Original Article

# Stabilization of refraction and timing of spectacle prescription following manual small-incision cataract surgery

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**Purpose:** To determine the stabilization of refraction at 2 weeks following MSICS by comparing the difference in spherical, cylindrical component and also spherical equivalent of refraction of 2 weeks follow-up with that of 6 weeks following surgery. **Methods:** The difference of spherical, cylindrical component and also spherical equivalent of refraction at 2 weeks and 6 weeks follow-up of 194 eyes that underwent uncomplicated MSICS with implantation of PMMA IOL conducted by a single experienced surgeon were compared to find out the amount of change and its significance was statistically tested by Wilcoxon-Signed Rank Test. **Results:** The difference in spherical power (0.04 ± 0.30), cylinder power (0.03 ± 0.40), and spherical equivalent (0.06 ± 0.34) were very small and not significant statistically (*P*-value ≤0.05). **Conclusion:** Necessary spectacle correction can safely be prescribed after 2 weeks following MSICS as subjective refraction stabilizes by that time without undergoing significant change. However, our observation was applicable in patients who had an uneventful cataract surgery without any risk factor, which can delay wound healing or cause poor visual outcome.

**Key words:** Manual small-incision cataract surgery, refraction stabilization, spectacle prescription

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Cataract remains the leading cause of avoidable blindness worldwide including India.[1,2] Currently, cataract surgery is the most common and cost-effective intervention to tackle cataract blindness. Modern cataract surgery aims at restoration of best quality of vision with a rapid postsurgical recovery and optimal postoperative refraction.[3] Cataract surgery nowadays with advances in both technology and technique has become a fast and safe surgical procedure allowing the patients to return to daily routine activities immediately following surgery.[4] The benefits of early spectacle prescription include improved ocular comfort because of clear distant and near vision and the patient can return to activities that require fine near vision early[5] and delay in spectacle correction functionally impact the quality of life and contribute to a loss of productivity due to uncorrected near or distance vision during the postoperative period. Rapid visual stabilization also improves patient satisfaction and quality of life.[6]

Phacoemulsification and manual small-incision cataract surgery (MSICS) are the two most popular methods of cataract surgery today. Phacoemulsification has become the routine procedure for cataract extraction in the developed countries, whereas MSICS has evolved to be an elegant and efficient surgery in developing countries as it is also characterized by early wound stability, less postoperative inflammation, no suture-related complications, few postoperative visits, like phacoemulsification, and has less damaging effect on the corneal endothelium. Moreover, MSICS can be performed in almost all types of cataract in contrast to phacoemulsification.[7] In the majority of situations, the two surgeries are considered equivalent in terms of final outcomes and complication rates with a small advantage of phaco over MSICS when considering UCVA secondary to SIA but at 6 months post op best spectacle corrected visual acuity to be equivalent.[8,9]

The time of stabilization of refraction is an important factor for prescription of glasses. There are few studies evaluating the stabilization of refraction, keratometry, anterior chamber depth, and CCT after cataract surgery. Several studies have been published earlier with similar results about refractive stabilization after phacoemulsification cataract surgery.[5,10,11] MSICS is often discredited for late visual rehabilitation in comparison to phacoemulsification, and there are not many studies to refute this concept. Current practice in India is to prescribe glasses later than 4 weeks after cataract surgery, a timeframe decided by historical observation of refractive stabilization time from conventional ECCE days.

The present study was undertaken to determine the time required to achieve refractive stability in an Indian population following MSICS cataract surgery, by comparing the subjective

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refraction 2 weeks post op with 6 weeks post up refraction and to recommend changes to current spectacle prescription practices.

## Methods

After obtaining the approval of Institutional ethics committee and due written informed consent from the participants, the present study was undertaken by including 200 adults who underwent uncomplicated manual suture less small-incision cataract surgery with monofocal PMMA IOL insertion by a single ophthalmologist (SHS) in a secondary eye care center between March and December 2020 being adhered to the Declaration oh Helsinki. Patients with history of glaucoma, corneal or scleral pathology, any retinal or macular pathology, traumatic and complicated cataracts, which may lead to poor visual prognosis after surgery, and also patients having any systemic conditions that may affect wound healing were not included in the study. Patients who had intra- or postoperative complications resulting in poor uncorrected vision on first postoperative day or those who did not complete all the scheduled follow ups were also excluded.

### Steps of surgical procedure

The surgery was performed under peribulbar anesthesia. After making a fornix-based conjunctival flap, a frown incision 6–6.5 mm long and 1/3–-1/2 thickness of scleral depth was made about 2 mm behind the limbus at 12 o'clock position. A crescent blade was used for fashioning the tunnel, 2 mm in the sclera, and 1–1.5 mm in to the clear cornea. At the internal incision, dissection was extended laterally 0.5–1 mm to produce the pockets on both sides. Anterior chamber was entered with a 3.2 mm keratome at the anterior most end of the tunnel. Then, with lateral and anterior movements, the entry was extended throughout the length of the internal lip of the incision. Capsulotomy either continous capsolorrhexis or can opener was done using a capsulorhexis forceps. Hydroprocedures, that is, both dissection and delineation were performed through the tunnel wound and the nucleus was dislocated into the anterior chamber using a dialer under viscoelastic substance, methylcellulose. Then, the nucleus was expressed out of the anterior chamber by using a wire vectis and pressing the scleral lip down. After cleaning the residual cortex by a simcoe cannula, a posterior chamber IOL was implanted. Postoperatively, patients received topical antibiotic and steroid eye drops for a minimum period of 6 weeks.

Follow-up was done on first day, first week, second week, and sixth week after the surgery. Uncorrected visual acuity was recorded in all visits, but subjective refraction was performed in second and sixth post op visit by two experienced optometrist being unaware of the study. The subjective refraction results of both second and sixth week follow-up of all the cases were recorded in an excel sheet master chart for comparison and as a convention sixth week post op refraction was prescribed for visual rehabilitation.

From the refraction measurements of sphere and cylinder, the spherical equivalent (SE = sph + (0.5 × cyl)) was calculated. The axis values were not considered as the meridian position of postoperative astigmatism has a minimal change of effect compared to its magnitude.

### Statistical analysis

Data was collected into an Excel sheet using Microsoft Excel 2013 (Microsoft Corporation). Data analysis was performed using SPSS version 24.0 (SPSS Inc, Chicago, IL). Descriptive analysis was conducted: categorical data were expressed as number and percentage; continuous variables were expressed as mean ± standard deviation and range (minimum: maximum). The continuous variables were subjected to Shapiro–Wilk test and found significantly different from normal distribution. Therefore, pairwise comparison of median (IQR) of spherical power, cylindrical power, and spherical equivalent between 2 and 6 week were done by using nonparametric Wilcoxon signed-rank test. A refractive shift was defined as the refraction difference of more than 0.5 D between two examinations. Confidence intervals were set at 95%, where a *P* value ≤0.05 was used as an indicator for detecting statistically significance.

## Results

Out of the 200 participants, 194 patients met the selection criteria and their results were taken for statistical analysis. Of them, 103 (53.1%) were males and 91 (46.9%) females. The patients age ranged from 46 to 78 years, with a mean of 63.4 ± 9.9 years. Majority of patients 81 (41.8%) belong to the age group of 60–69 years. In 93 (47.9%) cases, surgery was conducted in the right eye, and in 101 (52.1%) cases, the surgery was conducted in the left eye. The detailed demographic profile of cases are presented in Table 1.

Out of the 194 operated cases in 161 (83%) cases, there was either no change in the refraction or the change was within 0.5 D, and in the rest 33 (17%) cases, there was change in refraction–cylindrical power in 19 cases, spherical power in 9 cases, and both in 5 cases, as presented in Table 2.

Table 3 shows that the mean spherical error at 2 weeks follow-up was 0.37 ± 0.75 D and at 6 weeks follow-up was 0.33 ± 0.73 D with a difference of error of 0.04 (0.30) between both, and the mean cylindrical error at 2 weeks follow-up was -0.40 ± 0.68 D, which increased to -0.43 ± 0.66 D at 6 weeks follow-up with a difference of 0.03 (0.40). Similarly, the mean

**Table 1: Demographic profile of cases**

| Age group | No. | % |
|---|---|---|
| <50 | 16 | 8.2 |
| 50-59 | 38 | 19.6 |
| 60-69 | 81 | 41.8 |
| ≥70 | 59 | 30.4 |
| Mean±SD | 63.4±9.9 | |
| Nonparametric Chi-square "*P*" | 0.000 | |
| Gender | | |
| Male | 103 | 53.1 |
| Female | 91 | 46.9 |
| Binomial test "*P*" | 0.430 | |
| Eye | | |
| Right eye | 93 | 47.9 |
| Left eye | 101 | 52.1 |
| Binomial test "*P*" | 0.615 | |
| Total | 194 | 100 |

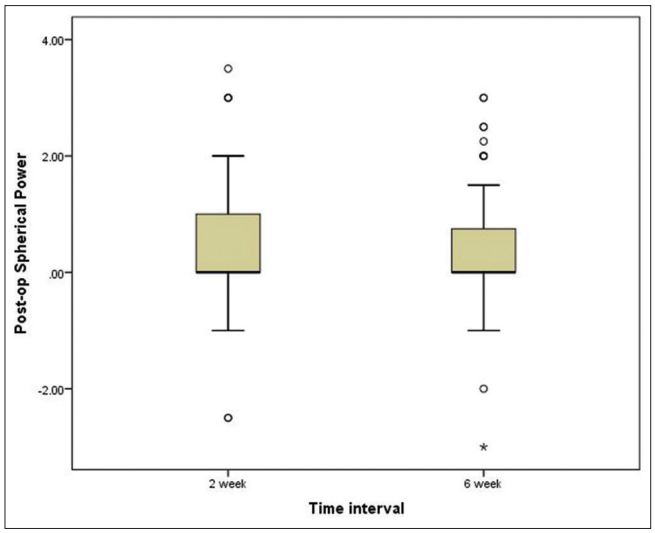


**Figure 1:** Box plot of post-op spherical power at 2 and 6 weeks

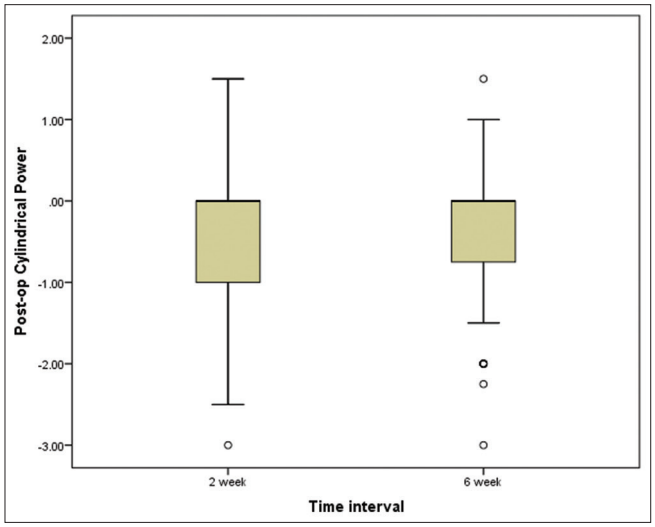


**Figure 2:** Box plot of post-op cylindrical power at 2 and 6 weeks

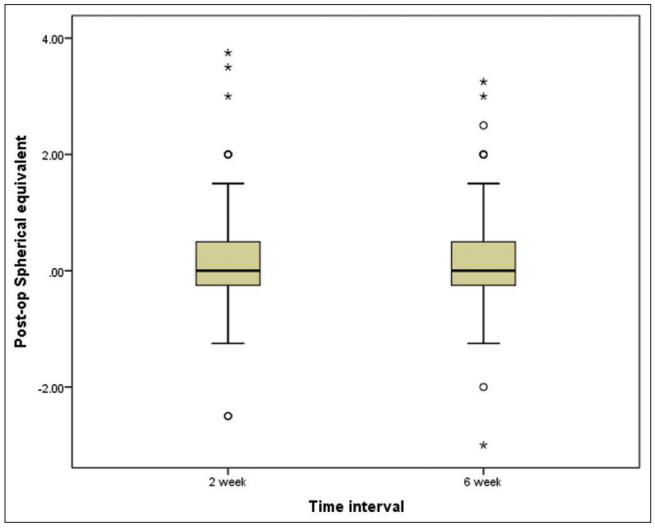


**Figure 3:** Box plot of post-op spherical equivalent at 2 and 6 weeks

**Table 2: Distribution of cases as per change in spherical, cylindrical, and both power**

| Change in refraction | No. | % |
|---|---|---|
| No change or change less than 0.5 D | 161 | 83 |
| Change in cylindrical | 19 | 9.8 |
| Change in spherical | 9 | 4.6 |
| Change in both spherical and cylindrical | 5 | 2.6 |
| Total | 194 | 100 |

refractive spherical equivalent error was 0.17 ± 0.78 D at 2 weeks and 0.11 ± 0.77 D at 6 weeks follow-up with a mean difference of 0.06 (0.34) between both the follow-ups. The difference between 2 and 6 weeks follow-up values of all the three categories are statistically not significant. The box plots at Figs. 1–3 give a visual appreciation of spherical, cylindrical, and spherical equivalent of vision.

## Discussion

Cataract surgery today aims to restore clear vision as quickly as possible. With cataract surgery being performed on relatively younger patients and with increased dependence on near vision, optimizing vision at the earliest postoperative period would be of benefit to improve the quality of life. The aim of the present study is to determine whether at 2 weeks following uncomplicated MSICS a sufficiently stable refraction is reached for final prescription as against the current practice of after 4–6 weeks of surgery, in order to improve the quality of life for patients within the appropriate postoperative period.

The refractive stabilization of the cornea after cataract surgery is usually achieved around 1 month following manual small-incision, whereas it occurs sooner following phacoemulsification. Studies on corneal healing following sclera-corneal tunnels are scarce. Sugar *et al*.[5] concluded that refraction became stable 1 week after phacoemulsification with foldable acrylic intraocular lens implantation. Similarly, Caglar *et al*.[12] in their study found that automated spherical and cylindrical refraction stabilized 1 week after surgery and changed minimally between the first week and the first month after phacoemulsification cataract surgery. Ionides and Claoue found a mean refractive change of 0.34 D between 2 and 6 weeks after implantation of all-poly (methyl methacrylate) IOLs, with a modal change of 0. They believe that spectacles can be safely prescribed at 2 weeks and that only a single postoperative visit at that time is indicated.[13] Joharjy *et al*.[14] also in their study concluded that refraction stability occurs within 1 week following cataract surgery by phacoemulsification. Dietze *et al*.[15] also opined that spherical refraction, cylindrical refraction, and visual acuity are stable at 1-week postcataract surgery. Therefore, lenses can be prescribed a week after cataract surgery by phacoemulsification. This is considered as an advantage of phacoemulsification cataract surgery over MSICS as studies on corneal healing and stabilization of refraction following sclero-corneal tunnels are scarce. Bernhisel *et al*.[8] concluded that refractive stabilization of the cornea after cataract surgery is usually achieved around 1 month following manual small-incision, whereas it occurs sooner following

**Table 3: Pair wise comparison of spherical, cylindrical, and spherical equivalent between 2- and 6-week follow-ups**

| Variable | Post-op | *n* | Mean±SD | Mean (SD) diff. | Median (IQR) | Wilcoxon signed-rank test "*P*" |
|---|---|---|---|---|---|---|
| Spherical error | 2 week | 194 | 0.37±0.75 | 0.04 (0.30) | 0.00 (0.00–1.00) | 0.060 |
| | 6 week | 194 | 0.33±0.73 | | 0.00((-) 1.00-0.00) | |
| Cylindrical error | 2 week | 194 | -0.40±0.68 | 0.03 (0.40) | 0.00 (0.00-0.75) | 0.261 |
| | 6 week | 194 | -0.43±0.66 | | 0.00((-) 0.75-0.00 | |
| Spherical equivalent | 2 week | 194 | 0.17±0.78 | 0.06 (0.34) | 0.00((-) 0.25-0.50) | 0.054 |
| | 6 week | 194 | 0.11±0.77 | | 0.00((-) 0.25-0.50) | |

phacoemulsification. Jauhari *et al*.[16] in 2014 opined stability of refraction, visual acuity and corneal thickness were achieved within 2 weeks postsurgery for an Australian cohort receiving monofocal IOLs, suggesting that spectacles can safely be prescribed from 2 weeks post cataract surgery rather than the 4 weeks waiting period currently recommended.

In the present study, we found that subjective refraction comprising both spherical and cylindrical components and also the spherical equivalent stabilized within 2 weeks after MSICS and changed minimally between the second and sixth week after cataract surgery. Hence, it may be possible to prescribe glasses for most patients after 2 weeks of an uneventful manual SICS cataract surgery.

## Conclusion

Since all measured visual and ocular parameters were stable from 2 weeks postoperatively, our study conclusively proves that spectacle prescription can safely be given to patients after 2 weeks following an uncomplicated MSICS in the absence of any ocular pathology. Hence, the prescription guidelines may safely be revised to allow for the earlier prescription of glasses for patients receiving monofocal IOLs, and they need not wait longer than this for spectacle prescription. However, we caution that the generalizability of our findings may be limited because we included only eyes with good visual potential and a good initial visual outcome. The other limitation of our study is that the refraction at both the follow-up visits was not conducted by the same refractionist in every case; hence, the degree of measurement bias cannot be ruled out. However, all efforts were taken to minimize this as all patients were evaluated in the same standardized fashion by senior optometrists experienced in performing retraction being blinded about the objective of the study. Again, all the surgeries in our study are performed by a single experienced surgeon; this also adds to the limited generalizability because construction of sclero-corneal tunnel is the crux of MSICS and it can considerably vary between surgeons, and that can impact wound healing. Further studies can be conducted in future to see if the same holds true for MSICS done exclusively through temporal approach, to find out in the subset of population where there is change in refraction at the sixth week the factors responsible for the change and to find the variables that may necessitate delaying of glass prescription beyond 2 weeks.

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### Conflicts of interest

There are no conflicts of interest.

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