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Advantages of IOL Implantation in Ringer Lactate without Viscoelastics in Phacoemulsification

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Abstract

Aim: To study advantages of Ringer's Lactate Solution (RL) instead of Hydroxypropyl Methylcellulose (HPMC) for Intra-ocular Lens (IOL) implantation in phacoemulsification. *Methods:* A prospective, randomized, interventional study was performed.100 patients of senile cataract were randomly divided in two groups; one in whom IOL was implanted in RL (ringer group) and one in which HPMC (visco group) was used. Results were evaluated on safety, efficacy, post-operative Intra-ocular pressure (IOP), reaction, endothelial cell count and surgical time. *Result:* Mean post-operative IOP at *6*, *24* and *48 hours* in ringer group was *16.02*, *13.46* and *12.44 mm Hg* respectively; and in visco group it was *22.24*, *17.32* and *13.84 mm Hg* respectively (p value < 0.0001; significant difference). Mean post-operative reaction at *24* and *48 hours* in ringer group was 1.48 and 0.72 respectively; and in visco group it was 1.56 and 1.08 respectively (p < 0.0001). Mean endothelial cell loss in visco group was 143.56 and in ringer group it was 210.68 (p = 0.055). Mean surgical time in visco group was *6.01 ± 0.93 mins* and in ringer group it was *5.08 ± 0.76 mins* (p < 0.0001). *Conclusion:* IOL implantation in bag under RL is safe, less time consuming, without significant extra loss of endothelial cells, controls spikes of IOP with less post-operative reaction.

Keywords: Ringer Lactate; Viscoelastics; Phacoemulsification; Intra-Ocular Pressure; Anterior Chamber Reaction; Endothelial Cell Count, Ringer's Lactate solution.

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Introduction

Phacoemulsification has gone through many modifications and results have been recorded in terms of improvement in surgical and visual outcome.[1] Classically in a cataract surgery we implant Posterior Chamber Intra-ocular Lens (PCIOL) after putting viscoelastic substance (visco) in anterior chamber (AC) which inflates the capsular bag.[2] However, there are common issues with retained visco in cataract surgery like post-operative spikes of Intra-ocular Pressure (IOP), pseudo anterior uveitis, capsular bag distension syndrome, extra surgical time, and endothelial trauma due to washing out of visco.[3,4] To circumvent these problems we modified only one step of the surgery. We performed phacoemulsification using visco before cortical wash, and after cortical matter wash we implanted the PCIOL under a continuous irrigation of Ringer's lactate solution using irrigation cannula inserted from a side-port, which helped to maintain the anterior chamber and keep the capsular bag inflated. We investigated the possible advantages of using Ringer's lactate for foldable PCIOL implantation over visco including surgical efficiency, post-operative reaction, post-

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operative IOP spike, endothelial cell count and surgical time.

Aims

- To study advantages of RL instead of HPMC for IOL implantation in phacoemulsification;
- To determine the difference in postop IOP between the two groups;
- To determine the difference in postop reaction between the two groups;
- To determine the difference in postop mean endothelial cell loss between the two groups;
- To determine the difference in the mean surgical time between the two groups.

Materials and Methods

Study Type

Prospective randomized interventional study.

Duration of Study

From *January 2019* to *February 2019*.

Sample Size

Hundred eyes of 100 patients with cataract who came to Ophthalmology OPD at our tertiary care hospital were selected for 95% confidence level by simple random sampling. Calculated from Open Epi, Version 3, Open source calculator--SSPropor.

Inclusion Criteria

- Patients with nuclear sclerosis grade 2–3;
- Patients willing to participate in the study;
- Patients who are able to read and understand Marathi/Hindi;
- Patients ready to give written informed consent.

Exclusion Criteria

Patients with:

- any previous ocular surgery;
- complicated cataract;
- mature and hyper mature cataract;
- glaucoma;
- corneal opacity/degeneration;
- and non-dilating pupil.

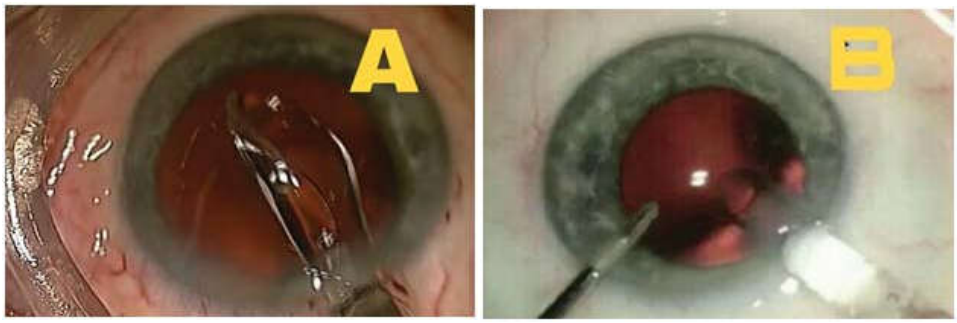
After selection of patients following pre-operative examinations were done:

- Slit lamp examination;
- Keratometry by Topcon auto kerato-refractometer KR-800;
- Axial length measurement using Tomey A scan biometer AL-100;
- IOP measurement by Goldmann's applanation tonometer;
- IOL power calculation using SRK-II formula;
- Endothelial cell count by specular microscope Topcon SP 3000 P model;
- Fundus examination by indirect ophthalmoscope;
- The patients were evaluated similarly after the surgery.

Patients were randomly divided into 2 groups; one in whom IOL was implanted in RL (ringer group) and other in which viscoelastic substance Hydroxypropyl methylcellulose (visco group) was used. All pts underwent phacoemulsification under peribulbar anesthesia by the same operating surgeon with similar surgical steps. Firstly *1.5 mm* size side ports were made at *10* and *2* O'clock positions at limbus and anterior capsule was stained with trypan blue dye under air bubble. The dye was washed and anterior chamber was filled with viscoelastic substance. A *5 mm* size anterior central continuous curvilinear capsulorhexis (CCC) was made, entry into anterior chamber with *2.8 mm* keratome was done. After hydro dissection nucleus was dialled and phacoemulsification was done by divide and conquer method. After thorough cortical matter wash with irrigation and aspiration cannulae, surgical steps were different in both the groups. In visco group anterior chamber was filled with viscoelastic substance and IOL was implanted, and after that the viscoelastic substance was aspirated from anterior chamber as well as from the bag, (**Fig. 1A**). In ringer group, after thorough cortical matter wash instead of viscoelastic substance we implanted the intra-ocular lens under a continuous irrigation of Ringer's lactate solution through a side-port which helped to maintain the anterior chamber and keep the capsular bag inflated **(Fig. 1B)**.

Outcome

The outcome was evaluated on safety (in terms of complications rate), efficacy (in terms of percentage of inbag-fixation of IOL - complete/partial), post-operative intra-ocular pressure (*8 hours*, *24 hours* and *48 hours*), post-operative anterior chamber cells,



Figs. 1A: IOL implanted after completely filling the anterior chamber with viscoelastic substance. **B:** IOL implanted under a continuous irrigation of Ringer's lactate solution through a side-port

endothelial cell count and surgical time **(Table 1)**. Data analysis was done by using SPSS statistical software version 17 with calculation of mean and standard deviation; student's *t*-test (paired) was utilized to look for statistical significance and odd's ratio was calculated.

Table 1: Different methods of measurement

Sr. No.	Variable	Method of measurement
1.	Intra-ocular pressure	Goldmann'sapplanation tonometer
2.	Post-op anterior chamber reaction	Slitlampbiomicrosope (Hogan *et al*. slit lamp grading)
3.	Endothelial cell count	Specular miscroscope
4.	Surgical time	Clock

Results

There were 50 (50%) patients in each group. The mean age of the patients in both the groups was comparable ($p = 0.10$).

Safety

There was no intra-operative complication in any group.

Position of IOL

Although the number of cases in which one haptic was in sulcus were more in ringer group, the difference between the groups was not statistically significant (odds ratio: 0.32; $p > 0.05$), (**Table 2**).

IOP Change

The mean IOP in visco group was *22.24 ± 8.42 mm Hg* at *6 hours* which normalized after that. In ringer group it was in normal range throughout. The difference was significant at *6 hours* and *24 hours* (p value < 0.0001). It was not significant at *48 hours* ($p = 0.11$), (**Graph 1**).

Table 2: Position of IOL

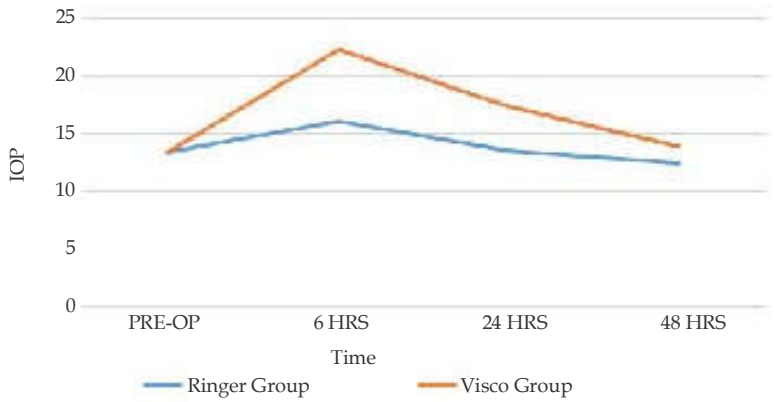
Group	Male/Female Ratio	Mean Patient's Age	IOL Position	
			Bag	Bag and Sulcus
Ringer Group	24/26	60.24 (SD ± 9.2)	47	3
Visco Group	34/16	64.2 (SD ± 7.3)	49	1

AC Reaction

The mean post-operative anterior chamber cells (Hogan *et al*. slit lamp grading) were more in visco group as compared to ringer group. The difference was significant (p value < 0.0001) at *24 hours* and *48 hours*.

Surgical Time

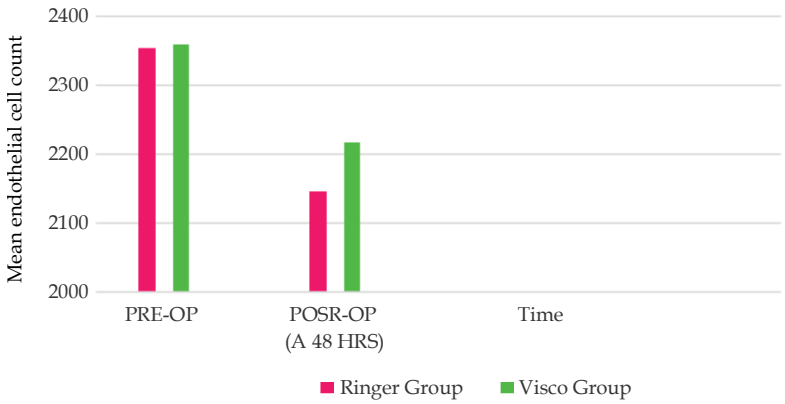
In ringer group the mean surgical time was *5.08 ± 0.76 mins* and in visco group it was *6.01 ± 0.93 mins*. The time difference between the groups was 11.8% and statistically significant (p value < 0.0001).



Graph 1: Changes in IOP

Mean Endothelial Cell Loss

The mean endothelial cell loss in visco group was 6.08% (143.56 cells) and in ringer group it was 8.9% (210.68 cells) at *48 hours*. Though the cell loss was more in ringer group, the difference was not statistically significant (*p* value = 0.055), (**Graph 2**).



Graph 2: Loss of mean endothelial cells

Discussion

Phacoemulsification is a popular technique of performing cataract surgery and various modifications have been described.[5] Thomas *et al*. have reported that implantation of IOL by Blumenthal technique is easy and safe.[6] In our study. there were no complications during IOL implantation in any group. In our study, IOP in visco group was high at *6 hours* and gradually became normal at *48 hours* but in ringer group there were lesser spikes of IOP. Shah *et al*. in their study reported maximum AC reaction on day one after cataract surgery using visco.[7] In our study, the number of AC cells on *day 1* was more than *day 2* in both groups, but cells in visco group were significantly more than that in ringer group. Tak *et al*. have reported that the average time of surgery was less in phaco during hydroimplantation of foldable IOL.[8] A similar outcome was noted in our study. Gogate *et al*. in their study reported 6.5% endothelial cell loss in phaco using visco.[9] Another study by Malik *et al*. has reported 5.5% endothelial cell loss in Blumenthal technique at three months. In our study, we observed an endothelial cell loss of 6.08% in visco group and 8.9% endothelial cell loss in ringer group At *48 hours*.

The weaknesses of our study were AC reaction calculation by slit lamp biomicroscope and absence of follow up data regarding endothelial cells and IOP. The results of several experimental corneal perfusion and clinical studies suggest that a more physiological solution (balanced salt solution Plus) may prove to be a better infusion solution for intra-ocular surgery than others presently being used such as RL.[10,11] The high cost of balanced salt

solution Plus limits its widespread acceptability and usage.[12] Despite the fact that RL lacks several essential constituents necessary for endothelial functioning and protection, it remains the most widely used irrigating fluid in our part of the world due to its low cost.[13]

Conclusion

We conclude that a small modification in one step of phacoemulsification can significantly control spikes of IOP with significantly lesser post-operative reaction. With some experience, implantation of IOL in the bag under a continuous irrigation of RL is safe, accurate and less time consuming method without any significant extra loss of endothelial cells.[14,15]

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