superior thickness ratio *SLP-F*			0.491	0.001			0.493	0.007
Superior/Nasal ratio *SLP-C*			0.559	<0.001			0.600	0.001
Superior/Nasal ratio *SLP-F*			0.567	<0.001			0.566	0.001
Inferior maximum thickness *SLP-C*	0.557	<0.001			0.420	0.023		
Inferior maximum thickness *SLP-F*	0.316	0.042			0.150	0.436		
Normalised inferior area *SLP-C*	0.645	<0.001			0.528	0.003		
Normalised inferior area *SLP-F*	0.570	<0.001			0.490	0.007		
Inferior thickness ratio *SLP-C*	0.540	<0.001			0.493	0.007		
Inferior thickness ratio *SLP-F*	0.489	0.001			0.500	0.006		

sensitivity of polarimetry and the corresponding visual field indices. No correlation was found for any parameter of either SLP mode in the control group ($p>0.05$ in all cases; detailed data not shown).

Discussion

In the present cross-sectional study, the potential benefit of customised corneal polarisation compensation

for polarimetric RNFLT measurements was investigated for eyes suffering from open-angle glaucoma and for healthy control eyes. The background of our investigation is the problem caused by the influence of the central cornea on the polarimetric RNFLT measurement.[7–15] The cornea has a significant optical polarising property due to its parallel collagen fibres. This cannot be completely neutralised with the conventional fixed-angle compensator, since the position of the slow axis of corneal retardation varies considerably between different eyes.[9,10] The polarisation from the cornea shows a symmetric double-hump distribution.[9,13] Uncompensated corneal polarisation is unavoidably added to the retardation caused by the retina. This in many cases leads to higher polarimetric RNFLT results, compared to the true values,[9,11–13] which may mask small defects and therefore may reduce the ability of SLP to detect minor changes of the retinal nerve fibre layer during follow-up.

With customised corneal polarisation compensation, the peripapillary polarimetric image is automatically corrected using data from the macular retardation image acquired as the first step of the measurement procedure. Since the fovea is free from retinal nerve fibres, this macular image represents the polarimetric effects only of the central cornea, the lens, and the retinal Henle layer.[9,11–13] In a previous study,[15] we have shown that, in contrast to SLP-F, SLP-C can effectively neutralise the retardation changes of the cornea caused by laser assisted *in situ* keratomileusis. This suggests that customised corneal compensation has a clinically meaningful benefit compared to the conventional fixed-angle compensation. Direct RNFLT values as measured on the same eyes with SLP-C were found to be lower than those measured with SLP-F,[9] which was confirmed in our present study. This suggests that using customised corneal polarisation compensation, corneal retardation is effectively neutralised. Recently, the area under the receiver operating characteristic curve was reported to be increased for polarimetry with variable corneal compensator compared with fixed-angle compensation.[16]

In the present study, we found that superior maximum and inferior maximum RNFLT were lower with SLP-C than with SLP-F, both in glaucoma and for healthy eyes (Table 2). Ellipse standard deviation, which represents the standard deviation of the RNFLT values along the measuring ellipse, was also lower with SLP-C than with SLP-F. These results seem to confirm that the corneal effect, which with SLP-F is superimposed on the true RNFLT, was effectively neutralised using the customised compensation. In addition to this, we found that The Number was significantly higher with SLP-C than with SLP-F both in the glaucoma group and in the control group. This suggests that in the SLP-C mode, the software may be more effective for early diagnosis than in the SLP-F mode, since it uses RNFLT data, which are more valid.

Correlating the RNFLT values with the corresponding visual field parameters in the glaucoma group, we found that the direct thickness values (superior and inferior maximum thickness) showed a significant positive correlation with the mean sensitivity of the opposite visual hemifield when measured with the customised compensation method, but showed no correlation in the SLP-F mode. This difference between the two compensation techniques was also found when SLP values were correlated with the corresponding retinal sensitivity values in early or suspected glaucoma using the Swedish Interactive Threshold Algorithm.[17] This means that the hypothesised relation between the quantity of axons (ganglion cells) and the corresponding function (light sensitivity) was demonstrable only with SLP-C. The probable reason for the absence of this correlation in the case of SLP-F is the addition of the uncompensated corneal retardation to the true RNFLT values. However, SLP parameters developed to increase the diagnostic sensitivity of polarimetry did show significant and clinically meaningful correlation with the corresponding visual field indices with both compensation techniques (Tables 4 and 5). The lack of correlation between the corresponding SLP and retinal sensitivity values in the control group might be the consequence of the small sample size and small sensitivity range in this group. Further investigations on bigger normal samples are necessary to clarify whether SLP-C is more suitable to detect structure—function correlation on healthy subjects than SLP-F.

In the present study, the RNFLT values for the glaucoma eyes were also compared with those for the control eyes. Similar statistically significant differences were found between the two groups for both types of corneal polarisation compensation. However, our control subjects were considerably younger than the glaucoma patients. Therefore, although we found that the two compensation techniques achieved similar discrimination, this cannot by itself be taken as a demonstration of the clinical usefulness of either technique.

In summary, our results suggest that RNFLT parameters as measured with SLP-C are a closer reflection of the number of retinal ganglion cells than those measured with the conventional fixed-angle compensation method. Thus, the customised compensation technique may increase the diagnostic power of SLP. Further studies are necessary to clarify whether the use of SLP-C enhances the

detection of small changes in the RNFLT during patient follow-up.

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