ORIGINAL ARTICLE

COMPARISON OF SITA STANDARD 24-2 WITH SITA FASTER 24-2C PROGRAM ON HUMPHREY FIELD ANALYZER IN ASSESSING VISUAL FIELD DEFECTS OF GLAUCOMA PATIENTS

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ABSTRACT

Introduction: *Periodical perimetry examination to detect and determine the rate of glaucoma progression continues to be a challenging task, because it depends on many factors. Besides, there is now a paradigm shift which central visual field defects occur earlier. SITA Standard (SS) 24-2 is the clinical standard for glaucoma examination, but there were studies reporting on the prevalence of central visual field defects not detected. SITA Faster (SFR) 24-2C was developed to address current shortcomings, but the performance has yet to be formally and independently assessed.*

Objective: *To compare the global indices (Mean Deviation, Pattern Standard Deviation, Visual Field Index) and test duration between SS 24-2 and SFR 24-2C program.*

Methods: *This is an analytical observational study with a cross-sectional design. Subjects aged >18 years who diagnosed with glaucoma and whose visual fields unaffected by other condition besides glaucoma were included. All subjects underwent testing of both programs.*

Results: *This study was conducted in 94 eyes of 66 patients. Comparison of global indices and test duration between the two programs was carried out by the Wilcoxon test. The mean results of MD and PSD global indices were not significantly different, however there was a difference in the mean VFI of 1.5% between the two programs. The test duration of SFR 24-2C was 55.03% faster.*

Conclusion: *There was no significant difference in the MD and PSD global indices, but there was a significant difference in the VFI, as well as the test duration between the two programs.*

Keywords: *glaucoma, visual field, Humphrey, SITA strategy.*

INTRODUCTION

In Glaucoma is the leading cause of irreversible blindness but ranked second to cataract in the global causes of blindness. Glaucoma affects 80 million people in 2020, with 11.2 million people experiencing bilateral blindness, and it is estimated to increase to 111.8 million by 2040. The International Agency for the Prevention of Blindness (IAPB) shows the majority of glaucoma cases were found in Asia.[1-4]

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Glaucoma is a group of chronic progressive optic neuropathy that can cause permanent visual impairment. Therefore, early detection is very important to provide immediate management and slow down the progression.[5,6]

Evaluation of glaucoma patients consists of determining intraocular pressure (IOP), structural properties (optic nerve head appearance, retinal nerve fiber layer thickness, and ganglion cells complex) using Optical Coherence Tomography (OCT), and functional characteristics (visual field sensitivity) using a Humphrey Field Analyzer (HFA). Although structural damage can precede functional loss, randomized clinical trials and prospective cohort studies have shown that functional deterioration can be detected in the absence of structural damage.[6,7]

Periodic visual function examination can detect and assess the progression of glaucoma, but this method is challenging. The long duration of the examination is one of the difficulties. In addition, it is also influenced by the frequency of testing and the level of measurement variability. The recommended frequency of examinations is three tests per year, but in reality, most patients only undergo one test per year.[7-9]

In addition, there is now a paradigm shift in glaucoma which central visual field defects occur earlier. Currently, most practitioners use the SITA Standard (SS) 24-2 strategy as the clinical standard for glaucoma examination. However, there are studies reporting on the prevalence of central visual field defects not typically detected by the 24-2 test grid, so a spatially dense central test grids, such as the 10-2, have been proposed to map out central scotoma. However, switching between these test grids can be problematic for analyzing disease progression and impracticalities of conducting both in a single clinical visit. To overcome this problem, modifications were made by adding test points to the existing grid.[10-12]

Recently, the 24-2C pattern which incorporates 10 additional test points within the central 10^{o} from fixation, 5 in each hemifield, were invented. Another potential practical advantage of the 24-2C grid is that sensitivity measurements are driven by the SITA Faster (SFR) paradigm, which reduces the test duration. However, the performance of the 24-2C has yet to be formally and independently assessed in comparison to the 24-2 grid.[12-14]

This study aims to determine the clinical use of the SFR 24-2C program in assessing visual field defects by comparing the global indices (Mean Deviation (MD), Pattern Standard Deviation (PSD), and Visual Field Index (VFI)) with the SS 24-2 program, as well as comparing the test duration between the two programs.

METHODS

The study was conducted at the National Eye Center Cicendo Eye Hospital, Bandung. Study had received approval from the Ophthalmology Department and Hospital Ethics Committee. Data collection was carried out in November 2021 – January 2022. This study was an analytical observational study with a cross-sectional design, then comparative analysis was carried out.

The inclusion criteria were (1) patients aged over 18 years with a diagnosis of glaucoma, either open-angle, angle-closure, or secondary glaucoma, who had received or had not received previous topical or systemic anti-glaucoma medical therapy, (2) patients who had reliable perimetry data within one month and there were no changes in visual acuity or surgery. Exclusion criteria were (1) presence of other ocular, systemic or neurologic comorbidities that would confound the visual field test result, (2) patients with best corrected visual acuity <1/60, and (3) history of ocular trauma.

The subjects were taken from patients who came to Glaucoma Unit of Cicendo Eye Hospital. Subjects underwent ophthalmological and vital signs examination, starting from visual acuity examination, intraocular pressure with applanation tonometry (ATN), examination of the anterior segment with slit lamp biomicroscopy, gonioscopy and posterior pole examination. The diagnosis was made by one of the four sub-specialist in the Glaucoma Unit and then subjects underwent visual field examination with two different programs, SS 24-2 and SFR 24-2C, with an interval of 15-30 minutes between programs. If the patient has reliable SS 24-2 perimetry results in the previous one month, further examination is carried out with the SFR 24-2C program or vice versa.

Statistical analysis performed to assess whether there are differences in the global indices and examination duration between the two programs. Paired t-test was used to determine the comparison between normally distributed numerical data, and the Wilcoxon test was used if it was not normally distributed.

P value ≤0.05 indicated statistically significant, and p value >0.05 indicated not statistically significant results. The data were processed using SPSS version 24.0 for Windows.

RESULTS

A total of 94 eyes from 66 patients who came to the Glaucoma Unit Cicendo Eye Hospital, met the inclusion criteria and eligible for further study. The characteristics of the subjects of this study are listed in Table 1. There were more women than men (53% (n = 35)

vs 47% (n = 31)). The mean age was 55.41±14.47 years with a range of 19–78 years. The majority of glaucoma were open-angle glaucoma (62.1% (n = 41)).

Table 1. Characteristics of Research Subjects

Characteristics	n	%
Gender (n=66)		
Male	31	47
Female	35	53
Age (n=66)		
Mean ± standard deviation	55.41 ± 14.47	
Median	59	
Range (min-max)	19-78	
Diagnosis (n=66)		
Open angle glaucoma	41	62.1
Closed angle glaucoma	19	28.8
Secondary glaucoma	6	9.1

Note: Categorical data is presented with number/frequency and percentage, while numerical data is presented with mean, standard deviation, median and range (min-max)

Table 2 shows a comparison of global indices between the SS 24-2 and SFR 24-2C program. The mean value of MD in SS 24-2 was smaller than SFR 24-2C, with difference of -0.10 dB, but not clinically or statistically significant. The mean value of PSD SS 24-2 was greater than SFR 24-2C, with a difference of 0.06 dB. However, these differences were also not significantly different. Meanwhile, the mean value of VFI SS 24-2 was significantly smaller than SFR 24-2C, with a difference of 1.5%.

Table 2. Comparison of the Global Indices between SITA Standard 24-2 and SITA Faster 24-2C Program

Variable	Strategy		p Value
	SITA Standard 24-2 (n=94)	SITA Faster 24-2C (n=94)	
MD (dB)			
Mean ± standard deviation	-12.01±11.150	-11.91±11.091	0.364
Median	-6.99	-7.85	
Range (min-max)	-34.32-1.24	-34,78-0,37	
PSD (dB)			
Mean ± standard deviation	4.96±3.410	4.90±3.383	0.090
Median	3.81	3.99	
Range (min-max)	1.06-14.18	1.11-13.59	
VFI (%)			
Mean ± standard deviation	69.65±35.367	71.15±35.099	0.001
Median	92.00	90.00	
Range (min-max)	0.00-100.00	0.00-100.00	

Note: Statistical test for numerical data of p value was tested by Wilcoxon test**.**

Comparison of test duration between the two programs is showed in table 3. The average of test duration in the SS 24-2 program was 5.76±1.296 minutes. Meanwhile, SFR 24-2C program was faster, which was 3.17±0.838 minutes. There was an average difference of 55.03% between the two examination programs.

Table 3. Comparison of the Test Duration between SITA Standard 24-2 and SITA Faster 24-2C Program

Variable	Strategy		p Value
	SITA Standard 24-2 (n=94)	SITA Faster 24-2C (n=94)	
Test Duration (minute)			
Mean ± standard deviation	5.76±1.296	3.17±0.838	0.0001
Median	5.46	3.20	
Range (min-max)	2.40-11.17	2.04-5.25	

Note: Statistical test for numerical data of p value was tested by Wilcoxon test.

DISCUSSION

This study was conducted on 94 eyes of 66 people with a mean age of 55.41±14.47 years. This results is in accordance with a hospital-based study conducted by Belete, et al. which showed the mean age of glaucoma patients was 55.1±13.2 years. As many as 53% of patients in this study were women, in accordance with the results of the study of Ezinne, et al. who reported that the majority of glaucoma occurred in women, which was 56.7%. Women have a greater risk of developing glaucoma due to female hormonal factor which decreasing estrogen is associated with an increased risk of glaucoma.[15-17]

Of the 70 million people with glaucoma worldwide, 74% have open-angle glaucoma. Population-based studies in Asian countries also show that open-angle glaucoma was the most commonly reported.[15,18] Similar results were obtained in this study, the majority of the diagnosis was open-angle glaucoma (62.1%).

The global indices have been widely used as a markers of potential visual field loss in glaucoma and for disease staging. Both the SS 24-2 and SFR 24-2C program report on these indices, so the results can be compared. This study intended to evaluate the new program SFR 24-2C compared to the standard, SS 24-2.[6,12,19]

The two most common global indices used in clinical practice are the MD and the PSD.[20] In this study, the results of the global indices of MD and PSD were not significantly different. Phu, et al. conducted a comparative study of SS 24-2 with SFR 24-2C, and SFR 24-2 with SFR 24-2C, the result of the global indices of MD and PSD were similar in both groups.[12]

In addition to the MD and PSD, the VFI was also compared in this study. The VFI is the latest global index that is not affected by media opacity, focuses on the central rather than peripheral visual fields, and used to evaluate the progression of the visual field defects.[21] In the current study, the mean VFI of the SS 24-2 program was 69.65±35.367%, a difference of 1.5% to the SFR 24-2C, and the difference was statistically significant. This may be influenced by whether the VFI calculation was based on the total or pattern deviation probability plot as seen from the MD value with a cut off value of -20 dB, so the results can vary widely. This result was different from the study conducted by Lee, et al. which showed that the comparison of both the global indices MD and VFI between SS 24-2, SITA Fast (SF) 24-2, SFR 24-2, and SFR 24-2C were not statistically different. However, reports regarding 24-2C are still limited.[20-22]

Gardiner, et al. reported that the MD global index detected visual field defects sooner than VFI or PSD in patients with early or moderate glaucoma. In addition, MD also detected more eyes during the first five years of follow-up, which were presumably undergoing more rapid progression. Meanwhile, Cho, et al. in their study showed that both VFI and MD were equally effective to assess the progression of glaucoma. Changes in glaucoma can be generalized, localized, or both, so changes in MD and VFI should be considered when assessing glaucoma progression at any stage of the disease.[19,23]

In the current study, SFR 24-2C program showed better MD, PSD, and VFI results than the SS 24-2. These were consistent with the study conducted by Lee, et al. which revealed that the diagnostic performance for global indices of MD and VFI in the SFR 24-2C program were lower in sensitivity than SS 24-2.[22] In addition, the mean global indices of SS 24-2 showed a worse MD value and a larger PSD value, then the resulting VFI value was also lower than the SFR 24-2C, so that it have an impact on the clinical implications of assessing glaucoma progression. Because if SFR 24-2C were used as an alternative to SS 24-2 in follow-up period, the results will give impression of no progression.

This study showed a significant difference in the test duration between SS 24-2 and SFR 24-2C. The average test duration in the SS 24-2 program was 5.76±1.296 minutes, while the average duration of the SFR 24-2C program was about half as fast, which was 3.17±0.838 minutes. This was in accordance with Heijl, et al. in their literature study which stated that the test duration with SS 24-2 was about 3-7 minutes, and the mean time for SFR was about 53.5% shorter.[24,25]

Phu, et al. also reported similar test duration of the SS 24-2 program and SFR 24-2C which the duration of SS 24-2 program (median 314.0 seconds) was longer than SFR 24-2C (median 155.0 seconds), with a median difference of 153.5 seconds.[12]

The SFR 24-2C program has 10 additional test points within the central 10^{o} from fixation which are derivatives of the 10-2 grid. This can increase the duration of the examination. Yu, et al. evaluated the timing of SFR 24-2C testing compared to other SITA strategies, including SS 24-2, SF 24-2, SF 10-2, and SFR 24-2. The results showed that the test duration with the SFR 24-2C program was 49.4% faster than the SS 24-2, which is similar to the results in this study. Meanwhile, when compared with the conventional SFR 24-2, the test duration was 17.5% longer. Phu, et al. also reported an increase in test duration of 20-30 seconds (median difference 26 seconds) when compared to the SFR 24-2.[12,26]

This study has several limitations. There was a potential of measurement bias due to fatigue effects. This study also did not further assess the 10 additional test points within the central 10^{o} from fixation, how they may affect the test duration. In addition, the 10 additional points that are asymmetrically distributed are locations that commonly affected in glaucoma. However, this study also did not further assess its average sensitivity of the visual field assessment.

CONCLUSIONS

There was no significant difference in the global indices of MD and PSD, but there was a significant difference in the VFI, as well as the test duration between the two programs. Similar studies can be carried out by further assessing 10 additional test points, or comparing with other grid, such as 10-2, to identify deeper central visual fields.

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