
CLINICAL SCIENCE

**IMPROVED AUTOMATED PERIMETRY
PERFORMANCE IN ELDERLY SUBJECTS AFTER
LISTENING TO MOZART**

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PURPOSE: To evaluate the performance of automated perimetry of elderly subjects naïve to AP after listening to a Mozart sonata.

INTRODUCTION: Automated perimetry (AP) is a psychophysical test used to assess visual fields in patients with neurological disorders and glaucoma. In a previous study, Fiorelli et al. showed that young subjects who listened to a Mozart sonata prior to undergoing AP performed better in terms of reliability than those who did not listen to the sonata.

METHODS: Fifty-two AP-naïve, normal subjects underwent Automated perimetry (SITA 24-2). The study group (25 subjects) underwent AP after listening to Mozart's Sonata for Two Pianos in D Major, and the control group (27 subjects) underwent Automated perimetry without prior exposure to the music.

RESULTS: The study group had significantly lower false negative rates and a lower visual field reliability score than the controls (P=0.04 and P=0.04, respectively). The test time was shorter for the study group (P=0.03).

DISCUSSION: This study shows that elderly subjects, when exposed to the Mozart sonata immediately before AP testing, have lower false negative rates and lower visual field reliability scores when compared with an age- and gender-matched control group. Our results differ from those of Fiorelli et al. who found lower false positive rates and less fixation loss in addition to lower false negative rates.

CONCLUSION: Listening to a Mozart sonata seems to improve automated perimetry reliability in elderly subjects.

KEYWORDS: Automated perimetry; Glaucoma; Mozart effect; Visual field reliability indices; Sita strategy

INTRODUCTION

Automated perimetry (AP) is a psychophysical test used to assess visual fields in patients with neurological disorders and glaucoma. The quality of the exam is dependent upon patient cooperation and fatigue as well as anxiety, and all of these factors can negatively interfere with the test results.

In a previous study, Fiorelli et al. showed that young subjects who listened to a Mozart sonata prior to undergoing AP performed better in terms of reliability than those who did not listen to the sonata.¹ The rationale for applying music

prior to visual field testing was based on a literature review of the different applications of music in medical sciences.^{2,3-9}

In an effort to ascertain the external validity of the Fiorelli study, we undertook this study to evaluate the reliability indices of older subjects naïve to AP after they listened to a Mozart sonata.

MATERIALS AND METHODS

This study was approved by the Santa Casa of Sao Paulo Ethics Committee, and the procedures followed were in accordance with the Helsinki Declaration of 1975, as revised in 1983. Fifty-two patients from the ophthalmology clinic were enrolled and gave formal consent to participate in the study. All subjects underwent a complete ophthalmological examination including best corrected visual acuity (BCVA), refraction, biomicroscopy, ophthalmoscopy, and aplanation

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tonometry prior to study enrollment. Subjects with refraction beyond +5.00 sph or -5.00 sph, BCVA less than 20/30, or retinal lesions that might cause visual field defects were not included in the study. The patient characteristics are presented in Table 1. None of the subjects had previously undergone AP.

Table 1 - Patient demographics

	Study group (n=25)	Control group (n=27)	P value
Age (years)*	58.7 ± 12.0	61.5 ± 7.6	0.39 ^a
Gender (M:F)	17 : 8	20 : 7	0.9 ^b
Ethnicity			0.69 ^c
White	5	6	
Non-white	20	21	
Visual acuity (decimals)	0.9 ± 0.0	0.9 ± 0.1	0.9 ^a

*Mean ± standard deviation; M:F - male/female ratio; a: Student's t test; b: Chi-square test; c: Fisher exact test

The subjects were randomly assigned to one of two groups. The study group was exposed to the first ten minutes of Mozart's Sonata for Two Pianos in D Major (K.448) immediately prior to visual field testing by means of a headset with noise reduction. The control group stayed in a quiet room for 10 minutes prior to visual field testing. All subjects underwent automated perimetry with a Humphrey Field Analyzer II (model 750, Zeiss-Humphrey Systems, Dublin, CA), program SITA 24-2, in the right eye only. After brief instructions as to how to proceed with the examination, the refractive error was corrected, and the perimetry was initialized. The time between completion of the sonata and the conclusion of the visual field testing was limited to ten minutes. A masked technician remained in the room throughout the examination and was unauthorized to interrupt the test until the completion of the exam.

For each group, the number of fixation losses, false positive errors, and false negative errors, as well as the test duration, were averaged, and these values were compared between the groups. The visual field reliability score, as proposed by Caprioli and modified for the SITA strategy, was calculated for each patient.¹⁰ This is a zero to ten point scale, with a lower score indicating greater reliability. The Mann-Whitney U test was used to compare differences between the study and control groups. The unpaired Student's t test was used to compare continuous demographic variables, and the Fisher exact test and chi-square test were used to compare categorical demographic variables when appropriate. A P value of less than 0.05 was considered statistically significant.

RESULTS

Table 2 shows a comparison of the automated perimetry performance of the groups. Patients exposed to the Mozart sonata had fewer false negative errors and better visual field reliability scores (Caprioli's scores) than the controls (P=0.04 and P=0.04, respectively). The test duration was shorter for the study group than for the control group (P=0.03).

Table 2 - Comparison of the reliability indices and test duration between groups.

	Study group	Control group	P value*
Fixation losses	0.09 ± 0.1	0.04 ± 0.08	0.98
False positive errors	2.0 ± 3.1	3.9 ± 7.1	0.3
False negative errors	2.8 ± 3.5	9.2 ± 12.5	0.04
Caprioli's score**	0.6 ± 0.8	1.9 ± 1.5	0.04
Test duration (minutes)	6.3 ± 1.2	7.7 ± 1.7	0.03

*: Mann-Whitney U test; **: Visual field reliability score

DISCUSSION

This study shows that elderly subjects, when exposed to a Mozart sonata immediately before AP testing, have lower false negative rates and higher visual field reliability scores than an age- and gender-matched control group. Our results differ from the observations of Fiorelli et al., who found lower false positive rates and less fixation loss in addition to lower false negative rates.¹ Fiorelli et al. studied young subjects who volunteered for the study, while we have used elderly patients from an ophthalmology clinic, a sample that is representative of the real universe of our patients.

Both false-positive and false-negative catch trials are intended to evaluate attention throughout the examination. A positive answer after no stimulus was presented (false positive) may be given by patients who are too nervous or eager to do well on the exam. A negative response after the presentation of the brightest stimulus in a particular area of the visual field where visual sensitivity had already been established (false negative) may be observed in patients who are no longer concentrating or who are lacking in attention. In addition, the reliability of a visual field depends largely on the quality of the eye fixation.¹¹ Taken together, these three indices, false positive rates, false negative rates, and the amount of fixation loss, are a measure of reliability. Caprioli has proposed a scoring system to gauge patient reliability.¹⁰ Briefly, it consists of a six item scheme including rates

of false-positive and false-negative catch trials, fixation losses, short-term fluctuations, total number of stimuli, and a subjective grading of performance by the perimetrist. For each item, a score is given, and the final score represents the sum of all the item scores. The maximum total score is 10. This reliability score was initially developed for the standard full threshold strategy. In this paper, however, we used the SITA 24-2 strategy, so a few changes were required. The application of the modified visual field reliability score reveals that patients exposed to the Mozart sonata performed better than those who were not exposed to the music.

The patients exposed to the Mozart sonata had a shorter test duration than the controls. In a lengthy threshold examination – which can take as long as 10 or 20 minutes – a patient will become tired, the level of attention will decrease, and the answers will become less reliable.¹¹ This is called the “fatigue effect” and consists of two components: the patient’s physical fatigue and the fatigue caused by increased “strain” on the visual system during a long examination.¹¹ With the development of fast strategies for

AP such as SITA, SITA-fast, and TOP, the test duration is shortened, and the effect of fatigue is reduced remarkably, causing patients to make fewer mistakes. It seems that listening to the Mozart sonata helps to increase attention, leading to reduced test duration, and to improve reliability, with false-negative indices being especially reduced. This applies even for the fast strategies.

CONCLUSION

This sonata has been described in the literature as one that enhances spatial-temporal reasoning.⁶⁻⁸ The current study concurs with the observation made by one of the authors in a previous study.¹ The beneficial effect of the Mozart sonata on the reliability indices of AP and the reduction in test duration can be extended to clinical practice. A more reliable visual field test carried out in a shorter period of time can contribute to better care for glaucoma patients, who need to undergo repeated visual field testing.

REFERENCES

1. Fiorelli VM, Kasahara N, Cohen R, França AS, Della Paolera M, et al. Improved automated perimetry performance following exposure to Mozart. *British J Ophthalmol*. 2006;90:543-5.
2. Covington H. Therapeutic music for patients with psychiatric disorders. *Holist Nurs Pract*. 2001;15:59-69.
3. Formisano R, Vinicola V, Penta F, Matteis M, Brunelli S, Weckel JW. Active music therapy in the rehabilitation of severe brain injured patients during coma recovery. *Ann Ist Super Sanita*. 2001;37:627-30.
4. Good M, Anderson GC, Stanton-Hicks M, Grass JA, Makii M. Relaxation and music reduce pain after gynecologic surgery. *Pain Manag Nurs*. 2002;3:61-70.
5. Lou MF. The use of music to decrease agitated behavior of the demented elderly: the state of the science. *Scand J Caring Sci*. 2001;15:165-73.
6. Rauscher FH, Shaw GL, Ky KN. Listening to Mozart enhances spatial-temporal reasoning: towards a neurophysiological basis. *Neurosci Lett*. 1995;185:44-7.
7. Rauscher FH, Shaw GL. Key components of the Mozart effect. *Percept Mot Skills* 1998;86:835-41.
8. Sarnthein J, vonStein A, Rappelsberger P, Petsche H, Rauscher FH, Shaw GL. Persistent patterns of brain activity: an EEG coherence study of the positive effect of music on spatial-temporal reasoning. *Neurol Res*. 1997;19:107-16.
9. Wang SM, Kulkarni L, Dolev J, Kain ZN. Music and preoperative anxiety: a randomized, controlled study. *Anesth Analg*. 2002;94:1489-94.
10. Caprioli J. Automated perimetry in glaucoma. *Am J Ophthalmol*. 1991;111:235-9.
11. Weijland A, Fankhauser F, Bebie H, Flammer J (eds). *Automated Perimetry – Visual Field Digest* (4th edition). Koniz/Bern, Switzerland: Haag-Streit AG. 2004.

