The Overestimation of Visual Acuities Using The Potential Acuity Meter (PAM) In Patients With Macular Disease

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Abstract: The potential acuity meter (PAM) has been reported to give false positive results in patients with Age Related Macular Degeneration and similar maculopathies. In this study, 10 Eyes with known maculopathy and clear medias were tested with PAM. PAM acuities were compared with best corrected Snellen acuities and found to give false positive results by an average of 2.4 Snellen lines in 100% of the eyes. When the PAM is used by clinicians to predict post-operative acuities, this potential for false positive results should be considered carefully before discussing potential post-operative results with the patient.

Keywords: potential acuity meter (PAM), false positives, Age Related Macular Degeneration (AMD), pseudophakes, aphakes

INTRODUCTION

The potential acuity meter (PAM) has become a valuable instrument for predicting post-operative visual acuity in patients with cataracts[1,7-9,12,13]. Since its introduction several years ago, it has been proven to have a high degree of accuracy (within 2 lines) in predicting the final acuity for over 90% of cataract patients[1,2,4-6,8-10,13]. The potential acuity meter (PAM) uses a point light source which is focused in the patient's pupil to create a pinhole aperature of .15mm in diameter through which a calibrated Snellen acuity chart is projected onto the retina. In theory, the pinhole aperature can be aimed through windows in the cataract to aviod blockage or light scatter caused by the opacities. This then, would allow the clinician to determine if visual loss is solely the result of the cataract or if macular disease is also present[1,13]. The potential acuity meter works very well for those patients with normal or near normal maculas. However, reports have shown that Age Related Macular Degeneration (AMD) and other macular diseases cause false positive tests[3,7,10,13,14]. Patients with clear media and macular disease were used in this study to determine if the potential acuity meter (PAM) does indeed elicit a false positive with maculopathy.

METHODS

Patients with known maculopathy who presented to the clinic for routine follow-up appointments were screened with a slit-lamp exam to rule out media opacities (cornela, lenticular, vitreal). If the patient was a pseudophake, an aphake, or had a clear lens with no nuclear sclerosing, permission was then obtained to participate in the study. Best corrected Snellen acuity (BVA) was obtained on all patients using a standard projected Snellen acuity chart and an AO phoropter. They were asked to read the smallest line they could read with guessing. The level of visual acuity was established by correctly identifying three or more letters on a line.

Next the pupils were fully dilated using one drop of 1% Tropicamide and one drop of 10% phenylephrine. Following dilation, the posterior pole was examined using a 90D lens and a description of the macula was charted. If all criteria were still met, the patient was included in the study.

The PAM (Mentor O&O Inc, Hingham, MA) was mounted on a Topcon slit-lamp. The patient's previously determined spherocylindrical equivalent was set on the instrument, the patient was positioned in the

slit-lamp, the room darkened, and the narrowest point of the PAM was focused in the patients eye. The patient was instructed to read the smallest possible line and to respond by talking through their teeth to minimize movement of the Snellen chart within the eye. Again, the level of visual acuity was established by correctly identifying three or more letters on a line. At the conclusion of the exam, fundus photographs were obtained.

The BVA and PAM acuities were obtained by the same examiner an all patients to eliminate examiner variability.

RESULTS

The 10 eyes tested had maculopathy ranging from mild dry AMD to active wet MAD with SRNVM and overlying subretinal fluid and hemorrhage. One eye with a SRNVM secondary to POHS was included. The pathology and corresponding BVA and PAM acuities are found in table 1.

The relationship of BVA and PAM visual acuity and their relationship to the line of perfect correlation is shown on table 2. 100% of the eyes tested showed a better PAM acuity than BVA, as illustrated by all eyes falling above the line of perfect correlation. All points above this line indicate false positives and those below are false negatives. Table 3 breaks this down further and illustrates by means of a bar graph the number of lines better than the BVA and the percentage of eyes in each category. 40% of the eyes showed a PAM acuity of 3 lines better, and 40% showed a PAM acuity of 2 lines better than BVA. The PAM averaged an over-prediction of the visual acuity by 2.4 lines.

DISCUSSION

Our results found that the PAM overestimated the actual visual acuity of patients with AMD or similar maculopathy. 100% of the eyes tested showed false positives with the PAM by an average of 2.4 lines. Similar results have been reported by Spurney[9] and Fish[10]. Since special care was taken in this study to eliminate any possible interference from corneal, lenticular, or vitreal opacities, it can be said that the PAM acuity is solely the result of the projected image's interaction with the retina.

The mechanism by which the PAM overpredicts the visual acuity in patients with maculopathy is unknown. Several theories, however, have been formulated. Perhaps the PAM allows the examiner to project the Snellen letters between affected areas of the macula, therefore, the

images fall on good retina and decreased distortion results. Fish[10] and co-workers suggest that an increased retinal illuminance of approximately 1.0 log unit with PAM versus a Snellen projector chart is responsible for the effect. This theory is substantiated by studies conducted by Sloan[11] who studied the variation of acuity with luminance in several ocular diseases. She found that patients with Age Related Macular Degeneration are extremely sensitive to retinal illumination and that they require an unusually high light intensity to obtain maximum acuity. Guyton[14], however, feels that false positives associated with dry AMD are not true false positives but rather the improved acuity is attributable to PAM eliminating the affects of an irregular refraction.

Regardless of the actual mechanism for false positive results, the fact that it occurs should be taken into consideration when administering this test and discussing post-operative results with cataract patients.

Due to the small size of the sample and the fact that the severity of macolopathy was not evenly distributed, no levels of statistical significance can be drawn. Yet, with the trend established by this and other studies, consideration should be kept in mind when making clinical determinations.

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Table I

	BVA	PAM	Mac Disease	Lens Type
1	20/40	20/20	dry AMD	Clear
2	20/400	20/200	wet AMD	psph
3	20/40	20/20	wet AMD	aphake
4	20/40	20/20	dry AMD	aphake
5	20/30	20/20	dry AMD	clear
6	20/30	20/20	dry AMD	clear
7	20/25	20/20	POHS	clear
8	20/40	20/20	wet AMD	psph
9	20/30	20/20	dry AMD	psph
10	20/30	20/25	dry AMD	psph

Table 2

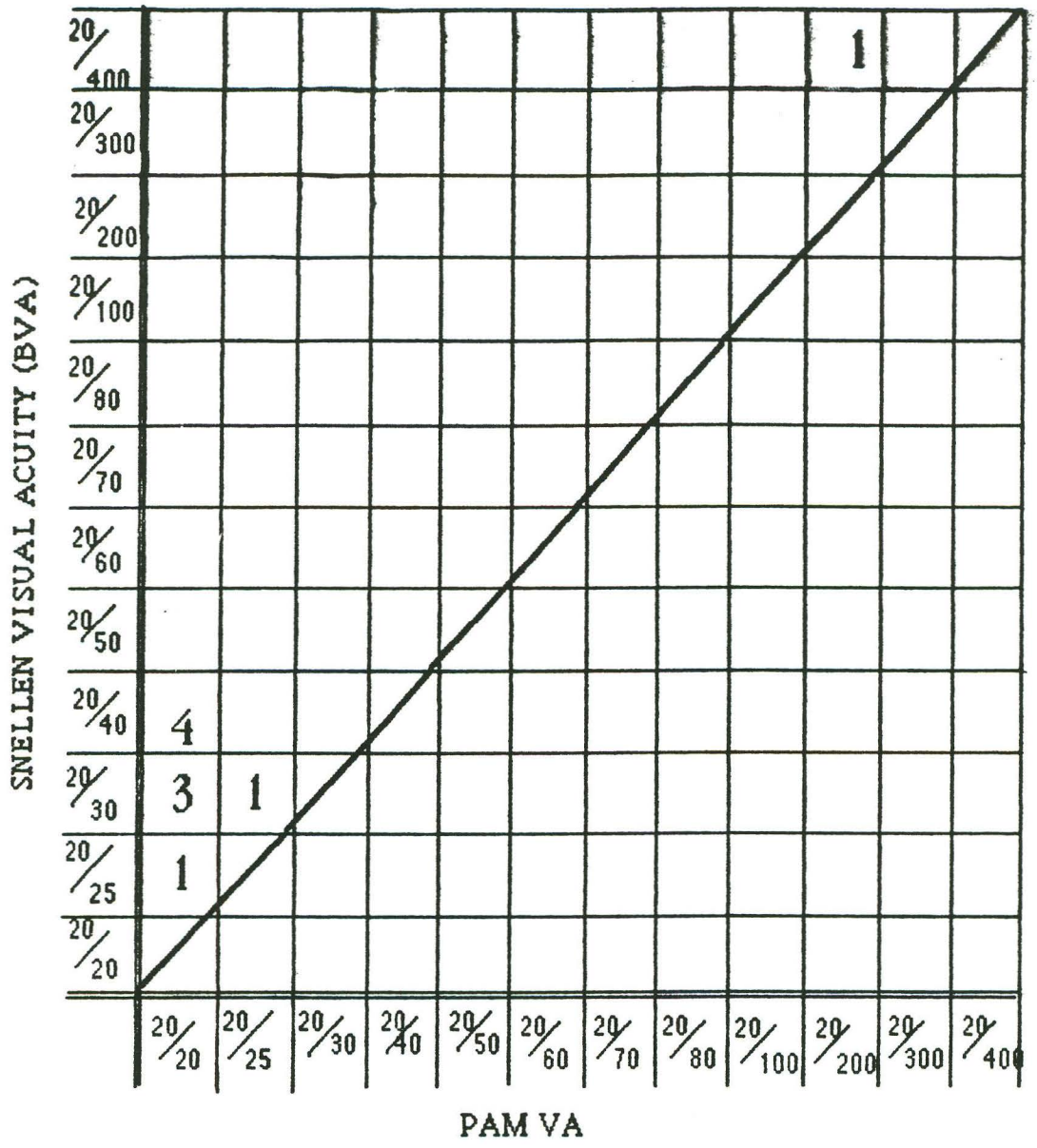

Table 3