

# Comparative Study of Endothelial Cell Loss after Phacoemulsification by Using 2% Hydroxypropyl Methylcellulose (HPMC) Versus 2.3% Sodium Hyaluronate (Healon 5)

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**Purpose:** To compare the protective effect of Healon 5 and HPMC on corneal endothelium during phacoemulsification.

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**Material and Methods:** All eyes scheduled to have phacoemulsification surgery by single surgeon at same centre were selected. First group was operated while using HPMC as viscoelastic agent and second group of eyes underwent identical surgery while using Healon 5 as viscoelastic agent. Patients were followed up at 24 hours, one week, one month, and 3 months after surgery for corneal endothelial cell loss by using specular microscope.

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**Results:** Fifty eyes underwent surgery equally divided in two groups. In first group HPMC was used. The mean loss of corneal endothelial cells at 3 months was 8.67 % ( 6.57%-13.61%). In second group Healon 5 was used during surgery and the mean loss of corneal endothelial cells at 3 months was 8.05 % ( 6.58%-10.94%).

**Conclusions:** The rate of corneal endothelial cell loss in patients undergoing phacoemulsification cataract surgery with HPMC or Healon 5 does not vary much although Healon 5 works better if there is advanced nuclear sclerosis. But in routine cases use of HPMC is a safe and cost effective.

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**M**ajor bulk of ophthalmic surgery is the cataract extraction<sup>1,2</sup>. Viscoelastics form an essential tool in the modern day cataract surgery. Various types of viscoelastics like cohesive and dispersive in nature are available in the market. All of them claim to provide maximum endothelial cell protection during surgery. But again quality is associated with a high price tag. In a developing country like Pakistan where per capita income is low and health insurance is a rarity, use of these costly viscoelastics becomes a burden both for the patient and for the surgeon. Especially when high volume cataract surgery is performed and resources are limited; its use becomes more and more difficult.

We carried out this study to compare the endothelial protective effect of HPMC with Healon 5.

## MATERIALS AND METHODS

This was a hospital based interventional comparative study launched at LRBT Eye hospital Lahore. We compared the endothelial protective effect of two viscoelastics. Fifty patients selected from out patient department were randomly divided into two groups. Group 1 received 2% HPMC and Group II received Healon 5 during phacoemulsification.

Posterior limbal self-sealing incision was given and after continuous curvilinear capsulorhexis, phacoemulsification was done with particular consideration given to phacoemulsification time (the total time used to manage the nucleus by ultrasonic tip). Posterior chamber intraocular lens was implanted in all the patients. Central corneal endothelial cell count was evaluated preoperatively and postoperatively by specular microscopy at day 1, week 1, one month and 3 months.

Statistical analysis was performed by the computer based SPSS (statistical package for social sciences (SPSS version 10.0) including: P value calculation with the help of student "t" test for corneal endothelial cell count preoperatively and postoperatively in both groups.

## RESULTS

The mean central endothelial cell loss at the end of 3<sup>rd</sup> month was 8.67% with a range of 6.57-13.61% for Group 1 (2% hydroxyl propyl methyl cellulose) and 8.05% with a range of 6.58-10.54% for Group 2 (Healon

5) with standard deviation of  $\pm 384$  cells/mm<sup>2</sup> and p value of 0.976. A direct relationship was observed between phaco time and percentage of endothelial cell loss during phacoemulsification i.e. more the phaco time (phaco energy) to manage the nucleus, more the endothelial cell loss (Table 1).

## DISCUSSION

This prospective, randomized study was designed to compare the endothelial protective effect of 2% hydroxy propyl methyl cellulose and Healon 5 in patients undergoing phacoemulsification with posterior chamber intraocular lens implantation.

Viscoelastic substances have assumed a major role in the anterior segment surgery especially phacoemulsification. Early studies have shown that phacoemulsification appears to be more traumatic to the corneal endothelium than conventional form of cataract extraction. The proper use of viscoelastic substances and refinements in surgical technique had made it a popular technique for cataract extraction<sup>3</sup>.

Several viscoelastic agents are now available for use in anterior segment surgery.

Sodium Hyaluronate is a repeating polymer of glucuronic acid and N-acetylglucosamine. Healon 5 contains 2.3% Sodium Hyaluronate. It contains the same molecular mass of sodium hyaluronate (4 million) but has higher concentration (2.3 mg/ ml versus 1 mg /ml).

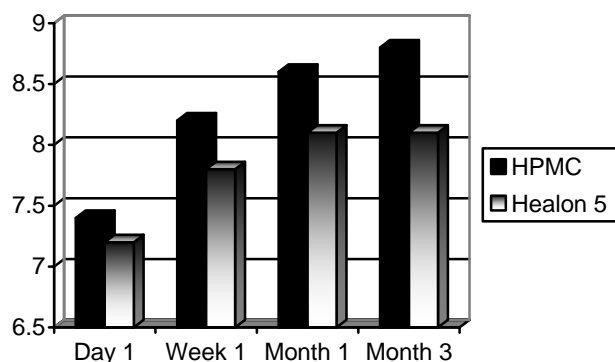
Healon 5 is highly viscous and has strong cohesive characteristics and can be difficult to remove, particularly from behind the intraocular lens (IOL) in the capsular bag and high intraocular pressure peaks after surgery have been observed. Space maintenance is significantly better with Healon 5.

Healon is documented to protect corneal endothelium in three ways. Mechanical protection as it is shock absorber due to its elasticity. Biological protection due to HABS (Hyaluronic acid binding sites). Chemical protection due to scavenger effect on harmful free radicals formed during phacoemulsification. 2% Hydroxypropyl Methylcellulose is another viscoelastic substance available. It is not elastic, has no shock absorbing ability. It is dispersive type of viscoelastic with limited coating ability.

**Table 1:** Endothelial cell density

Groups	Pre-operation		At week 1			At month 3		
	Mean (Cells/mm <sup>2</sup> )	Range (Cells/mm <sup>2</sup> )	Mean (Cells/mm <sup>2</sup> )	Range (Cells/mm <sup>2</sup> )	% loss	Mean (Cells/mm <sup>2</sup> )	Range (Cells/mm <sup>2</sup> )	% loss
Group I	2514.48	2061--2846	2309.40	1900--2660	8.19	2297	1860--2620	8.67
Group II	2523.40	2048--3519	2325.12	1920--3250	7.87	2320	1900--3170	8.25

Group I=2% Hydroxypropyl Methylcellulose  
Group II=Healon 5



**Fig. 1:** Percentage endothelial cell loss after phaco with HPMC and Healon5.

2% Hydroxypropyl Methylcellulose has not got the same endothelial protective characteristics as Healon 5 does but our results showed that at the end of 3 months the mean central endothelial cell loss was 8.67% (6.57-13.61%) for 2% Hydroxypropyl Methylcellulose group which is not significantly different from Healon5 Group i.e. 8.05% (6.58-10.94%). So, 2% Hydroxypropyl Methylcellulose also gives reasonable protection to the endothelium during phacoemulsification.

Our results are fairly close to the results given by “Long-term endothelial cell loss following phacoemulsification: model for evaluating endothelial damage after intraocular surgery” conducted by Werblin TP. University of Virginia, Charlottesville. This demonstrated that routine uncomplicated phacoemulsification surgery demonstrated a 9% endothelial cell loss 1 year postoperatively<sup>4</sup>.

One study conducted at Department of Ophthalmology, Humboldt University Berlin, Campus Virchow Klinikum, Germany shows that the Healon5 group had the lower mean endothelial cell loss (6.2%), than 2% Hydroxypropyl Methylcellulose<sup>5</sup>.

Another study conducted at Meiwakai Medical Foundation, Miyata Eye Hospital, Miyakonojo, Miyazaki, Japan obtained that the mean rate of endothelial cell loss 3 months after surgery was 5.9% ± 5.3% in the Healon group<sup>6</sup>.

A similar study was carried out by Lane SS et al. in which the protective effect of 3 different visco-elastics was determined (2% Hydroxypropyl Methylcellulose, Viscoat and Healon). Specular Microscopy showed no significant difference in cell loss between any of the group after 3 months postoperatively<sup>7</sup>.

### CONCLUSIONS

According to our results, the following conclusions and clinical implications can be drawn:

1. Healon 5 offers greater endothelial cell protection than 2% Hydroxypropyl Methylcellulose particularly if high nucleus grading is present or the endothelial status is marginal.
2. The endothelial cell loss was not significantly different with the use of 2% Hydroxypropyl Methylcellulose (which is cost effective) as compared to Healon 5, in patients with low nucleus grading on which un-complicated phacoemulsification was performed.
3. Conceivably, Healon 5 slightly greater protective capabilities would be useful in patients in whom:
  - Increased manipulation of nuclear material is suspected.
  - The corneal endothelial cell density is marginal as in aged persons.
  - Diabetic patients (in these patients endothelial cell density is normal but the other morph metric

parameters are disturbed i.e. pleomorphism and polymegathism.)

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#### **REFERENCE**

1. **Khan Qureshi MB, Khan MA.** Facts about the status of blindness in Pakistan. *Pak J Ophthalmol.* 1999;15:15-9.
2. Helping the blind and visually handicapped (but not bypassing the hat around) (Editorial). *Pak J Ophthalmol.* 1996; 12:77-8.
3. **Sugar J, Mitchelson J, Kraff M.** The effect of phacoemulsification on corneal endothelial cell density. *Arch Ophthalmol.* 1978; 96: 446-8.
4. **Werblin TP.** Long-term endothelial cell loss following phacoemulsification: model for evaluating endothelial damage after intraocular surgery. *Refract Corneal Surg.* 1993; 9: 29-35.
5. **Holzer MP, Tetz MR, Auffarth GU, et al.** Effect of Healon5 and 4 other viscoelastic substances on intraocular pressure and endothelium after cataract surgery. *J Cataract Refract Surg.* 2001; 27: 213-8.
6. **Miyata K, Maruoka S, Nakahara M, et al.** Corneal endothelial cell protection during phacoemulsification: low- versus high-molecular-weight sodium hyaluronate. *J Cataract Refract Surg.* 2002; 28:1557-60.
7. **Lane SS, Naylor DW, Kullerstrand LS, et al.** Prospective comparison of effect of occucoat, Viscoat and Healon on intraocular pressure and endothelial cell loss. *J Cataract Refract Surg.* 1991; 17: 21-6.