

## Evaluation of the Accuracy of Retinal Acuity Meter in Estimating Post-Phacoemulsification Visual Acuity in Diabetic Patients

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### Abstract

**Introduction:** Cataract surgery is the most common surgery performed worldwide, however, retinal disease is an uncertain contraindication for cataract surgery. Although the surgical out-comes of patients with retinal disease can be unsatisfactory, some cataract patients with retinal disease experience improvements in visual acuities. Thus, the need to predict which surgeries will succeed and which will fail has motivated development of many types of specialized technical instruments.

**Materials and Methods:** This prospective observational study included 36 diabetic patients, who underwent phacoemulsification cataract surgery. Preoperative full evaluation included macular optic coherent tomography and retinal acuity meter (RAM) for predicting postoperative visual acuity. Postoperative assessment included best-corrected visual acuity. The correlation between preoperative RAM and postoperative BCVA was done.

**Results:** There is no statistically significant correlation between preoperative RAM and postoperative BCVA in diabetic patients.

**Conclusion:** RAM is not an accurate method to predict the potential visual acuity after cataract surgery in diabetic patients.

**Keywords:** Retinal Acuity Meter; Phacoemulsification; Accuracy

### Introduction

Cataract surgery is regarded as the most common surgery performed worldwide [1]. Both visual acuity and overall functioning of the patient can be improved by successful cataract surgery [2,3]. 90% of patients undergoing cataract surgery with lens implantation attain visual acuity of 20/40 or better, which means that 10% of cataract surgeries do not attain anticipated visual improvement [2]. Most of these failures are due to other pathology in the retina [4,5]. We face difficulty to predict the potential impact of other retinal pathology on postsurgical vision in the presence of dense cataracts [6,7].

However, retinal disease remains an uncertain contraindication for cataract surgery, due to the fact that, even though most surgical outcomes of patients with retinal disease do not achieve 20/40 postsurgical visual acuity, there are still some cataract patients with retinal disease who experience improvements in visual acuities [4]. Thus, for one thing, it would be unfortunate to exclude surgical candidates with potential to benefit; nevertheless, performing surgery on candidates with guarded prognosis can raise unrealistic expectations and waste resources.

The development of different specialized technical instruments was motivated by the need to predict which patients have potential to improve and which don't. This included the laser interferometer, Moire fringe interferometer, and the potential acuity meter [8]. However, there is the question of how accurate the predictions made using these equipment [6,7,9] and predictions have contributed little to the accuracy of clinical predictions made by an experienced ophthalmologist [9].

The illuminated near card (INC), which was first introduced in 1996 [10], is a handheld device, which the patient holds 40.0 cm away. It consists of a visual acuity chart (Snellen-like letters) with a fluorescent white light bulb mounted behind it. The examiner rotates the lines of the chart using a knob. The patient views the INC using a trial frame that has best distance correction fitted, a + 2.50 diopter lens, and a multiperforated disc with 1.0 mm pinholes.

Hofeldt and Weiss had evaluated the predictive value of the INC in cataract patients and found that it can accurately predict post-cataract surgery visual acuity within two lines in 91% of all patients, and in 98% of the patients with 20/100 visual acuities or better preoperatively [11].

### Patients and Methods

The Study was conducted as a prospective observational study in accordance with the tenets of the Declaration of Helsinki and was approved by the Institutional Ethics Committee in Alexandria University.

The procedure was explained to eligible subjects and they will sign a consent form.

The study included 35 eyes eligible for phacoemulsification cataract extraction, which are known to be diabetics.

#### Inclusion criteria

- Diabetic patients with immature senile cataract undergoing phacoemulsification cataract extraction surgery, including patient with diabetic retinopathy, and history of diabetic maculopathy.

#### Exclusion criteria

- Patients with hand motion visual acuity due to dense mature cataract.
- Active maculopathy that needs treatment in the form of intravitreal injections.
- Other ocular pathology, that contribute to guarded prognosis (corneal pathology, glaucoma).

#### Preoperatively

- All the patients underwent a complete preoperative ophthalmologic examination, and macular optical coherence tomography (OCT) to exclude any active macular disease.
- Preoperative best-corrected visual acuity (BCVA) using snellen chart was obtained.
- Preoperative visual potential was recorded using Retinal acuity meter (RAM; AMA Optics Inc., Miami). Patients had a fitted pinhole aperture and a 2.50 D lens that focuses the image at approximately 40 cm placed over the eye being tested; the other eye is occluded. Refractive errors were corrected if present. The patient then viewed the visual acuity chart at 40 cm, and the examiner rotated the knob to get the patient's RAM reading.

#### Procedure

All patients underwent phacoemulsification cataract extraction by the same surgeon (Elmassry A).

Postoperatively, all patients received topical antibiotics, topical steroid and topical non-steroidal anti-inflammatory eye drops.

Best-corrected visual acuity was measured on the 1-week postoperative follow up and the 1-month postoperative follow up, using Snellen’s acuity chart.

**Statistical analysis**

Data were analyzed using IBM SPSS software package version 20.0. Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level.

**Results**

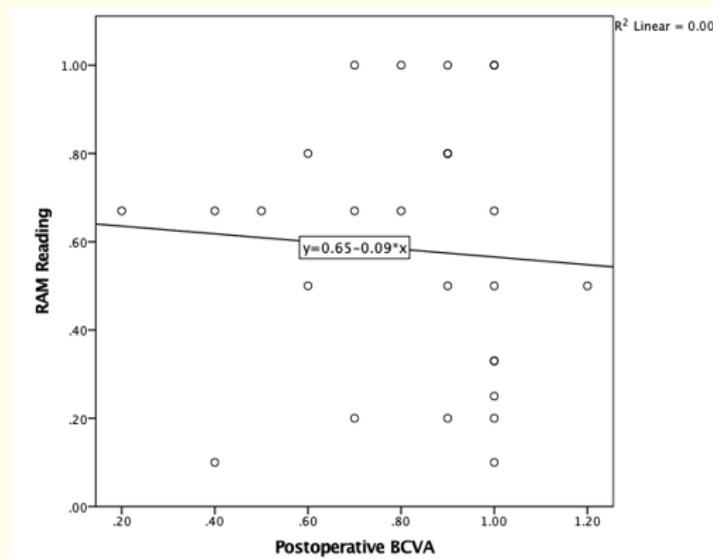
This study included 35 eyes of 28 patients that underwent phacoemulsification cataract extraction surgery for immature senile cataract that included 12 male patients and 16 female patients, with mean age of 67 year old.

Of the 35 eyes, 29 didn’t have prior intravitreal injection, and 6 had prior one or more intravitreal injections, but the maculopathy was stable at the time of surgery.

Preoperative patient’s characteristics	(Mean (standard deviation))
Age	66.68 (8.45)
Gender (male:female)	12:16
Preoperative BCVA	0.32 (0.24)
Preoperative RAM reading	0.62 (0.29)
Intraocular pressure	14.45 (2.19)

**Table 1:** Preoperative patient’s characteristics.

Testing the correlation between the RAM visual acuity pre-operatively and the Best-corrected visual acuity (BCVA) post-operatively at 1 month of follow up using Spearman’s correlation, showed no statistically significant correlation (Figure 1).



**Figure 1:** Scatter graph showing correlation between RAM and post-operative BCVA in diabetic patients.

For the diabetic patients, there was no statistically significant correlation found in analysis of subgroups according to having previous injections or no injections (Figures 2 and 3).

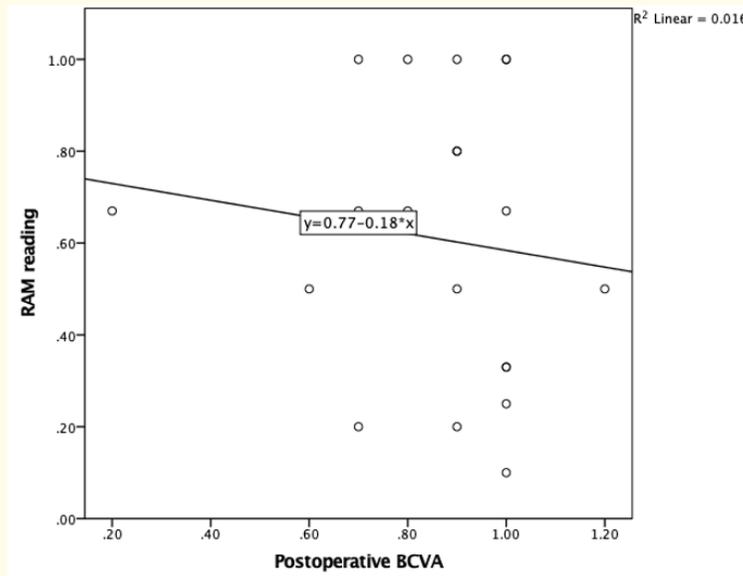


Figure 2: Scatter graph showing correlation between RAM and post-operative BCVA in diabetic patients, with no previous injection.

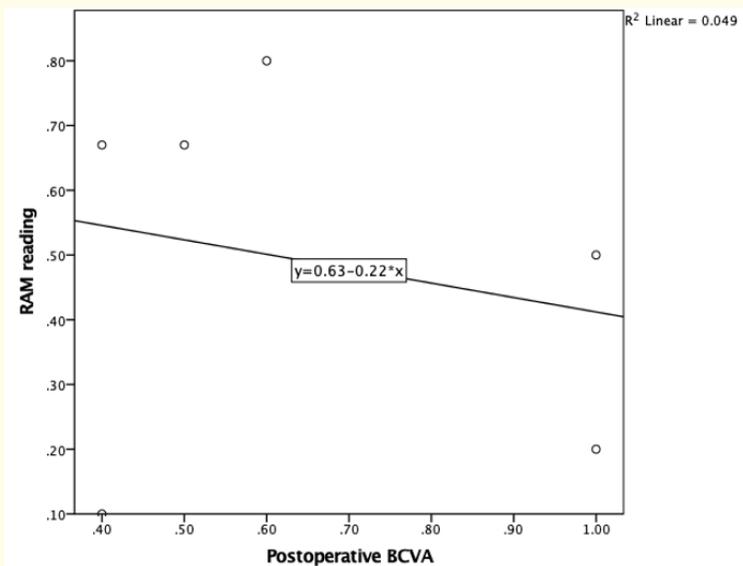


Figure 3: Scatter graph showing correlation between RAM and post-operative BCVA in diabetic patients, with previous injection.

### Discussion and Conclusion

The need to predict the visual acuity after cataract surgery, specially in those eyes that suffer from other risk factors that can compromise the vision post-operatively have been a major issue. Ideally this predictive test should be accurate, reproducible, and easy to perform.

Evidence shows that PAM can be a useful instrument to evaluate retinal function in eyes with media opacities [12-15]. Barrett, *et al.* [13] showed that the PAM successfully distinguished patients with retinal/neural disease from those without such disease in eyes with cataract. PAM was recommended by Datiles, *et al.* [12] in high myopes with moderate cataracts and poor VA to reliably determine how much of the vision loss was due to the cataracts. Klein, *et al.* [14] used the PAM to assess retinal function before neodymium-YAG laser posterior capsulotomy, which showed a good predictive value, reducing the chances of the capsulotomy being a failure by fourfold. Steinert, *et al.* [16] used PAM as a predictor of retinal function in evaluating patients who underwent penetrating keratoplasty and had mild to moderate corneal edema preoperatively. The PAM also has been shown to be a safe and quick method to predict VA after scleral buckling of macula-off retinal detachments, repair of macular holes, and after photodynamic therapy for subfoveal choroidal neovascularization due to AMD [16-18].

However, Vianya-Estopa, *et al.* [19] reported that Potential acuity meter and Laser interferometer accuracy is affected by the density of the cataract and that they are inaccurate in patients with macular disease. Reid, *et al.* [20] also reported that neither the PAM nor the Visometer predictions were statistically significant predictors of postoperative BCVA after cataract surgery, and therefore announced that they found no clinical benefit to support the use of PAM or visometer in the preoperative assessment of cataract patients.

In our study, we assessed the correlation between the RAM preoperative acuity, and the post-operative best corrected visual acuity after cataract surgery in diabetic patients, and we found no statistically significant correlation in all of our subject group and subgroups.

There was a negative correlation in the diabetic group including both who had no prior intravitreal injections and those who had, but this negative correlation was not statistically significant.

To the best of our Knowledge, no previous studies used the Retinal acuity meter (RAM; AMA Optics Inc., Miami) in predicting visual acuity in diabetic patients after cataract extraction. It is well established that different types of retinal acuity meters have different accuracy, which is also affected by retinal pathology [21]. Therefore, we recommend a larger study to assess the RAM in different patient population.

Finally, early identification of patients that will suffer poor outcomes may prevent unnecessary healthcare costs and undue exposure to surgical risks. It will also allow the surgeons to discuss visual potential with their patients preoperatively. It will allow the patients to be prepared psychologically for these outcomes, avoiding high expectation from their surgeries, and therefore prevents patients' dissatisfaction postoperatively.

### Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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