

Correlation between visual acuity at discharge and on final follow-up in patients undergoing manual small incision cataract surgery

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Purpose: The aim of this study was to determine the correlation between visual acuity on discharge and at final follow-up in patients undergoing manual small incision cataract surgery (MSICS) through outreach services of a tertiary care training center. **Methods:** A prospective observational study was done to determine the correlation between visual acuity on postoperative day 1 and final follow-up (4–8 weeks) among various categories of surgeons and surgical complications in patients who underwent MSICS between January 2018 and March 2018. Proportions of patients benefitting from refractive correction were also analyzed. **Results:** Of the 924 patients who underwent MSICS through outreach services during the study period 841 were eligible for the study. Follow-up rate at 4–8 weeks was 91%. Mean age was 61.6 (SD 9.2) years, 63% were females and 55% were operated by trainees. There was a positive correlation between visual acuity at day one and final follow-up with a Spearman's correlation coefficient of 0.375 and 0.403 for uncorrected (UCVA) and best corrected visual acuity (BCVA) respectively ($P < 0.001$). The correlation coefficient, while still positive, was lower for trainees (0.287), as compared to consultants (0.492). At least two lines of improvement in visual acuity on refractive correction were found in 77% of patients. **Conclusion:** Visual acuity on the day of discharge may be a useful quality indicator of visual outcome for monitoring cataract surgical programs. However, a follow-up at 4–8 weeks is recommended for individual patient benefit and monitoring surgical quality especially in training hospitals.

Key words: Cataract surgery, outcomes, visual acuity

Reports from the literature show that early postoperative vision correlates well with final vision and may be used for monitoring cataract surgical programs especially where follow-up is poor.^[1,2] Other authors, however, stress on the importance of follow-up.^[3] Whether this correlation between early and final visual acuity holds good in institutes where large proportions of surgeries are done by trainees is not reported. Moreover, the routinely performed superior section cataract surgeries are known to cause increased surgically induced astigmatism.^[1,4-8] Our study aims to determine the correlation between visual acuity at postoperative day 1 and final follow-up in a training center and the proportion benefitting from a refraction on follow-up.

Methods

This was a prospective observational study approved by the institutional review board (IRB No: 11099, date: 10/1/2018) and followed the Tenets of the Declaration of Helsinki. All the patients who presented for cataract surgery through outreach service during the study period of January 2018 to March 2018 were invited to participate in the study. The exclusion criteria of the study were as follows: (1) those who were uncooperative for vision assessment, (2) less than 18 years of age, (3) those

who underwent phacoemulsification or combined surgery, and (4) those who did not complete final follow-up at 4–8 weeks. Following informed consent, patients who were planned for cataract surgery underwent a comprehensive eye examination including uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), slit lamp examination, applanation tonometry, fundus exam and biometry. A manual small incision cataract surgery with intraocular lens implantation using a superior sclero-corneal tunnel was done by various levels of surgeons in sterile operating conditions in keeping with the hospital's standard protocol. Cases were assigned to surgeons based on difficulty of the case and the experience level of surgeon. Intraocular lens powers were aimed at near emmetropia and intra-operative complications were noted if any. Following surgery, UCVA and visual acuity with pinhole was recorded on the first post-operative day. Thereafter, UCVA and BCVA with refraction on the final post-operative visit at 4–8 weeks were recorded. At the final visit the patient were prescribed glasses if indicated. The visual acuity was measured by experienced optometrists who are part of the outreach services. They were unaware of the study and measured vision

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according to the regular standard of care. The optometrists measuring the final visual acuity were blinded to the vision at discharge. All vision recordings were converted to Log MAR for analysis. Statistical analysis was done in statistical package for the social sciences (SPSS) version 21.0. Spearman’s correlation coefficient between post-operative vision at day one and final follow-up was analysed. The same was analysed for various categories of surgeons and for cases with intra-operative complications. Visual acuity was categorized based on WHO’s recommendations for post-operative visual outcome.^[6] *P* value less than 0.05 was considered significant. Proportions benefitting from refractive correction, i.e., those with at least two lines of improvement in visual acuity were also analysed.

Results

Out of the 924 patients (924 eyes) who underwent manual small incision cataract surgery, 841 (91%) followed up unprompted at 4–8 weeks [Fig. 1]. Mean age was 61.6 (SD 9.2) years and 533 (63%) were females. The uncorrected visual acuity in the eye to be operated was less than 6/60 in 435 (51.7%) patients before the cataract surgery and 463 (55%) were operated by trainee surgeons. None had bilateral surgeries. The post-operative vision (UCVA and BCVA) in various categories of visual acuity are given in Table 1.

The Spearman’s correlation coefficient between vision in the operated eye on the first post-operative day and that of the final post-operative visit was 0.375 and 0.403 for UCVA and BCVA respectively, (*P* values <0.001). Scatter plots for the same are as shown in Figs. 2 and 3 respectively. The correlation coefficients among learning surgeons, though still positive (0.287 for UCVA and 0.336 for BCVA; *P* values <0.001) was lower as compared to consultants (0.492 for UCVA and 0.504 for BCVA; *P* values <0.001). The presence of intra-operative complications did not alter the correlation significantly. In eyes without intra-operative complications, the correlation coefficient was 0.369 for UCVA and 0.428 for BCVA; and in those with complications, it was 0.337 and 0.403 respectively.

While assessing change in visual acuity in the operated eye from the pinhole vision documented at discharge to BCVA at final follow-up, 671 (79.7%) of the patients remained in the same WHO vision category, 151 (17.9%) improved, and 19 (2.2%) showed a drop in vision category [Table 2]. At least two lines of improvement on refractive correction were found in 648 (77%) patients at the final follow-up. Mean spherical equivalent was –1.55 dioptres. Analysed separately, the mean spherical error (*n* = 535) was –0.51 dioptres (SD = 1.23) and for those with cylindrical error (*n* = 771) the mean power was –1.45 dioptres (SD = 0.80).

Discussion

In this prospective, observational study there was a positive correlation between visual acuity at discharge and on final follow-up in patients undergoing MSICS through outreach services. Studies from other centers have also reported a positive correlation; however, proportions of surgeries done by learners were not mentioned.^[1-3] Ours is a training center with a large proportion of surgeries being done by residents and we wanted to explore if vision at discharge was predictive of the final vision.

A positive correlation between immediate postoperative visual acuity and that at final follow-up both for UCVA and BCVA was found in our study as depicted in Figs. 2 and 3. The PRECOG study, which was a multi-center observational study, reported a comparative correlation between early and late postoperative uncorrected visual acuity following small incision cataract surgery ($r_s = 0.59, P < 0.0001$) which also held good for best-corrected visual acuity ($r_s = 0.60, P < 0.0001$).^[1] In a retrospective study done in Nigeria, where post-operative follow-up was about 80%, the correlation was positive for UCVA (Spearman’s coefficient = 0.46, *P* = 0.001) similar to our study.^[2] They, however, did not report the correlation in BCVA. Gupta *et al.*, in a retrospective study, with a large sample size and good follow-up rate, reported a similar positive correlation (Spearman’s rank correlation: 0.40) between immediate post-operative pinhole vision to the final best-corrected vision.^[3] To the best of our knowledge, this is the first report of correlation between visual acuity at discharge and final follow-up both for UCVA and BCVA where large proportion of cases were operated by residents. In our institution, there is a graded training for cataract surgery and supervision withdrawn in a staged manner depending on the competency of the trainee. However, a consultant is always available in the theatre to assist, even a competent trainee, should the need arise. This highlights the fact that when surgeries are done under appropriate supervision by trainees, vision at discharge may be predictive of final vision. The correlation held good both among patients with complications and those without. However, the numbers of patients with complications were low, and the study was not powered to look for a correlation in this group.

For monitoring of a cataract surgical program, according to the recommendations by the WHO for vision following cataract surgery, 90% of the patients must have a final best-corrected

Table 1: Visual acuity at discharge and on follow-up

	Proportions at day 1 post-op (%)	Proportion at 4-8 weeks (%)
UCVA		
6/6-6/18	356 (42.3)	452 (53.7)
<6/18-6/60	452 (53.7)	370 (44)
<6/60	33 (4)	19 (2.3)
BCVA		
6/6-6/18	662 (78.7)	794 (94.4)
<6/18-6/60	149 (17.7)	33 (3.9)
<6/60	30 (3.6)	14 (1.7)

Post-operative vision (UCVA and BCVA) on the 1st day and on final follow-up

Table 2: Change in visual acuity at post-operative visits

BCVA (n=841)	At final follow-up at 4-8 weeks		
	6/6/-6/18	<6/18-6/60	<6/60
At discharge			
6/6/-6/18	649 (77.1%)	12 (1.4%)	1 (0.1%)
<6/18-6/60	130 (15.4%)	15 (1.7%)	6 (0.7%)
<6/60	15 (1.7%)	6 (0.7%)	7 (0.8%)

Table showing number of patients (with percentages) who showed a change across WHO vision categories from discharge to final follow-up.

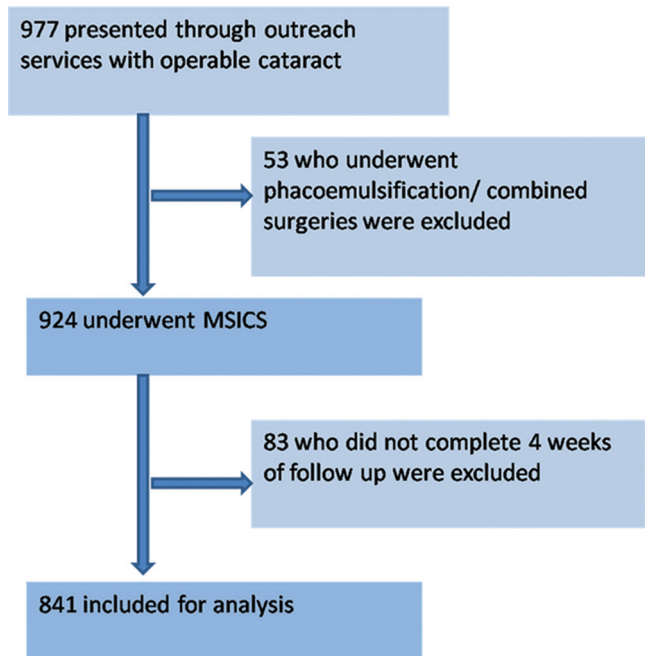


Figure 1: Flow chart of the study

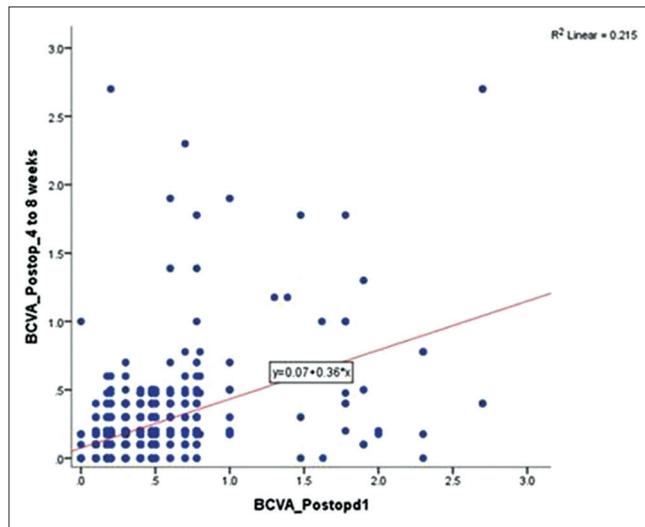


Figure 3: Scatter plot showing correlation of best corrected visual acuity (BCVA) between first and final post-operative follow up

visual acuity and 80% of patients an uncorrected visual acuity of more than 6/18.^{16]} We analyzed our visual acuity data at discharge and at final follow-up from a program monitoring point of view. Table 2 shows the number of patients in each vision category (BCVA) that stayed in the same category at the time of discharge and at the final follow-up, the number that improved in category and the number that worsened. These numbers show that approximately 80% of the patients remained in the same category or improved. We also looked at the predictive value of BCVA improving to better than 6/18 in each category. In the group that had BCVA better than 6/18 at discharge 98% stayed the same; in the group that had BCVA between 6/18 and 6/60, 86% improved to better than 6/18; and in the group that had BCVA less than 6/60 at discharge, 53.6%

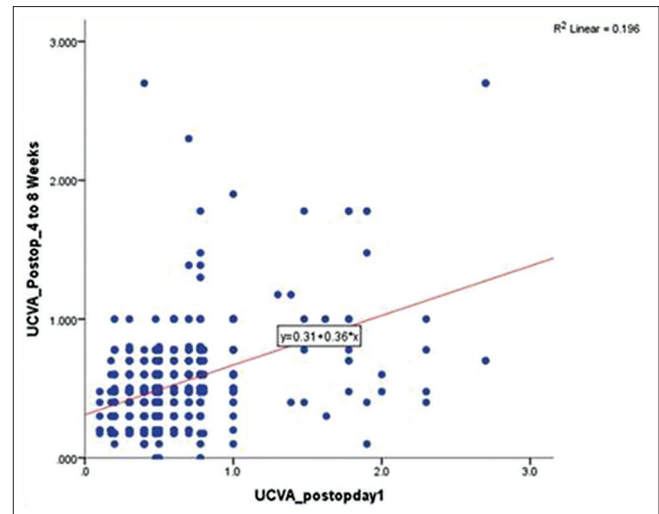


Figure 2: Scatter plot showing correlation of uncorrected visual acuity (UCVA) between first and final post-operative follow up

improved to better than 6/18. Hence vision at discharge may be used to monitor a cataract surgical program especially since this it will be readily available even at centers with poor follow-up. This pattern of a grid using the standard WHO visual acuity categories can be instrumental for monitoring cataract surgery programs [Table 2]. The number of patients with vision better than 6/18 at discharge, along with the proportion that remains in the same category or improves, will give a good estimate of the overall surgical performance.

Studies done in India have shown a drop-out from follow-up of around 30% following cataract surgery mainly among patients undergoing surgery through outreach services and among older patients^{9,10]} In our study the unprompted follow-up rate was a good 91%. This was probably because of better awareness, good transport connectivity in the state, and our practice of ensuring a free review appointment for outreach patients before each patient is discharged. The multicentre prospective (PRECOG) study done at 40 centers in 10 countries including India had an unprompted final follow-up of only 51%. It ranged from 27% in China, 93% in Latin America, and 47% in the Indian subjects.^{11]}

Only five out of the 40 hospitals in the PRECOG study achieved the WHO target of 80% of patients with late uncorrected visual acuity of 6/18 or better. Overall, patients who achieved this was only 64%; however, 85% achieved a final BCVA that was better than 6/18.^{11]} This being a multicentric study, might have had increased variability in measurements and the participants were not a random representation of institutes in developing countries. In our study as well, the uncorrected visual acuity of more than 6/18 was seen only in 53.7% which is also lower than the WHO's recommended standards; however, a BCVA better than 6/18 was achieved in 94.4% of patients, indicating that majority of the low vision were due to a refractive error. Resultant astigmatism in our patients is probably because of the established fact that manual small incision cataract surgery (MSICS) with a superior sclero-corneal tunnel incision results in higher surgically induced astigmatism resulting in a lower uncorrected visual acuity.^{15,7]} Superior section cataract surgery is the regular practice in most teaching

hospitals as ours. The PRECOG study, however, does not mention the incision site for small incision surgeries.

The refractive stabilization of the cornea after cataract surgery is usually achieved around one month following manual small incision whereas it occurs sooner following phacoemulsification. Studies on corneal healing following sclera-corneal tunnels are scarce. However, long term shifts in astigmatism have been reported even years after cataract surgery.^[11-13] Hence it also needs to be borne in mind that an immediate acceptable refractive outcome may lead to a false sense of surgical success and that a follow-up after a month for refraction is reasonable. Six hundred and forty-eight (77%) of our patients showed a two-line improvement or more at final follow-up. This is similar to that report by Gupta *et al.* (71.2% of MSICS eyes and 21.0% of phacoemulsification eyes).^[3] Similar improvement of more than one line of visual acuity as a benefit of following up has been reported in paediatric cataracts as well.^[14] Moreover, spectacle use after surgery is largely shown to be related to prompting by surgeons even in developed countries.^[15,16]

Monitoring the cause for change in vision helps to specifically address those factors. Among those who showed a drop in vision in our study, some of the common causes were cystoid macular edema in 5 (26%) and posterior capsular opacity in 4 (21%). One patient who had an intra-operative posterior capsular rent presented one month later with a retinal detachment. This study highlights the need for follow-up by reporting the number of patients who had at least two lines of improvement in BCVA along with a certain number who show a drop in final visual acuity that cannot be neglected. Therefore, even though the immediate post-operative vision correlates with the overall final visual outcome, follow-up is warranted for individual patient's benefit.

The strength of our study is that it is a prospective study in a single hospital with standard measurements for all patients and a good follow-up rate. More than half the patients were operated by surgeons in training allowing us to analyze correlation in trainee surgeons. To the best of our knowledge, this is the first report of correlation between first and final post-operative visual outcomes among trainee surgeons. Our study had certain limitations. The same optometrists did not measure vision at discharge and final follow-up; hence, the degree of measurement bias cannot be ruled out. However, all efforts were taken to minimize this; all patients were checked in the same standardized fashion and senior optometrists experienced in vision assessment conducted the vision examination as is the regular practice. We were unable to report the correlation in visual acuity in patients with intra-operative complications due to low numbers with complication. Inclusion of a higher number of patients in a study powered to assess correlation in those with and without complications would satisfactorily answer this question.

Conclusion

Visual acuity on a post-operative day one may be used as a quality marker for cataract surgical programs especially in settings with poor follow-up rates. However, for individual patient's benefit, a final follow-up should be encouraged in view of the improvement in vision with refraction especially in cases operated by surgeons under training.

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Conflicts of interest

There are no conflicts of interest.

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